



NEW YORK ENCOUNTER 2011: Can an Accomplished Scientist Be a Genuine Believer Today?

A discussion exploring the boundaries of faith and science

With Msgr. Lorenzo ALBACETE, Theologian, author, columnist, Dr. Kenneth MILLER, Professor of Biology, Brown University, and Dr. Charles TOWNES, Nobel Prize Winner in Physics

Sunday, January 16, 2011, The Manhattan Center, New York, NY

Landi: Good evening. My name is Maria Teresa Landi and I'm a scientist at the National Institute of Health, and I'm also a member of the Advisory Board of Crossroads Cultural Center that is among the organizers of New York Encounter.

Tonight I have the great privilege to introduce three distinguished speakers, Professor Charles Townes, Nobel Prize winner in physics, Professor Kenneth Miller, a professor of biology at Brown University, and Msgr. Lorenzo Albacete, author, theologian and former scientist.

Tonight we will address one of the most widely discussed topics in academic and public life: Can an accomplished scientist be a genuine believer today? And we have asked the speakers to address this question starting from their experience.

I want to begin introducing Professor Townes with just a few salient points among his long list of accomplishments. Dr. Charles H. Townes, who received the Nobel Prize in 1964 for his role in the invention of the maser and the laser, is presently a Professor in the Graduate School at the University of California, Berkeley, and engaged in research in astrophysics. He is known for a variety of research involving the interaction of electromagnetic waves and matter, and also as teacher and government advisor.

Born July 28, 1915 in Greenville, South Carolina, Dr. Townes graduated with highest honors from Furman University in 1935, earning a Bachelor of Science degree in physics and a Bachelor of Arts degree in modern languages. He completed a master's degree at Duke University and in 1939 received the Ph.D. degree at the California Institute of Technology. He was a staff member of the Bell Telephone Laboratories 1939-1947, Associate Professor and Professor at Columbia University 1948-1961, Vice President and Director of Research at the Institute for Defense Analysis 1959-1961, Provost and Professor of Physics at the Massachusetts Institute of Technology 1961-1965, and became University Professor of Physics at the University of California, Berkeley in 1967.

Dr. Townes's principal scientific work is in microwave spectroscopy, nuclear and molecular structure, quantum electronics, radio astronomy, and infrared astronomy; he is presently most active in the latter two fields. He has the fundamental patent on masers, and with A.L.Schawlow, the basic patent on lasers. In addition to the Nobel Prize, he has received a number of awards and honors, including membership in the National Academy of Sciences and in the Royal Society of London, the National Academy of Sciences' Comstock Prize and the John J. Carty Medal, the Rumford Premium of the American Academy of Arts and Sciences, the Stuart Ballentine Medal of the Franklin Institute (twice), and the C.E.K. Mees Medal of the Optical Society of America, and the Medal of Honor of the Institute of Electrical and Electronics Engineers, the Plyler Prize of the American Physical Society, NASA's Distinguished Public Service Medal, the Thomas Young Medal and Prize of the

Institute of Physics and the Physical Society (England), the Wilhelm Exner Award (Austria), the 1979 Niels Bohr International Gold Medal, membership in the National Inventors Hall of Fame, South Carolina Hall of Fame, Engineering and Science Hall of Fame, the National Medal of Science, as well as honorary degrees from twenty-five colleges and universities.

Professor Townes, I'll let you have the floor.

Townes: There have been many people who've felt that science and religion were contrary to each other and not consistent with each other, hence there was a conflict. My point of view is very different than that, and I think increasingly people are giving up that kind of point of view. I think really science and religion are quite parallel and complimentary with each other; they help each other. Well, what are they exactly? I will try to define them. I would say science is an attempt to understand our universe, what it's like, what it does. You have to understand our universe, including human life and everything around us. That's science. What is religion? Well, religion is the attempt to understand the purpose and meaning of this universe, the purpose and meaning of this universe always around us, but particularly including human life. What is the purpose and meaning of this world, this life? So that's the difference, but if we understand how the systems work, then maybe we can understand its purpose and meaning, because clearly the purpose and meaning have something to do with what it's like, and vice-versa. So the two are related; they just look at things from a different point of view, and they're complimentary.

Now I think in both cases we need to examine things very carefully and open-mindedly. Science certainly examines things. We think of science as proving things, and religion is just postulates and faith. Well that's not an accurate view of science at all. Science postulates things, and it has faith; it assumes laws and it believes those laws occur, it believes those laws are obeyed and it sometimes has to change them. There are many really basic unknowns. For example, most of the matter in the universe isn't known by scientists. We know it's there, but we don't know what it is. Actually you and me, and we know all these things around us, but we know that our galaxies in this universe are being pulled by something, and we believe in gravity. Science has faith in the gravitational laws. If it's pulled by something, there's a mass there. There's something there, and that mass is greater than all the mass that we know, but we don't know what it is; we can't see it; we can't detect it; we don't know what it is. Well, we're working hard to try to find out what it is, and maybe someday we'll know, but at present we don't know, but we have a postulate that the laws of gravity, that gravity itself is produced by mass, and hence we think there's mass there and that's all the more matter in the universe than everything else we know. Well that's a kind of striking thing—uncertainties in science, and we have faith, we have belief. Yes, it must be there. And there are puzzles. The same thing is true in religion of course. We make postulates and we have beliefs and we think this is most likely right, and we think it's right so we act accordingly.

Now another interesting puzzle to science is the initiation of the universe. The universe had a beginning. It suddenly exploded and existed. How do we know that? Well, I'm very proud of one of my students, Arnold Penzias, who discovered the so-called "Big Bang." He discovered radio radiation from way, way out there, coming from all directions, and we all eventually concluded that had to come from a big bang, the universe exploding. And we now know that the universe is expanding. We can see things moving apart all the time, and moving at such a speed that we know about how long ago it occurred. It occurred a little more than 13 billion years ago; the universe had a beginning. It started. It started with a big bang, just an explosion, and it's still expanding and expanding. We can see it expanding.

Well, that was a surprise to many scientists. For example, Einstein said, "No, the universe can't have a beginning. No, it doesn't make sense. It can't have a beginning. How can it possibly have a beginning?" But as the scientific information began to come in, he eventually was convinced, well, for goodness sake, it had a beginning. How? That's a puzzle for science. Of course it's very suggestive to religion, and so you see this shows you right away how science and religion can relate to each other. Scientists proved that the universe had

a beginning that was started somehow, 13 billion years ago. Religion says that God created it. There was a Creator. And this indicates, yes, there was a Creator and a creation.

Now, in addition, we know that the laws of science are almost just right so we can be here. They had to be almost exactly the way they are for us to be here and be what we are and have all the abilities we have, and so on. All the laws of science have to be almost exactly the way they are for things to be this way. Well, why did they turn out that way? Again it's very indicative, very suggestive, at least, of a Designer, a Planner, a design. It was designed; it was planned. Now, there are some scientists who say, "Oh no, it just happened to turn out this way. There are lots and lots of universes, billions and billions of universes, and they're all different, and this one turned out this way, and that's why we're here. Well, they can say that, but that's purely a postulate; there's no way of testing it. No way of testing, no way of seeing these other universes, if they're out there. So you see, some scientists make postulates and they can believe that if they wish, but it doesn't seem highly likely. There had to be an enormous number of universes for things to turn out exactly right this way without it being planned. So the initiation of the universe is a puzzle to science—why it's made the way it is exactly so we can be here, and so on.

Now there's another thing, the initiation of life. We know that life on earth began only once. It began maybe 4 or 5 billion years ago, and we're all related. All life on earth is related. How do we know that? We know that from the molecules. We're made of molecules and certain molecules can be left-handed or right-handed; we all have some left-handed molecules that are similar. Well, maybe there was a right-handed type that was created once and it died out or something, but life couldn't have been created many times. It was created only once. Why? And how did it begin? Well, we can sort of imagine how it might have begun. Molecules just happened to have come together accidentally in the right way. It's highly improbable, just the right way. We can imagine that, but we can't prove it. We can't do it ourselves. We can't put molecules together that way. Maybe someday we'll learn enough about life that we'll be able to reproduce it, but not now. We don't know.

As a puzzle of free will—most of us think we can do things. I think I can put my hand this way or that way whenever I want to. Oh? Science doesn't allow free will. Our present science says, "No, there can't be any free will." Quantum mechanics says, "No, things are not predictable. Exactly what happens is not predictable, but nobody has control. There's nothing they can have control of, according to science." Well, how many people believe that? I think almost everybody thinks they have free will; they can make some free choices; they can't choose everything, but they can make some free choices. They've got some free will. It's quite contrary to science. Of course, it's very much a part of religion that God has given us some free will, made us like Himself, able to do things, able to do new things. Well, is it real? Well, I think it is, and we all have that instinct. We think we have free will; we can make some free choices. I don't think I'm just automatically what the molecules tell me to do—that's what I do; that's why I'm here; that's why I'm saying what I'm saying. Oh? I can't believe that.

Science also tells us something about the effects of religion of on life. Psychologists and biologists have studied the effects of religion on life. In general it expands and enlarges and helps life. The effects of religion on life—this is the way science and religion do interact. They are very parallel; they're dealing with the same universe; they just look at it from a little different ways, but they tell each other something. And religion has told science something. Well, it's told science that the universe had a beginning, and told it that it's planned. And we have free will and it's planned. Those are the laws of science the way they are.

Now revelations, we believe in revelations in religion. Revelations in science? Well, maybe. Let me tell you how the laser began. I had worked for many years doing spectroscopy for wavelengths about half a centimeter long. I had wanted to get them shorter. I could get them down a little bit shorter. Not much. I was using electronic oscillators, and electronic oscillators couldn't oscillate faster than that. I worked on it and I worked on it. I was appointed a chairman of a national committee to see how to get down to shorter wavelengths with

faster oscillators, get down to maybe a millimeter or shorter, down in the infrared. We traveled all over the country interviewing people, seeing if anybody had any ideas, and after a year's time, the national committee met in Washington, and we said, "Well, we're just going to have to write a report saying that we just don't find any answers." Well, I woke up early in the morning worrying about this; I went out and sat on a park bench in Franklin Park, Washington, DC. I remember it very well. It was a bright Sunday morning and I sat on the park bench and thought: Why hadn't we been able to get any ideas how to get an oscillator with shorter wavelengths? We've tried this and we've tried that. None of them worked. My students have tried this, and that didn't work. Nobody seemed to have any ideas of what else to do. I said, well, of course molecules and atoms can produce short waves. They can produce infrared and light; they can produce short waves. But we can't produce an oscillator with them; they don't amplify. Oh, wait a minute! Wait a minute! We know atoms and molecules have an upper state and a lower state, and if they drop down from the upper state, they emit light. If they go from the lower state to the upper light, they absorb. And thermodynamics says there has to be more in the lower state than the upper state, so there are more absorptions than emissions. So if you send light through a bunch of molecules and atoms, it gets absorbed. It doesn't get amplified. But hey, what we have to do is get more atoms up here than down here, and then we send light through and then there'll be more emission than absorption; we get amplification! Wow! (I pulled out a piece of paper and pencil and wrote down some equations.) Oh, it looks to me like it's really possible. Wow!

Was that a revelation? A sudden idea. You know people had worked and worked. I had worked and worked on this for many years. A sudden idea. How did it occur? I don't know. It suddenly came to me. A revelation.

I knew that people would question this, and I didn't have it all tried out yet, so I thought, well, I won't tell the committee about it; I'll just go home and see what I can do. I didn't tell the committee, and we wrote our report saying that we hadn't found any answers.

Well, I went home, and I persuaded a student, Jim Gordon, to work on this and try to build one. I thought I'd build one first, microwave wavelengths—I had a lot of equipment for that. I thought I'd build one to amplify using ammonia molecules, amplify the wavelength about half an inch, one centimeter roughly, and try and see if it worked. So Jim Gordon agreed to try and do his thesis on this; he'd been working on it six months or so, maybe a year, and the head of the department and the previous head of the department, Professor Rabi and Professor Kush, both of whom got Nobel Prizes in physics, so they're not bad physicists, came to my lab and said, "Look Charlie, that's not going to work. We know it's not going to work. You know it's not going to work. You've got to stop." Well, fortunately my title was Associate Professor then, and an Associate Professor can't be fired just because he's stupid. If he does something morally wrong he can be fired, but not just because he makes a mistake. So I said, "No, I think it has a chance of working; I'm going to keep at it." They marched out of my laboratory angrily, and so on. Well, about six months later Jim Gordon had it working. He came into my classroom and said, "Hey, it's working!" Everybody in the classroom got up and went and said, "Yes, yes, he's amplifying waves with molecules."

A lot of people would come by and look at my work and say, "Oh, yes, that's kind of interesting." But nobody had tried to copy me. There was no competition because nobody took it very seriously. I was lucky that I was able to go ahead and build one before anybody else did. We called it the maser, which stands for "microwave amplification by stimulated emission of radiation." And as soon as that got to work, then everybody got excited, and there was lots of competition. Everybody tried to make one, and make various kinds, and they made all kinds of different varieties. This is a very exciting field. Nobody thought of getting a much shorter wavelength. That's what I wanted to do. After about a year, I sat down and said, "I want to get down to shorter wavelengths now. Let me see just how I can do it." I wrote it all down. Oh, looks like I can get right on down the light waves. Wow! Art Schawlow had been a post doc with me. I talked with him about it and he said, "That's interesting. Can I work on it with you?" So he did and he added some ideas and so we published a paper on how to make this get the shorter wavelengths. The paper we called, "Optical Masers." Masers was "microwave

amplification by stimulated emission,” but we wanted to push them on to light. We called it “Optical Masers.” Pretty soon after that paper was published, everybody jumped in and they called them lasers—light amplification by stimulated emission of radiation. Light amplification. Then we thought maybe the systems that work in the infrared we should call them “erasers” for infrared! But something else was already called erasers. Infrared systems are lasers. Anything one millimeter or longer is a maser, one millimeter or shorter, that’s a laser, but there’s really no difference.

Just to show you the doubts about new ideas, I was consulting for Bell Labs and Art Schawlow was working for Bell Labs. I told Art, “I suppose we ought to give the patent to Bell Labs; you talk to the Bell Lab lawyers.” Well, he called me up the next day and said, “The Bell Lab lawyers said they don’t want to patent it because light’s never been used for communication, so they’re not interested.” And I said, “Well now, wait a minute. Just because they don’t understand, I don’t think we should cheat Bell Labs. You go tell them, ‘Yes, it can be used for communication.’” So he called me up the next day and said, “Well, they said if we can show them how it can be used for communication, they’ll patent it for Bell Labs.” We gave the patent to Bell Labs.

Well, that was a revelation—the laser.

Again let me emphasize the parallelism between science and religion. They’re both trying to understand the universe. One is how it works and the other is its purpose and meaning. And they are related, of course, and they’re trading off and giving each other ideas. And does science have revelations? Yes, I think probably so. We have to recognize that all our beliefs in science are not necessarily right. I mentioned that there’s all this dark matter; we don’t know what in the world it is. We think it’s there because of our belief in gravity. And then this dark energy which represents even more mass. We’ve recently discovered that the universe is being pushed apart by dark energy that’s even more mass. That’s about 20 times the mass that we see around us or we know about. Dark matter is about five times the mass that we know about, so most of the matter in the universe we don’t really know. Science says it’s there, but what in the world is it? Well, you see, there are many things we don’t know in science—how the world began, what’s most of the matter in the universe? How can we have free will? There are many, many things we don’t understand, and science has to recognize that, and it does. More and more we recognize that science is preliminary. It’s remarkably successful; it can predict and do a lot of things, but some of it may be wrong, and there are new things to be found out, modifications.

Now the same is true of religion. We can’t pretend that we now completely all about religion. We want to know as much as we can, understand as much as we can. Some of it may be wrong, but let’s use it as best we can. So in both science and religion, we want to try hard to understand, use all the information, knowledge, reasoning that we can, and beliefs to understand what’s there, and we figure out what we think is most likely right, and then we use it and live by it, even though we know we may not be perfect, it may not know everything, but let’s understand as much as we can, and live accordingly in both science and religion.

Thank you.

Landi: Thank you Professor Townes. To really help us to understand how deeply things are connected in science and faith, the beginning of life, the beginning of the universe, free will, everything can be explored from different points of view—how it works and what it is its meaning.

I’d like to move quickly now to Professor Miller. Dr. Kenneth R. Miller is a Professor of Biology at Brown University. He performed his undergraduate work at Brown, and completed his Ph.D. in 1974 at the University of Colorado. He returned to Brown University in 1980 after spending six years as Assistant Professor at Harvard University. His research work on cell membrane structure and function has produced more than 60 scientific papers and reviews in leading journals, including *CELL*, *Nature*, and *Scientific American*. Miller is coauthor, with Joseph S. Levine, of four different high school and college biology textbooks which are used by

millions of students nationwide. He has received 6 major teaching awards at Brown, the Presidential Citation of the American Institute for Biological Science (2005), and the Public Service Award of the American Society for Cell Biology (2006). In 2009 he was honored by the American Association for the Advancement of Science for Advancing the Public Understanding of Science, and also received the Gregor Mendel Medal from Villanova University. He is the author of *Finding Darwin's God (A Scientist's Search for Common Ground between God and Evolution)*, and *Only a Theory (Evolution and the Battle for America's Soul)*. And I just learned that Professor Miller gave the inaugural lecture at the annual series of lectures dedicated to Professor Townes at MIT, so there is already a link between the two speakers that I wasn't aware of before.

Professor Miller...

Miller: Thank you very much. I'd like to thank New York Encounter for inviting me here today, and especially for the honor of sharing the platform with Professor Townes and Msgr. Albacete. It's a great honor and I'm enormously happy to be here.

I'm a biologist and what we face as biologists sometimes amounts to what you'll see on the billboard on the very first slide: "If we evolved from monkeys, why are monkeys still here?" There's actually a quick answer to that, although I'm not going to go into it now, but it fits into a stereotype, and you can see it in the cover of this book, *A History of the Warfare of Science with Theology in Christendom* by Andrew D. White. The stereotype that this implies is that science and faith are drawn into inexorable conflict. And there are plenty of examples of that in our present culture.

A good example is what happened in a county in Georgia a couple of years ago. They decided that they would purchase new biology text books for the 13 high schools in the county, but they were so concerned about the way evolution was treated in one of these texts books, and you can see the cover of the book, and this might be familiar to some of the younger people in the audience, and you might also notice my name on the cover. Yes, that was my book, along with Joe Levine, and they were so concerned about these books that they stuck a warning label on the books which read, "This book contains material on evolution. Evolution is a theory, not a fact, on the origin of living things. Students are urged to study carefully, be critical and keep an open mind." And I still remember when a reporter for the *Atlanta Journal Constitution* called me up after these stickers went on the books. She started the interview by saying, "Dr. Miller, aren't you outraged at the stickers they've put on your books?" And I've been interviewed before, but I'd never had an interviewer put a word in my mouth like "outraged." Then I realized, she's trolling for a quote. She wants me to say something inflammatory so she can write an article in the newspaper with a headline like, "AUTHOR INCENSED," or even better, "NORTHERN AUTHOR UPSET BY WHAT THEY'VE DONE TO HIS BOOKS."

So I decided I would not give her the pleasure, so I said, "No, I like the stickers. I think the stickers are great; they just don't go far enough." And I tried to explain that saying students should keep a critical and open mind when they study evolution, was unfair to science.

And she said, "You mean to the science of evolution?"

And I said, "No, I'm a cell biologist. It's unfair to cell biology because it implies that everything in my field is pretty well figured out. It's only evolution that's a little shaky. I'll tell you what I'll do, no charge. I will rewrite the sticker for the schools in Cobb County." And there on the slide you'll see a sticker that I would be proud to have on my book: "This textbook contains material on science. Science is built around theories, which are strongly supported by factual evidence. *Everything* in science should be approached with an open mind, studied carefully and critically considered."

Sadly, the school district didn't take me up on my very generous offer. As you'll see in the next slide, they were taken to court by a local citizen. He's the short guy there, Jeffrey Selman, a native New Yorker, who sued the Cobb County Board of Education. I actually testified in that trial, and in 2004 a federal judge ruled that the stickers violated the First Amendment to the Constitution because they were an effort to advance a particular religious view.

Now you can see the headline to how this was written up in a lot of places. I'm older and wiser now, and I realize that if an *Associated Press* reporter calls you up and asks you for a comment, your name is liable to be in the first sentence of an article that will appear the next day in a thousand newspapers, and my name did. You should have seen my email inbox that evening. All the ones that I remember were the ones that read, "You're going to burn in hell." And I actually wrote back to all those people and said, "Maybe so, but if I do, it's not going to be on account of evolution; it's going to be on account of something else I've done that you don't have any idea about." Well, this event in Georgia was a small affair, to be perfectly honest.

A larger affair appeared about a year later in a school district in Pennsylvania. And that school district adopted a policy requiring their teachers to teach something called "Intelligent Design." The teachers refused, but the school board persisted with the policy and actually wrote its own Intelligent Design lesson which it had read to students. As a result, 11 parents of the district filed a lawsuit. And what happened in the fall of 2005 was a trial. I had the honor, although I'm not sure that's the right word, of being the lead witness for the parents in that trial. This was an extraordinary event. It was widely covered in the media. In the next slide you'll see the NBC TV courtroom sketch, and that is me being cross-examined during the first two days of the trial. My cross-examination went on for more than 9 hours. The trial itself went on for more than 7 weeks. The last day of the trial when the attorneys sum up, the attorney representing the school board got up to make his closing statement. He fiddled with his DayMinder. Nobody knew what he was doing. And he looked up and he said, "Your Honor, I'm not sure if you're aware of this, but this trial has gone on for 40 days and 40 nights."

It was then we had an idea which way the judge would rule because he then leaned forward from the bench and said, "But it wasn't by design."

As you'll see, in December 2005, right before Christmas the decision was announced and the decision was an overwhelming win for science. And the judge, who incidentally is a life-long Republican and a George W. Bush appointee, ruled that Intelligent Design simply wasn't science; this was reported in newspapers and television outlets all over the country, and it set off rejoicing inside the town of Dover. It's important to remember that it was the parents that complained about this policy.

One of the things that is interesting that happened during this trial is time and time again I heard news reports saying things like, "It's God versus science in a Pennsylvania courtroom." But the interesting thing about that is of the 11 parents, 7 are professing Christians, 2 are Sunday school teachers, and 1 actually runs a summer Bible camp. Of the expert witnesses, 3 of us were Christians, and 1 is a professor of theology at Georgetown University. People of faith were very much on the side of science, and this came to some people, although certainly not to most of us, from surprising quarters. One of our most vocal supporters was Fr. George Coyne, at that time the director of the Vatican Observatory. And Fr. Coyne was outspoken in saying that Intelligent Design profanes science; it cheapens God; it reduces the vision of creation. That's from a clergyman and a scientist.

How about from a scientist deeply involved in the theory of evolution itself? Well, the greatest evolutionary geneticist of the Twentieth Century was the late Theodosius Dobzhansky. And Dobzhansky is famous, not just for his fundamental contribution to evolution, but for writing a marvelous article. The title of that article, *Nothing in Biology Makes Sense Except in the Light of Evolution* says it all. It's absolutely true. It's a statement to which any biologist would subscribe. But in that article there are some remarkable statements. One of them is: "The organic diversity [of life] becomes, however, reasonable and understandable if the Creator has created

the living world not by caprice but by evolution propelled by natural selection.” And Dobzhansky went on, “It is wrong to hold creation and evolution as mutually exclusive alternatives. I am a creationist *and* an evolutionist.” Why did he say that? He said because “Evolution is God’s, or Nature’s method of creation.” And then, very significantly, “Creation is not an event that happened in 4004 BC; it is a process that began some 10 billion years ago and is still under way.”

One of our allies in this has been, in fact, Pope Benedict. And here you’ll see some interviews that he gave to Italian journalists in which he called the creation versus evolution clash “an absurdity.” His exact words were these: “The contrast is an absurdity, because there are many scientific tests in favor of evolution, which appears as a reality that we must see and enriches our understanding of life and being.” That’s kind of technical, Vatican-speak language, so if you do what I do when I’m confused by complicated language, go to the *New York Post*: “EVOLUTION & GOD DO MIX: POPE.” You couldn’t have said it any better than that.

Now the topic which we are all considering today, in effect, is a topic that 11 or 12 people were asked to write about a couple years ago by the Templeton Foundation. And these essays are still on line, and the topic is: Does Science Make Belief in God Obsolete? Of the people who wrote for this, about 4 of them said, “Yes, it does.” Another 4 said, “No, it doesn’t.” I wrote, “Of course not.” And a few others hemmed and hawed one way or another. The reaction to these published essays was so favorable and so interesting that the organizer of the event called me up and asked me if I would be willing to debate someone in print. I said, “Sure, that’d be fun. Who do you want me to debate?” The answer was Christopher Hitchens. So if you are interested you can still find, at the Templeton organization Web site, a three-part, print debate between myself and Christopher Hitchens on this issue, and I think you’ll find it illuminating if only because I think I was able to strip away from Mr. Hitchens the pretension that science has indeed disproven the existence of God.

Now the interesting thing, and I don’t think Mr. Hitchens was aware of it, is that religious belief is actually pretty common among working scientists. This is an article published in *Nature* a little more than a decade ago in which thousands of working scientists from the American Association for the Advancement of Science were surveyed. 45% professed simple disbelief in a Supreme Being. About 14.5% were not sure, but 39.6% professed a belief in a personal God to whom one could pray and who could intervene in human affairs. It’s a very conventional kind of belief. And here’s what’s interesting. The questions in the survey duplicated a series of questions asked of AAAS of its members in 1917 and the percentages in 1917 were almost exactly the same as they were in the late 1990s.

I think one of the people who best put this whole struggle about evolution in context is the columnist Charles Krauthammer who writes for *The Washington Post*. At the conclusion of that trial in which I testified, he wrote, *Phony Theory, False Conflict*, “How ridiculous to make evolution the enemy of God. What could be more elegant, more simple, more brilliant, more economical, more creative, indeed more divine than a planet with millions of life forms, distinct and yet interactive, all ultimately derived from accumulated variations in a single double-stranded molecule, pliable and fecund enough to give us mollusks and mice, Newton and Einstein? Even if it did give us the Kansas State Board of Education, too.”

Nonetheless, it’s true that faith in the popular sense is still considered to be a contradiction of scientific reason. And I can think of no better example of this than last year, two of the great inventors of the human genome project, Craig Venter and Francis Collins. When Francis Collins was nominated by President Obama to head the National Institute of Health, there was strong support among active research scientists, but not from what I might call the anti-faith community. In particular, Sam Harris wrote an impassioned op-ed piece in the *New York Times*, and the gist of Dr. Harris’s reasoning was this: Christians believe a lot of stupid things; Francis Collins is a Christian and therefore he believes a lot of really stupid things. No one who believes a lot of really stupid things should run the N.I.H.. Well, I was very quick to write a letter in response which the *New York Times* was kind enough to publish. I wasn’t alone. There was a flurry of letters in support of Dr. Collins who

has been confirmed unanimously by the Senate, and I think whose track record as the director of the N.I.H. may be for biologists the single most important scientific institution in the world. His track record has been absolutely extraordinary.

Nonetheless, this goes on. Only a few months ago, a colleague and a friend of mine, Jerry Coyne from the University of Chicago published an op-ed piece in *USA Today* with a broader readership than the *New York Times* in some respects, and what he argued is:

- Science and faith are fundamentally incompatible, just like irrationality and rationality.
- Religious scientists may hold contradictory ideas, but this does not prove compatibility.
- Religion rejects doubt, demands certainty without evidence.
- Science embraces doubt, and demands evidence.
- Science finds truth. Religion has no way to find truth - hence religious wars, pogroms, and persecutions.

Now, Jerry is entitled to his opinion, but I think there's a flaw in his reasoning. And this flaw is common among scientists who argue that science can exclude faith, and that is that he expects faith to work just like science, to reveal empirical truth. The reality is, that's not what faith's all about. You might ask yourself: Did Jesus come to teach calculus, describe atomic orbitals, or invent the microscope? Of course not. The purpose of faith, even the purpose of revelation, is entirely different.

I think you get a much more accurate view of the boundary between faith and science if you look for the person who actually invented the mathematical foundation for cosmic expansion; in other words, what we call the *Big Bang*. His name is Georges Lemaître. He's a Belgian priest trained in mathematics and physics, and it was he who first pointed out the mathematics in general relativity that demanded an expanding universe. Because he was a priest, Fr. Lemaître was often asked, "Doesn't this contradict the Bible?" And here's what he said:

The writers of the Bible were illuminated more or less -- some more than others -- on the question of salvation. On other questions they were as wise or as ignorant as their generation. Hence it is utterly unimportant that errors of historic or scientific fact should be found in the Bible, especially if errors relate to events that were not directly observed by those who wrote about them... The idea that because they were right in their doctrine of immortality and salvation they must also be right on all other subjects is simply the fallacy of people who have an incomplete understanding of why the Bible was given to us at all.

As a scientist, I often find myself turning, believe it or not, to Saint Augustine to see the proper relationship to scientific rationale in truth. Augustine was an extraordinarily enlightened man. And one of the things that he observed was: "The universe was brought into being in a less than fully formed state, but was gifted to transform itself from unformed matter into a truly marvellous array of structure and life forms." He was almost an evolutionist.

Once I showed that slide to an audience of scientists and somebody got up and said, "Well, that's fine that you like Augustine, but what kind of science would you get if you followed the precepts of a weird, 5th Century mystic like Augustine?"

And knowing this person's field, a big grin came across my face. And I said, "I want to tell you about someone who was so transfixed by the work of Augustine that he entered an order of priests founded according to the precepts of Augustine. He was a very religious man; he was respected by his peers; in fact, he was elected the Abbot of the Augustinian Monastery of St. Thomas in Brunn, what is today the Czech Republic. Now, at one point in his life, this Augustinian priest got interested in what today you and I would recognize as a scientific question. He was interested in how plants pass their characteristics along from one generation to another. So what did he do? Did he pray? Of course he prayed. Did he read Scripture? Of course he did. But to answer this scientific question, do you want to know what he did? He went into the garden and did experiments. The name

of that Augustinian priest was Fr. Gregor Mendel, the father of the modern science of genetics. What do you get when you do science according to Augustinian precepts? The answer is you get genetics.” And I think that’s as profound a statement as one can make about the compatibility of science and faith.

So here’s what I’d like to close with. I think it is self-evident that science is done and is done well by theists, that is, people of faith. My evidence of that is 40% of the working scientists in the United States profess to be people of faith. Why is that? Because the first devotion of any Christian, certainly any person of faith, should be to the truth, and that’s also the devotion of science. Secondly, There is no scientific fact or theory that contradicts belief in a Creator-God who is responsible for the universe we investigate through science, and that’s true even though many flawed arguments for God (like those of the creationists) have been (foolishly) predicated on scientific ignorance. As I argued in the first popular book I wrote several years ago, “We ought to be able to find God, not in the dark recesses of our ignorance about science, but in the bright light of what we know and understand about the universe.”

Secondly, the “evidence” for that God is not empirical (material and scientifically testable). And the reason for that is the existence of empirical evidence would make God an ordinary part of the natural world (in other words, not God at all). To a theist, the evidence for God is immaterial, but no less real. How can the immaterial be real? In the same way that truth can be real. When we argue with passion for any viewpoint (even if we argue that religion is false) we affirm the value and reality of truth - a non-material concept.

Finally, I think it’s important for religious people to accept science is important. In a religious nation, this is the most practical way to build support for scientific rationality. And, it is also the correct way — because it avoids extending science beyond its philosophical boundaries.

It’s interesting to note that Albert Einstein, although not a religious person, recognized the religious roots of the scientific impulse. What he wrote once was:

While it is true that scientific results are entirely independent from religious or moral considerations, those individuals to whom we owe the great creative achievements of science were all of them imbued with the truly religious conviction that this universe of ours is something perfect and susceptible to the rational striving for knowledge. If this conviction had not been a strongly emotional one and if those searching for knowledge had not been inspired by Spinoza's *Amor Dei Intellectualis*, they would hardly have been capable of that untiring devotion which alone enables man to attain his greatest achievements.
Ideas and Opinions, *Crown Publishers, Inc., New York, 1954.*

What kind of “God” could exist in a “scientific world” in which nature acts according to orderly, predictable rules which can be studied, described, and understood? The answer: A God who fashioned a world that is rational and intelligible. To people of faith, God is not the antithesis of scientific reason. He is the reason why science works in the first place.

Landi: Thank you, Professor Miller. It’s amazing. Being at N.I.H., I really experience this battle. And the fact that you discussed the nomination of Collins as the director of N.I.H., I was there. I remember the debate, even within the institute precisely on this point: Is there a contradiction or not? Well, there is a different point of view.

Now a few words of introduction for Msgr. Albacete. Msgr. Lorenzo Albacete, author, theologian, and *New York Times Magazine* contributor, is a physicist by training. He holds a degree in Space Science and Applied Physics as well as a Master’s Degree in Sacred Theology from the Catholic University of America in

Washington, DC. He holds a doctorate in Sacred Theology from the Pontifical University of St. Thomas in Rome.

He is co-founder and has been a professor at the John Paul II Institute in Washington, DC. He has taught at St. Joseph's Seminary in Yonkers, NY, and from 1996 to 1997 served as President of Catholic University of Puerto Rico in Ponce.

He has been advisor on Hispanic Affairs to the U.S. Conference of Catholic Bishops. He is a columnist for the Italian weekly *Tempi*, has written for *The New Yorker*, and has appeared or has been interviewed on CNN, *The Charlie Rose Show*, PBS, EWTN, *Slate*, *The New Republic*, and *Godspy*, where he is the theological advisor.

Beside columns and articles on a number of American and international publications, Albacete is the author of *God at the Ritz: Attraction to Infinity* (Crossroad Publishing Company), a book in which as priest-physicist he talks about science, sex, politics, and religion. He is also the Chairman of the Crossroads Cultural Center Board of Advisors.

Albacete: Really, after listening to the other two introductions, brilliant careers, what a Mickey Mouse background I have! I absolutely have no shame in appearing here with such illustrious people. I have not won the Nobel Prize. I did win the little arithmetic star in kindergarten. I don't even know how this so-called "smartphone" works. And as to biology, all I know is how to cut up frogs because the normal biology teacher got sick, so they asked this nun who knew nothing about biology to take over, and we spent an entire semester cutting up frogs. But I have debated Christopher Hitchens, only that he accused me of being an atheist. Still, here we go.

I began to prepare for this presentation during the Christmas Season. Sometimes I reflected on the relation between science and faith, and other times I thought about the meaning of Christmas. According to my Latin American, Spanish, and Puerto Rican cultural tradition – at least when I was growing up – the heart of Christmas was the Solemnity of the Epiphany, or as we called it: *La Venida de los Tres Santos Reyes Magos* (the coming of the Three Holy "magician" Kings). In Spain, this was the day children received their presents from the Kings, though in Puerto Rico we also expected gifts from Santa Claus on Christmas Day, and many times he proved to be more generous than the Three Holy Kings, who also required food for their camels in exchange for their gifts. At one point in my musings, however, the two topics came together; that is, my thoughts on science and faith coincided with my thoughts about the Three Kings! It occurred to me that it would be interesting if I offered to you today my thoughts on science and faith in terms of the Biblical account of the encounter between the Magi and the newborn Jesus.

First of all, here is the relevant Biblical text in the Gospel of Matthew, Chapter 2, verses 1-12, according to the New Revised Standard Version of the Bible:

In the time of King Herod, after Jesus was born in Bethlehem of Judea, wise men from the East came to Jerusalem, asking, "Where is the child who has been born king of the Jews? For we observed his star at its rising, and have come to pay him homage." When King Herod heard this, he was frightened, and all Jerusalem with him; and calling together all the chief priests and scribes of the people, he inquired of them where the Messiah was to be born. They told him, "In Bethlehem of Judea; for so it has been written by the prophet: 'And you, Bethlehem, in the land of Judah, are by no means least among the rulers of Judah; for from you shall come a ruler who is to shepherd my people Israel.'" Then Herod secretly called for the wise men and learned from them the exact time when the star had appeared. Then he sent them to Bethlehem, saying, "Go and search diligently for the child; and when you have found him, bring me word so that I may also go and pay him homage." When they had heard the king, they set out; and there, ahead of them, went the star that they had seen at its rising, until it stopped over the place where the child was. When they saw that the star had stopped, they were overwhelmed with joy. On entering the house, they saw the child with Mary his mother; and they knelt

down and paid him homage. Then, opening their treasure chests, they offered him gifts of gold, frankincense, and myrrh. And having been warned in a dream not to return to Herod, they left for their own country by another path. (They are mentioned twice shortly thereafter, in reference to their avoidance of Herod after seeing Jesus, and what Herod had learned from their earlier meeting.)

Who were these mysterious figures called the Magi, popularly referred to as *wise men* and *kings*?

The word *Magi* is a Latinization of the plural of the Greek word *magos* (μαγος—pl. μαγοι), itself from Old Persian *maguš*, referring to the priestly caste of Zoroastrianism. As part of their religion, these priests paid particular attention to the stars, and gained an international reputation for astrology, which was at that time highly regarded as a science. Their religious practices and use of astrology caused derivatives of the term *magi* to be applied to the occult in general and led to the English term *magic*. Translated in the King James Version as *wise men*, the same translation is applied to the wise men led by Daniel in the Hebrew Scriptures (*Daniel* 2:48). The same word is also translated as *sorcerer* when describing "Elymas the sorcerer" in *Acts* 13:6-11, and Simon Magus, considered a heretic by the early Church, in *Acts* 8:9-13.

The Zoroastrian Magi in Matthew's Gospel were indeed motivated by religious reasons to study the stars, but their studies themselves were pursued without religious prejudices. They were searching for laws of nature that revealed an order, a logos, a cosmos with a permanent structure that dispelled the fear of chaos present in primordial experiences of the mystery of existence. In that sense, they were scientists.

In his commentary on Matthew's Gospel (in Volume 1 of the book *Heart of the Word*) Erasmo Leiva-Merikakis writes: "Like good scientists, the Magi take a more cosmic, a more all-encompassing view of things... In these pagans we encounter a perfect unity between patient science and moral justice ...the wise man seeks truth, and when he finds it, he does not hesitate to adore it, to subject himself to it..." This is adoration as the end of all scientific and philosophic search!

Another characteristic of the Magi's discovery of the new star is joy—not merely a mental satisfaction as when solving a problem or finding an answer to a problem, but an existential satisfaction, an interior vibration of the heart filled with wonder at the existence of a reality that is revealing its secrets, so to speak. What true scientist has not experienced this joy, this wonder, this awe before a deeper knowledge of reality?

The question we face today is whether this experience of a joyful wonder is possible, or whether we have to resign ourselves to a relativism that reduces everything—scientific research included—to subjectivism.

Consider the observations of Jonah Lehrer in his recent article in *The New Yorker* magazine a few weeks ago. The article's title is "The Truth Wears Off: Is there something wrong with the scientific method?"

"On September 18, 2007, a few dozen neuroscientists, psychiatrists, and drug-company executives gathered in a hotel conference room in Brussels to hear some startling news. It had to do with a class of drugs known as atypical or second-generation antipsychotics, which came on the market in the early nineties. The drugs... had been tested on schizophrenics in several large clinical trials, all of which had demonstrated a dramatic decrease in the subjects' psychiatric symptoms. As a result, second-generation antipsychotics had become one of the fastest-growing and most profitable pharmaceutical classes..."

The data presented at the Brussels meeting made it clear that something strange was happening: the therapeutic power of the drugs appeared to be steadily waning. A recent study showed an effect that was less than half of that documented in the first trials, in the early 1990s. Many researchers began to argue that the expensive pharmaceuticals weren't any better than first-generation antipsychotics, which have been in use since the fifties.

Before the effectiveness of a drug can be confirmed, it must be tested and tested again. Different scientists in different labs need to repeat the protocols and publish their results. The test of replicability, as it's known, is the foundation of modern research. Replicability is how the community enforces itself. It's a safeguard for the creep of subjectivity. Most of the time, scientists know what results they want, and that can influence the results they get. The premise of replicability is that the scientific community can correct for these flaws.

But now all sorts of well-established, multiply confirmed findings have started to look increasingly uncertain. It's as if our facts were losing their truth: claims that have been enshrined in textbooks are suddenly unprovable. This phenomenon doesn't yet have an official name, but it's occurring across a wide range of fields.

For many scientists, the effect is especially troubling because of what it exposes about the scientific process. If replication is what separates the rigor of science from the squishiness of pseudoscience, where do we put all these rigorously validated findings that can no longer be proven? Which results should we believe? Francis Bacon, the early-modern philosopher and pioneer of the scientific method, once declared that experiments were essential, because they allowed us to "put nature to the question." But it appears that nature often gives us different answers.

This suggests that the decline effect is actually a decline of illusion. Many scientific theories continue to be considered true even after failing numerous experimental tests. Even the law of gravity hasn't always been perfect at predicting real-world phenomena. (In one test, physicists measuring gravity by means of deep boreholes in the Nevada desert found a two-and-a-half-per-cent discrepancy between the theoretical predictions and the actual data.)

Such anomalies demonstrate the slipperiness of empiricism. Although many scientific ideas generate conflicting results and suffer from falling effect sizes, they continue to get cited in the textbooks and drive standard medical practice. Why? Because these ideas seem true. Because they make sense. Because we can't bear to let them go. And this is why the decline effect is so troubling. Not because it reveals the human fallibility of science, in which data are tweaked and beliefs shape perceptions. (Such shortcomings aren't surprising, at least for scientists.) And not because it reveals that many of our most exciting theories are fleeting fads and will soon be rejected. (That idea has been around since Thomas Kuhn.) The decline effect is troubling because it reminds us how difficult it is to prove anything. We like to pretend that our experiments define the truth for us. But that's often not the case. Just because an idea is true doesn't mean it can be proven. And just because an idea can be proven doesn't mean it's true. When the experiments are done, we still have to choose what to believe.

In such a case, is awe, wonder, and joy at scientific discoveries possible?

When I was thinking about this, a friend sent me the text of a speech given by Msgr. Luigi Giussani about the "love of being" that is remarkably appropriate to this reflection.

Giussani's argument is that the truth of Christianity can be verified by a proper consideration of the evidence for it. Evidence, he says, is the correct word, even if the evidence for the Christian claim is given to us through signs. Signs are things that can be touched, seen, and experienced. The Apostles had Jesus in front of them and this presence was a sign of His victory over death, and therefore of His mysterious identity. But what about us? What happens with the passage of time? What signs are there for us as evidence of the truth of the Christian claim, of the reasonableness of the Christian claim?

The interpretation of the signs available to us engages our liberty, he says. In this drama, our liberty is a manifestation of our love for being. Without this love for being we are not truly free and we will never grasp the evidence of the signs given to us. At this point, as an example of this love for being, Giussani invokes the Magi.

He asks why the Magi decided to pursue the sign of the star. Why did they follow the “impulse” that they felt within themselves when they saw the star? “Because they were full of love for Being,” he answers. This is the characteristic of those who are poor in spirit, he continues. The poor in spirit is a child who says yes to everything that is evidently present before him. It is a matter of not imposing our expectations to block our recognition that something unforeseen is happening, that it has happened, and it is worthwhile to pursue its meaning. This is what made the Magi take off on their journey, this opening or poverty of spirit, this child-like fascination, amazement, awe. The sign of the star, so to speak, unveiled a path to follow, a road to take. What determined this road for them, as they traveled day and night on their camels with their presents, as they rested at night looking at the sky because they were perhaps not sleepy? What determined their way? It was following the path of the star they could see.

Still, recall that at one moment the star disappeared. Why did they continue their search? Why not give up and go back home, losing interest in the search, figuring they had made a mistake? The star was gone, their enthusiasm low or gone, and yet they continued. Obviously, it had not been the star itself, or their intelligent calculations, or their imagination, or their enthusiasm that moved them: it was something that had happened, that they could not rationally deny had happened. The reason for their search was a kind of “benevolence,” says Don Gius, a benevolence that guided them. The reason for following the road, the motivation, that which defined the road, was the initial event, that which had made them take off on their journey, and they could not go back on it, because *factum infectum fieri nequit*, you cannot make something that happened become something that has not happened.

And so it is this poverty of spirit, this interior simplicity, this lack of fear of innocence, this spirit of the beggar that begs for the spiritual nourishment that truth communicates, this love for being that opens us up for the grace of the gift of faith that allows us to recognize the truth of the Mystery of Being.

Is this not also at the root of scientific research, a love for science that protects it from the relativism that now threatens it?

But, to ask again, is such an interior disposition possible today?

I immediately recalled the words of my dear friend Robert Pollock, Professor of Biological Sciences and Director of the Center for the Study of Science and Religion at Columbia University, talking about “Science Informed by Awe” at our Crossroads Cultural Center on Sept. 9, 2009.

Bob starts the day with the Jewish prayer: “The beginning of Wisdom is Awe of the Lord” (in our Old Testament Book of Wisdom we also read: “The fear of the Lord is wisdom, and to depart from evil is understanding). This awe, he said, was understood as awe before the grandeur of nature, before its incomprehensibility, as in Psalm 92, recited by the Levitical priesthood in the Temple on Shabbat: “How vast are Your works, Lord; Your designs are beyond our grasp.” However, according to Pollock, in this age of Science, we no longer have the luxury of this “incomprehensibility.”

Consider this: “I am not exaggerating the seriousness of this problem: scientific insight into the meaninglessness of DNA-based life is not simply missing meaning. It is a demonstration that a satisfactory, even elegant explanation of the workings of this aspect of nature actually conflicts with the assumption of purpose and meaning.” Pollock thinks that poets can understand this better than those not as skilled in self-awareness, quoting from Edna St. Vincent Millay’s poem “Spring”: *To what purpose April, do you return again?...The smell of the earth is good/ It is apparent that there is no death/ but what does that signify?/*

Not only under ground are the brains of men/Eaten by maggots,/Life in itself is nothing./An empty cup, a flight of uncarpeted stairs/ It is not enough that yearly, down this hill/April /comes like an idiot, babbling and strewing flowers.

Still Pollack sees grounds for awe in the human ethical choices that are inexplicable in terms of nature, to freely perform actions on behalf of another that “slip the constraints of natural selection.” (During a visit to a House where professional women lived in community, freely embracing a life of poverty, virginity, and obedience, Dr. Pollack said to me that to freely choose such a life was an example of escaping the boundaries of natural selection.)

“That is also the intersect of awe and science,” he concluded, and thus, I suggest, the path to a faith that expands the scope of reason beyond what scientific rationality allows. Once again, the capacity to experience awe or wonder is the path to the knowledge of reality made possible by faith.

Which, of course, was known all along by St. Gregory of Nyssa (c.335AD– after 394), who wrote *The Life of Moses* in which he said: “Concepts create idols; only wonder [or awe] knows.” In an essay with the title, “Only Wonder Knows,” Fr. Giussani insists again that the capacity to wonder requires simplicity of heart and poverty of spirit, the attitude of a child who, upon seeing something new (like a new star in the sky), reaches out to it to touch it, to explore it without any “if”s or “but”s. Wonder is the experience that John and Andrew had when they first saw Jesus and decided to follow Him.

Faith is the affirmation of a fact, of the objectivity of a fact from which there emanates an aesthetic, a suggestiveness that demonstrates human reason in action. Goodness or ethics, writes Giussani, derives from aesthetics. Otherwise, morality is alienating, because it doesn’t correspond to the desire of the heart that make us human; it doesn’t generate amazement, wonder, or awe, but leads instead to fear or boredom. Sacrifices required by preconceptions are destructive of the self; only a sacrifice motivated by wonder, awe, by an unexpected attractiveness of a Presence is consistent with being fully human. Aquinas put it bluntly: without grace, the Law of Christ is deadly. What is grace if not gracefulness, gentility... yes, beauty to be discovered in nature in spite of the meaninglessness of the results of evolutionary science.

The title of this presentation is whether a scientist of today can meet the requirements of modern science and still be a believer. The answer, I propose, is not only *yes he can*, but, in fact, it is faith that will sustain his or her passion for investigating nature, and prevent the process itself and its results from becoming enslaved to political, economic, and religious ideology.

Thank you very much.

Landi: Thank you. I just want to conclude thanking all the speakers for their help because they have shared their experience on this fundamental topic. Since you, Msgr., quoted the Magi example, I just want to say one thing that really struck me. I read the homily of the Pope on the Epiphany, and what struck me was how he said the Magi were scientists, were men who knew somehow that the star was a sign of something bigger. Reality holds a signature from God, a signature that man must seek to decipher, to know. And this is precisely where there is the union from a scientist’s point of view—this wonder in trying to understand an aspect of reality that at the same time brings something much bigger.