Can Science and Religion Co-Exist in Harmony?

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Some of the nation's leading journalists gathered in Key West, Fla., in May 2009 for the Pew Forum on Religion & Public Life's Faith Angle Conference on religion, politics and public life.

Francis S. Collins, the former director of the Human Genome Project and an evangelical Christian, discussed why he believes religion and science are compatible and why the current conflict over evolution vs. faith, particularly in the evangelical community, is unnecessary.

Barbara Bradley Hagerty, the religion correspondent for National Public Radio, discussed how the brain reacts to spiritual experiences and her belief that people can look at scientific evidence and conclude that everything is explained by material means or look at the universe and see the hand of God.

Speaker: Francis S. Collins, Former Director, National Human Genome Research Institute
Respondent: Barbara Bradley Hagerty, Religion Correspondent, National Public Radio
Moderator: Michael Cromartie, Vice President, Ethics and Public Policy Center; Senior Adviser, Pew Forum on Religion & Public Life

In the following excerpt ellipses have been omitted to facilitate reading. Read the full transcript, including audience discussion at pewforum.org.

FRANCIS COLLINS: I'll spend most of the time [today] talking about the current conflict that appears, at least in this country, to be a rather unpleasant one, where the voices that are arguing that science and faith are incompatible are actually quite loud -- even shrill at times. I'll offer up from my own perspective why that conflict is an unnecessary one and provide some possibilities of how it might be resolved in a way that I think would be good for our future. I'm sure there will be opinions about this, and those would be great to hear.

So let's start with the science. I know there's broad diversity and background in this room, but I'm not going to get deeply into the nitty-gritty of genomics. I will simply use this metaphor because I think it's a pretty good one, that the DNA of an organism is its instruction book sitting there in the nucleus of the cell. All of the DNA of any organism is its genome. Ours happens to be about 3.1 billion of those letters of the code.

The Human Genome Project set itself up in 1990 as an international effort to read out all of those letters at a time when many people thought this was foolhardy because the technology to do this hadn't been invented. But due to the ingenuity and commitment of a very dedicated group of over 2,000 scientists that I had the privilege of leading, we did in fact -- two-and-a-half years early and about $400 million under-budget -- achieve the goal of reading out all of those 3.1 billion letters in April of 2003. A lot of the effort on the genome since that time has been to understand how the instruction book actually does what it does. How do you read these instructions written in this funny language that has just four letters in its alphabet -- A, C, G and T -- the four bases of the DNA code?

But particularly, we've been interested in trying to identify the ticking time bombs in the human

genome that put each of us at risk for something. Progress here has been actually quite exhilarating.We're identifying all of these risk factors for almost any disease using the tools of the Human Genome Project. That in turn provides the opportunity to identify who's at risk for what. You can already, for $400, send your money to one of these direct-to-consumer marketing companies, and they will tell you what your risk is for about 20 different diseases.
I just recently finished a book on personalized medicine, which will be coming out early in 2010, designed to try to explain this for a non-scientific audience, namely the general public, to try to begin the process of people imagining how to incorporate this information into their own health care.

I've been talking about DNA; this is actually DNA.

It's a different sort of picture than you're used to, where instead of looking from the side, you're looking down the barrel of the double helix. It's quite a beautiful picture that way, and I think this is a provocative pair of images to introduce the main topic this morning, which is, are those two worldviews that you see there incompatible? On the left is the rose window of Westminster Cathedral, a beautiful stained glass window, and on the right, a picture of DNA.

There are certainly voices out there arguing that you can't have both of those; you've got to take your pick. You either are going to approach questions from a purely scientific perspective or a purely spiritual perspective, and the two are locked in eternal combat. I don't happen to agree with that, so perhaps I should say a bit of a word about how I got there.

I grew up in a home where faith was not practiced. My parents were free spirits in the arts and theater and music. I was home schooled till the sixth grade. I was not taught that faith was ridiculous, but I was certainly not taught that it mattered very much. When I got to college and later graduate school in chemistry, I became an agnostic and then eventually an atheist. In my view at that point, the only thing that really mattered was the scientific approach to understand how the universe worked; everything else was superstition.

But then I went to medical school and discovered that those hypothetical questions about life and death and whether God exists weren't so hypothetical anymore. I realized my atheism had been arrived at as the convenient answer, not on the basis of considering the evidence. A thoughtful person turned me onto the writings of C.S. Lewis, which was quite a revelation in terms of the depth of intellectual argument that undergirds a belief in a creator God and the existence of moral law. I began to realize that even in science, where I had spent most of my time, there were pointers to God that I had paid no attention to that were actually pretty interesting.

One obvious one, although maybe it's not so obvious, is that there is something instead of nothing. There's no reason there should be anything at all. Wigner's wonderful phrase "the unreasonable effectiveness of mathematics" also comes to mind -- Eugene Wigner, the Nobel laureate in physics, talking about the amazing thing about the whole study of physics is that mathematics makes sense; it can describe the properties of matter and energy in simple, even beautiful, laws. Why should that be? Why should gravity follow an inverse square law? Why should Maxwell's five equations describe electromagnetism in very simple terms, and they actually turn out to be true? A thoughtful and interesting question.

The Big Bang, the fact that the universe had a beginning out of nothingness, as far as we can tell -- from this unimaginable singularity, the universe came into being and has been flying apart ever since -- that cries out for some explanation. Since we have not observed nature to create itself, where did this

come from? That seems to ask you to postulate a creator who must not be part of nature or you haven't solved the problem. In fact, one can also make a pretty good philosophical argument that a creator of this sort must also be outside of time or you haven't solved the problem.

So now we have the idea of a creator who is outside of time and space, and who is a pretty darn good mathematician, and apparently also must be an incredibly good physicist. An additional set of observations I found quite breathtaking is the fact that the physical constants that determine the nature of interactions between matter and the way in which energy behaves have precisely the values they would need to have for any kind of complexity or life to occur.
Various people have written about this. Martin Rees has a book on this called Just Six Numbers. Depending on how you count them up, somewhere between six and a dozen of these constants are independent of each other, and I'm talking about things like the gravitational constant. Theory can tell you that gravity is an inverse square law, but there's that constant in there to say how strong gravity is and you can't derive that by theory. That is something you have to measure experimentally.

It makes you wonder, suppose it didn't have the value that it does? What kind of interesting universe would that be? [I]t turns out that if you go through the mathematical modeling of what would happen after the Big Bang if gravity was just a little weaker, things would just keep flying apart indefinitely. And I mean just a little weaker, one part in a billion. If gravity was just a little stronger, things would coalesce into stars and galaxies and planets, but a little too soon, and before we ever arrived on the scene, a Big Crunch would have followed the Big Bang.

Each one of these constants has that same amazing, precise, knife-edge tuning to it. [Y]ou can't look at those numbers and not marvel at what's going on here. You're basically stuck with two options: Either those constants were set by an intelligence that was interested in having a universe that was not sterile, or the alternative is that actually there are an almost infinite number of other parallel universes out there that have different values of those constants. Of course, we have to be here in the one where everything worked or we wouldn't be having this conversation.

That second hypothesis, the multiverse hypothesis, does require a certain amount of faith because those are not other parallel universes that we ever expect we would be able to observe. So which of those is a more faith-requiring hypothesis? I would ask you to think about that from my perspective, using the Ockham's Razor approach that the simplest explanation may in fact be the right one. This sounds a lot like all of these things are pointing us toward a creator who had an intention about the universe that would include setting these constants so that interesting things might happen.

Then there's C.S. Lewis' point that I discovered while reading the first chapter of Mere Christianity, "Right and Wrong as a Clue to the Meaning of the Universe." Where does this notion of morality come from? Is this a purely evolutionary artifact, where we have been convinced by evolution that right and wrong have meanings and that we're supposed to do the right thing, or is there something more profound going on?

But how can you be both a believer and a biologist? I've certainly been asked that question on numerous occasions by people who find out that I'm a geneticist who studies DNA every day and I'm a Christian. After all, don't you realize that evolution is incompatible with faith? If you believe in evolution, how can you be a believer? That's the usual kind of concern.

First of all, let me say the evidence for Darwin's theory of descent from a common ancestor by gradual change over long periods of time operated on by natural selection is absolutely overwhelming. It is not

possible, I think, to look at that evidence accumulated, especially in the last few years on the basis of the study of DNA, and not come to the conclusion that Darwin was right -- right in ways that Darwin himself probably never could have imagined, not knowing about DNA, not knowing that we'd have a digital record of these events to study.

Among the evidences are the ability to compare the genomes of ourselves with other species. You can feed all of that data into a computer and say, make sense of this, without telling the computer anything about what these animals look like or what the fossil record said, and the computer comes up with this analysis with all of these species lined up in order. Humans are there as part of this story, and the computer says, this really only makes sense if you derive this back to a common ancestor in this case of vertebrates. We could even extend this to invertebrates, where we have lots of sequence as well.

When you look at the details of that tree in terms of which animals are clustered close together and how long the branches are, which says something about how long it's been since they diverged, the matchup here with the fossil record and with anatomical descriptions is breathtaking. It's all very internally consistent. Now you might say, looking at this tree, that that doesn't prove anything about descent from a common ancestor. If you believe that Genesis says that all of these organisms were created as individual acts of special creation, wouldn't it have made sense for God to use some of the same DNA motifs, modifying them along the way? And wouldn't it therefore seem to show you that DNA is more similar between creatures that look more like each other, so this doesn't prove anything.

But when you start looking at the details, that argument really can't be sustained anymore. I could give you many examples, but I'll just give you one because of the time. Here is one that I think really cannot be easily understood without the common ancestor hypothesis being correct and with it involving humans.

If you look across the genome of ourselves and other species, you find genes in a particular order with space in between them. Here's a place, for example, in the human and the cow and the mouse genome where you have the same three genes. They're lined up in the same order, which also is consistent with a common ancestor, although it doesn't prove it. But I picked these three for a particular reason. These genes have funny names -- so what do they actually do?

I'm not going to bother you about two of them, but GULO is an interesting gene. It codes for an enzyme called gulonolactone oxidase. That is the enzyme that catalyzes the final step in the synthesis of vitamin C, ascorbic acid. You probably know that vitamin C is something that's a vitamin because we need it. We can't make it ourselves, and the reason for that is that our GULO gene has sustained a knockout blow About half the gene has been deleted, and there's a little remnant left behind that you can see. The tail end of it is still evidence that GULO used to be there, but it's not in any of us. In fact, it's not there in any primate.

So somewhere higher up in that lineage this happened in a single individual, and that happened to be spread throughout all of the following organisms, primates and humans. That's why we humans get scurvy if we don't have access to vitamin C. Apparently in most of human history and primate history, there was plenty of vitamin C in the environment, so there was no great loss sustained here until we went to sea for long periods of time. Cows and mice don't need vitamin C; they make their own. They have a GULO gene that works.

Now looking at that, of course, that immediately suggests common ancestry for all three of these species -- not only suggests it, but, it seems to me, demands it because if you're going to try to argue

that the human genome was somehow special, that God created us in a different way than these other organisms, you would also have to postulate that God intentionally put a defective gene in exactly the place where a common ancestry would say it should be. Does that sound like the action of a God of all truth? I could give other examples. But -- once you look at the details -- it is, I think, inescapable for somebody with an open mind to conclude that descent from a common ancestor is true and we're part of it.

Despite that, we have issues, especially here in the U.S., about what people believe about this question. You all probably have seen the Gallup Poll that gets asked every year -- given the choice among three options, what do people say? That first option, that God guided a process that happened over millions of years -- 38 percent; the second option, that God had no part, that being a deist or an atheist perspective -- 13 percent. But the largest number -- 45 percent, almost half -- choose the third option, that God created human beings in their present form in the last 10,000 years. You can't arrive at that conclusion without throwing out pretty much all of the evidence from cosmology, geology, paleontology, biology, physics, chemistry, genomics and the fossil record. Yet that is the conclusion that many Americans prefer.

There are a lot of forces trying to encourage that view. If you've been to the Creation Museum -- I haven't, but I gather some of you have -- it will show you this perspective of humans and dinosaurs frolicking together in a way that's consistent with the 6,000-year-old Earth. Again, many children going to see this are probably walking away thinking, yeah, that makes sense.
I get e-mails practically every week from people who were raised in this tradition -- many of them home schooled or schooled in a Christian high school where young Earth creationism is the only view that they're exposed to. Then they get to university and they see the actual data that supports the age of the Earth as 4.5, 5 billion years old, and they see the data that supports evolution as being correct, and they go into an intense personal crisis.

We've set those folks up for a terrible struggle by what we're doing right now in this country.
It seems to me that atheism is, of all of the choices, the least rational because it assumes that you know enough to exclude the possibility of God. And which of us could claim we know enough to make such a grand statement? G.K. Chesterton says this quite nicely: "Atheism is the most daring of all dogmas, the assertion of a universal negative."

So how, then, do we put this synthesis together? I'll give you the view that I've arrived at, which in my experience is also the view that about 40 percent of working scientists who believe in a personal God have arrived at. So here it is -- God, who is not limited in space or time, created this universe 13.7 billion years ago with its parameters precisely tuned to allow the development of complexity over long periods of time. That plan included the mechanism of evolution to create this marvelous diversity of living things on our planet and to include ourselves, human beings. Evolution, in the fullness of time, prepared these big-brained creatures, but that's probably not all we are from the perspective of a believer.

Some would say, evolution just doesn't seem like a very efficient method. Why would God spend so much time getting to the point? Remember, a few steps back there, we said the only way you've really solved the creator problem without ending up in an infinite regress is to have God be outside of time. So, basically, it might be a long time to us, but it might be a blink of an eye to God.

The intelligent design perspective, which is so prominent now in the evangelical church and, of course, is a flashpoint for debates about the teaching of science in schools, is basically that evolution might be

OK in some ways, but it can't account for the complexity of things like the bacterial flagellum, which are considered to be irreducibly complex because they have so many working parts and they don't work with any of the parts dropping out, so you can't imagine how evolution could have produced them.

This is showing severe cracks scientifically in that the supposedly irreducibly complex structures are, increasingly, yielding up their secrets, and we can see how they have been arrived at by a stepwise mechanism that's quite comfortable from an evolutionary perspective. So intelligent design is turning out to be -- and probably could have been predicted to be -- a God-of-the-gaps theory, which inserts God into places that science hasn't quite yet explained, and then science comes along and explains them.

I think I would also say intelligent design is not only bad science; it's questionable theology. It implies that God was an underachiever and started this evolutionary process and then realized it wasn't going to quite work and had to keep stepping in all along the way to fix it. That seems like a limitation of God's omniscience.

I think we need only go back before Darwin and see what theologians thought about Genesis to have a better conversation about this. Go back all the way to Augustine in 400 A.D. Augustine is writing here specifically about Genesis: "In matters that are so obscure and far beyond our vision, we find in Holy Scripture passages which can be interpreted in very different ways without prejudice to the faith we have received. In such cases, we should not rush in headlong and so firmly take our stand on one side that, if further progress in the search for truth justly undermines this position, we too fall with it." And is that not what is happening in the current climate with, in fact, insistence that the only acceptable interpretation for a serious Christian now is a literal acceptance of the six days of creation, which, again, Augustine would have argued is not required by the language?

BARBARA BRADLEY HAGERTY: I've thought a lot about the evidence for or against God, or kind of an intelligence that stitches together the universe, over the last few years in terms of writing my book [The Fingerprints of God: The Search for the Science of Spirituality].

For the past century, materialism had reigned triumphant. But the National Opinion Research Center at the University of Chicago has done extensive polling on people who have spiritual experiences -- not just believe in God, but a spiritual experience. It turns out that 51 percent of people have had a spiritual experience that absolutely transformed their lives. That's a lot of people.So now I think there is a move afoot among scientists to, if not embrace, then at least study this thing called spiritual experience. They can do that because they have the technology to do that or at least to start to make inroads. They have brain scanners and EEGs, which allow them to peer into the brain.

Back in 2006, I took a year off from NPR to just study, to look at what I think of as the emerging science of spirituality. My litmus test in doing my research was this: Basically, if a prominent scientist or if prominent scientists were investigating some aspect of spiritual experience, then it was fair game for me to report on it. So I encountered questions like, is there a "God spot" in the brain? Is there a God chemical? Is God all in your head?

First I attacked the question of the "God spot" in the brain: Is there an area of the brain that handles or mediates spiritual experience -- by spiritual experience I mean that notion, that transcendent moment that you have, that sense that there's another being in the room or around you. The question is, if you can locate the place that mediates spiritual experience, does that mean that God is nothing more than brain tissue?

People have long suspected that the temporal lobe has something to do with religious experience. The temporal lobe runs along the side of your head, and it handles things like hearing and smell and memory and emotion. The first concrete evidence that there was a connection between the temporal lobe and spiritual experience was made by a Canadian neurosurgeon named Wilder Penfield. Back in the 1940s and '50s, he began mucking around in the brains of patients as he operated on them. There aren't any pain receptors in the brain, so he'd go in and he could take an electrode and prod a part of the brain -- keep them awake -- prod a part of the brain and see what part of the body corresponded with that part of the brain. Well, when he prodded the temporal lobe, something very strange happened. People reported having out-of-body experiences and hearing voices and seeing apparitions. He hypothesized that he might have found the physical seat of religious experience.

So science figured out that one way to try to explore spiritual experience and look at the brain mechanics of religious experience is to look at people with temporal lobe epilepsy on the theory that the extreme elucidates the normal. Temporal lobe epilepsy is basically an electrical storm in the brain where all the cells fire together. Usually seizures are really horrible things. I went to a Henry Ford hospital to the epilepsy clinic and it was just -- it's a horrifying experience to watch a seizure. But in a few rare cases, people have ecstatic seizures, and they believe that they are having a religious experience. They may hear snatches of music or words, presumably from their memory bank, and they interpret it as a message from God or the music from the heavenly spheres. They may see a snatch of light and think that that's an angel.

Today a lot of neuroscientists have kind of retrofitted a lot of major religious leaders with temporal lobe epilepsy. Like Saul on the road to Damascus -- was he blinded by God and heard Jesus' voice or did he suffer, as one neurologist said, "visual and auditory hallucinations with photism and transient blindness"? Joseph Smith, the founder of Mormonism, did he see a pillar of light and two angels or did he suffer a complex partial seizure? What about Moses and the burning bush, hearing God's voice?

Now I've got to say, I have a little trouble with this kind of retrofitting, because it's hard to imagine something as debilitating as epilepsy being helpful in writing, say, the bulk of Christian doctrine, as did Paul; guiding a nation through the wilderness for 40 years, as did Moses; or founding one of the three monotheistic religions, as did Mohammed. But I do think that scientists are onto something. I think the temporal lobe may in fact be the place that mediates spiritual experience.

One of the people who convinced me of this is a guy named Jeff Schimmel. Jeff is a writer in Hollywood. He was raised Jewish, never believed in God, had no interest in spirituality. Then a few years ago, nine years ago, when he was 40 years old, he had a benign tumor in his left temporal lobe removed. The surgery was a snap, but a couple of years later, unknown to him, he began to suffer from mini-seizures. He began hearing things and having visions. He remembers twice lying in bed when he looked up at the ceiling and saw a kind of swirl of blue and gold and green all settle into a shape, a pattern. He said, then it dawned on me, it was the Virgin Mary. Then he thinks, why would the Virgin Mary appear to a Jewish guy? But a few other things began to happen to Jeff. He became fascinated with spirituality. He found himself weeping at the drop of a hat when he saw pain in other people. He became fairly obsessed with Buddhism.

But he began to wonder, could his newfound spirituality have anything to do with his brain? So the next time he visited his neurologist, he asked to see a picture of his brain scan, the most recent one. And, in fact, the temporal lobe was very different before and after the surgery. It had kind of pulled away from the skull. His temporal lobe was smaller, a different shape, it was covered with scar tissue,

and those changes had begun to spark electrical firings in his brain. He essentially developed temporal lobe epilepsy. But there was no question in his mind that his faith, his newfound love for his fellow man, all of that, came from his brain.

Are transcendent experiences -- not just Jeff Schimmel's, but Teresa of Avila's -- are they merely a physiological event or could it possibly reflect an encounter with another dimension?
I want to propose that how you come down on that issue depends on whether you think of the brain as a CD player or a radio. Most scientists who think that everything is explainable through material processes think that the brain is like a CD player: The content, the CD with the song on it, for example, is playing in a closed system, and if you take a hammer to the machine, you know, destroy it, the song is not going to play. All spiritual experience is inside the brain, and when you alter the brain, God and spirituality disappear.

Now there is some scientific support for this line of thinking. These days scientists can make transcendent realities, or God, disappear or appear at will. It's kind of a party trick. Recently a group of Swiss researchers found out that when they electrically stimulated a certain part of the brain in a woman, she suddenly felt a sensed presence, that there was another being in the room enveloping her. A lot of people describe God that way: a sensed presence, a being nearby enveloping them. So they could conjure up God just by poking part of the brain.

Making spiritual experiences disappear is, of course, far more common. It's what epilepsy specialists are trained to do: You remove part of the temporal lobe or you medicate the brain and tamp down the electrical spikes and, voila, God disappears, all spiritual experience goes away. But suppose the brain isn't a CD player. Suppose it's a radio. Now in this analogy, everyone possesses the neural equipment to receive the radio program in varying degrees. So some have the volume turned low. Other people hear their favorite programs every now and again, maybe some of you all, like me, who have had brief transcendent moments. Some people have the volume way too high or they're caught between stations and they hear a cacophony, and those people actually need medical help.

But in this analogy, the sender is separate from the receiver, and the content of the transmission doesn't originate in the brain anymore than, say, the hosts of "All Things Considered" are sitting in your radio when they're broadcasting. If the brain is a receiver, then it's picking up God's communications, which never stop, even when the brain has been altered by surgery or medication or death. [P]erhaps people who have vivid or frequent transcendent moments are able to tune into another dimension of reality that many of us ignore. Maybe St. Paul and Joan of Arc weren't crazy; maybe they just had better antennae.

So that's one debate about the brain and whether spiritual experience is just something within the brain or something that may transcend the brain. Another argument that God is all in your head comes from neuropharmacologists. They propose that God is nothing more than chemical reactions in your brain.

Peyote like other psychedelic drugs, including LSD and magic mushrooms seem to prompt mystical experience. Scientists have discovered recently that these psychedelic drugs have a couple of interesting things in common. Chemically, they all look a lot like serotonin, which is a neurotransmitter that affects parts of the brain that relate to emotions and perception. Now scientists at Johns Hopkins University have discovered that they all target the same serotonin receptor, serotonin HT2A. So what that receptor does is, it allows the serotonin or the psilocybin or the active ingredient of these psychedelics to create a cascade of chemical reactions, which then create the sounds and sights and smells and perceptions of a mystical experience. Essentially, they've discovered a "God neurotransmitter," in a way.

[D]oes that mean that God is just a chemical reaction? Roland Griffiths, who's the researcher at Johns Hopkins, doesn't think so for a couple of reasons. One is that people who have spiritual experiences can do this without help from their chemical friends. They can do it through meditation and prayer and chanting and fasting. Second, he says it's just as plausible that the chemical reactions and the electrical firings in the brain are reflecting an interaction with God or the spiritual realm. He uses this analogy: When you eat a piece of apple pie, all sorts of things happen in your brain. The part of the brain that mediates smell will light up or taste will light up. Probably the part of the brain that handles memory will light up as you think about the last time that you had a piece of apple pie. But does the fact that there is this predictable and measurable brain activity mean that the apple pie doesn't exist? So maybe, Griffiths says, this brain activity is chronicling an interaction with the divine.

He raises a third issue, which Francis alluded to, which is, why? Why are we wired to have mystical experiences in the first place? Is it possible that there is a God or an intelligence who's created this way? I mean, if there is a God who wants to communicate with us, he probably wouldn't use the big toe; he'd probably use the brain. Doesn't it make sense that this is how God would communicate?

Now in the end, I don't think science will be able to prove or disprove God, but I do think there's a really fascinating debate that's circling around spiritual issues. We may actually make some headway about it. There may be a way to tackle this issue in a definitive way. It's the mind-brain debate, or can consciousness operate when the brain is stilled?