

Faith in Science

Scientists search for truth

Edited by
W. Mark Richardson
and Gordy Slack

with a foreword by Ian Barbour



London and New York

Contents

<i>Foreword</i>	vii
IAN BARBOUR	
Introduction	1
W. MARK RICHARDSON	
1 Francisco Ayala: Parallel Evolution	6
2 Arno Penzias: The Elegant Universe	18
3 John Rodwell: A Priest at Work	35
4 Brian Cantwell Smith: The Language of Matter	51
5 Bruno Guiderdoni: Reading God's Signs	70
6 Pauline Rudd: Molecular Grace	87
7 Mark Pesce: Virtually Sacred	103
8 Mehdi Golshani: The Ladder to God	120
9 Kenneth Kendler: Just, Loving and Random God	136

vi *Contents*

10 Joel Primack: Transcendental Theory	152
11 Charles Townes: Testing Faith, Wrestling with Mystery	170
12 Anne Foerst: Do Androids Dream of Bread and Wine?	187
<i>Further reading</i>	204

Introduction

W. Mark Richardson

We marvel at the success and power of contemporary science and the countless ways it is transforming our lives. But rarely do we note that the science of today can be traced back to the cultures of Western monotheism – Christianity, Judaism and Islam. On the surface this connection seems odd, even distant, especially under the apparent strain between religion and science in our day. But beneath the veneer of estrangement remain deep family ties between the scientific pursuit of truths about the material world and the spiritual quest to comprehend its significance and to find the rightful place for humans in it. These family ties, some ancient, others brand new, some practical, others philosophical, are at the heart of this book.

The men and women interviewed here represent a diverse cross-section of the highest strata of scientific accomplishment. Some are physicists, others biologists, cosmologists, or computer scientists. Some are Muslims, others Jews, and others Christians. Still others fall squarely into none of these traditional religious categories. The one thing they do all have in common is a willingness to explore openly the interface between their science and the fundamental orientations and perspectives embodied in their spiritual or religious quests. They all explore how spiritual experiences have influenced their professional work, and conversely, how perspective gained through the sciences has influenced their understanding of the great religious themes about God, about the nature of persons as moral and spiritual agents, and about purpose and meaning in the universe.

The scientists in this book find no single answer to the questions

2 *Introduction*

posed at the juncture of science and religion. Rather, the interviews reveal the many subtle and complex factors that shape the relationship between scientific and religious pursuits of truth. The variety of understandings among people who share as much in common as scientists do is a large part of the story told by this book. Each appreciates the mutual influence of science and religion in his or her own way, some acknowledging a high degree of integration, others seeing complementary relations but real differences in the modes of knowing and objects of knowledge, and still others remaining skeptical that the two domains of their lives brush against each other at all. Indeed, the approaches taken and conclusions reached by the scientists are as diverse as their backgrounds. Even scientists who share as much as Charles Townes and Arno Penzias do (both are physicists with Nobel Prizes) take radically different approaches to combining their science and religion in a single life. While Penzias says the complete lack of God's thumbprint in the world is the strongest argument for His existence (and His good taste), Townes stresses the power of his own direct experience with the divine. The differences grow from there. Mark Pesce, a leading software innovator and a pagan, sees no division between the science he does and the spiritual meaning he seeks; he is dedicated to making cyberspace, the realm of his science, a sacred place. Theologian and computer scientist Anne Foerst helped to build robots at MIT's Artificial Intelligence Lab. She speculates about baptizing her electronic creations and about when turning them off will violate the commandment against murder. Brian Cantwell Smith is a "hacker-philosopher" who thinks computer science may put meaning back in matter, fusing science and religion together once again.

As diverse as these scientists are, recurring threads do run through the interviews. Indeed, they make another thing crystal clear: the classic questions of past ages remain central in our own, despite scientific progress. Psychiatrist Kenneth Kendler and others, for instance, wrestle with the brutal reality of apparently indiscriminate pain and suffering against the backdrop of faith in God's goodness. Others struggle to understand the apparent contradiction of nature's unremitting regularity and our own undeniable experience of freedom. What role does God play in a world governed by physical law? And how skeptically should we

view our basic trust in the *purpose and meaning* of life and the universe, over and against the ambiguity of natural evidence for it, and given science's methodological resistance even to look for it?

Almost all wrestle with the truth status of spiritual insight, and with the wisdom of tradition: these notions resonate deeply in human experience, yet they lack the rigorous testability or precision we demand in the sciences.

Many of the scientists interviewed here acknowledge the limited range and status of the knowledge achieved through their work, as well as the evolving nature of scientific knowledge altogether. As a consequence, spiritual wisdom seems to make use of, but also stand somewhat free from, this changing process. Steady-state cosmology, evolution and deterministic Newtonian physics have all been perceived as threats to religious doctrine. But scientific theories come and go, and although some may ultimately prove correct and others false, their fallibility and shifting nature may soften our distress at inconsistencies between the scientific world view of the day and long-held perspectives rooted in religious tradition. Charles Townes, for example, when asked why God doesn't show up in physicists' equations, dryly points out that the equations are not complete: "There is a great deal we don't yet understand. And there are inconsistencies within science itself, yet we continue to believe it."

Some researchers remark on the limits of science. What science does, it does well. But that, they say, is precisely because of the strictly prescribed kinds of progress we expect from it. As evolutionary biologist Francisco Ayala says, science may one day provide a complete and accurate description of the entire physical world, including the human body, but it will always leave many of life's most pressing questions completely untouched.

Iranian physicist Mehdi Golshani agrees. Science can take the seeker far, he says, but to reach ultimate understanding he or she must engage in metaphysical and religious insight. Without these latter modes of knowing, says Golshani, even the scientific genius is left stranded atop the high ladder of information with nowhere meaningful to go.

The theme of religion's *moral* center surfaces often in the interviews, with several of the scientists finding the heart of spirituality to be in its practical bearing. Many of the scientists strive, too, to

4 *Introduction*

use their religious and spiritual insight as an ethical guide to their scientific careers, not so much for scientific inspiration, but to help them make moral decisions as scientists. Mark Pesce, for instance, sees great potential for both good and harm in the virtual reality computer technology he develops. It is his responsibility, as dictated by his spiritual compass and as empowered by his religious practice, to try to influence it for the good.

Religion, others say, has its limits as well. It may eloquently address the meaning of life and the rightful role of humans in it. It may offer millennia of accumulated wisdom about the ways toward fulfillment and meaning and harmony. But on atomic structure, speciation, the roots of diabetes, or the formation of galaxies and black holes, it is either mute or misleading. Some, such as Brian Cantwell Smith and botanist and Anglican priest John Rodwell, wish for the major spiritual traditions to recover an open and inquisitive spirit, and through this to restore their vitality. They fear that religions, locked in dogmas that are insulated from lived experience, will lose their power to interpret modern life at all.

In light of how hot the conflict between evolution and creationism burns in popular culture, especially in the United States, there is a surprising lack of heat on the subject among these scientists. No one interviewed seemed burdened on a philosophical or spiritual level by the implications of Darwinian biology for the special status of persons and their relationship to God. Perhaps the group was self-selecting in this regard. The truth is, there are not many creationists at the top levels of science today, certainly not in biology or genetics. Creationists say this is because scientists who question evolution are locked out of the debate, left marginalized and unpromoted in mainstream academe. Darwinists might even agree: denial of evolution's main tenets disqualifies scientists from serious biological discourse in the same way that flat-Earthers are not invited to high-level debates about astronomy or geology.

Is the Bible's account of creation, including human origins, wrong, then? No, says Darwinist Francisco Ayala, no more than Shakespeare is wrong when he says that his love is a rose. The Bible, these religious scientists seem to agree, is not a scientific

textbook, and to treat it like one does credit neither to science nor to religion.

A word about how these interviews came to be:

In 1997, sixty leading scientists from around the world met in workshops in Berkeley, California, to discuss the relationship between their professional work and major themes from some of the world's great spiritual traditions. The scientists were encouraged to bring the spirit of open, hypothetical inquiry, typical of the process of their scientific work, into discussions involving moral and spiritual topics.

The results of these workshop discussions and individual research were presented at a public conference in June, 1998, on the campus of the University of California at Berkeley. There, twenty-seven of the participating scientists presented the findings of their research. Never before had such a distinguished group of scientists convened to speak about science and spirituality.

While it is certainly not rare for scientists to be influenced by religion, it is very unusual, perhaps unprecedented, for them to meet with dozens of colleagues from different fields and traditions to reflect on the relationship between these aspects of their lives. Something special occurs when scholars and scientists are encouraged to give utterance to ideas, and to think through the implications of their work *together* rather than pursue such work in private. Through trust, and through an open exploratory process, these discussions drew out of each person insights that private reflection could not.

Time was also set aside for workshop participants to be interviewed at length by Sonoma State University philosophy professor Philip Clayton and science writer Gordy Slack. The interviews in this book, which are original and creative contributions presented here for the first time, are the result of those conversations. Highlights from the conference are gathered in a companion to this volume, entitled *Science and the Spiritual Quest: New Essays by Leading Scientists*.

1 Francisco Ayala

Parallel Evolution

Francisco Ayala is the Donald Bren Professor of biology and a professor of philosophy at the University of California at Irvine. He is the author of 15 books and more than 700 articles on genetics and evolution. In 1960, while still living in his native Spain, Ayala was ordained a Dominican priest. But by later that year he had met the famed Columbia University geneticist Theodosius Dobzhansky, and by 1961 he was in New York City and on the fast track to a doctorate in genetic biology. In 1980, he was inducted into the National Academy of Sciences for his work on population genetics. In 1981, he joined Harvard evolutionary biologist Stephen J. Gould on the front pages of America's newspapers when he testified for the defense in *McLean vs Arkansas Board of Education*. In 1994 Ayala served as president of the American Association for the Advancement of Science and from 1994 to 2001 he served on President Clinton's Scientific Advisory Committee. Last year, a profile in the *New York Times* described Ayala as "the Renaissance man of evolutionary biology."

As a former priest who is also dedicated to the teaching of evolution, Ayala is often asked about conflicts between evolutionary explanations and those in Genesis. Just as Copernicus' revelations did not undermine the sixteenth-century religious perspective – though many feared it would – Darwin's need not undermine ours, says Ayala. Science and religion present two separate ways of knowing, not unlike science and art or science and literature. On the other hand, insisting that the Book of Genesis is unscientific would be like telling Shakespeare that his love is not a rose.

Science may well some day explain the entire natural world, Ayala says, but it will always leave many of the most pressing human questions untouched. It is the approaches religion provides to those questions – about life’s meaning, about our relationships to one another and to the rest of the universe, about responsibility – that makes it so irreplaceable an ingredient in human life.

FRANCISCO AYALA: My interest in religion, and particularly the interface between religion and science, stems from my belief that religion plays an important role in the lives of most people, so that any satisfactory and fulfilling view of the world has to integrate a religious view. My own concerns and activity are primarily centered around a scientific view of the world. But I don’t believe for a moment that science tells us all that is worth saying about the world. It just happens to be the activity to which I have dedicated my professional life, and I find it rewarding and enlightening and fulfilling. But to the extent that society at large wants science to be part of a world view, this has to be done within a context that includes religion.

In the United States many people object to science education in the schools, because they think it conveys a materialistic view of the world. Many additional problems arise from the fact that so many people, and not only common people, perceive a conflict between science and religion. One could go back decades ago to people like Bertrand Russell, the great philosopher, who wrote about the warfare between science and religion. There are scientists in our midst, whom I know, who are dear friends and people I respect, who go as far as to claim that one reason they pursue science is because they hope to obliterate religion. The other side of the coin is even more common. There are people who think that it is unfortunate that science has so much credibility, because they believe that religion needs to get rid of the materialistic view they see as propounded by science.

But science has a lot to offer to society. Certainly it is a very successful way of knowing. Yet I must say once more with no equivocation that I don’t think it’s the only way of knowing.

GORDY SLACK: Or the only valuable way of knowing?

AYALA: Right. But it is a very important way of knowing and one of great consequence in practical life. Most of modern technology is directly related to science. Much of industrial and economic development is directly related to science. Science is a very powerful way of knowing with consequences that impact our daily lives. And yet, when polls are taken of the public at large, we find that most American citizens are illiterate with respect to science. Half of the US citizens don't know that the Earth goes around the Sun once a year. A majority believe that mankind was created a few thousand years ago just as it now exists. They do not accept that we may have evolved from non-human beings. Well, this is scientific illiteracy.

And illiteracy of any kind is evil. And education is good. I have to confess my prejudice there. I believe knowledge and education are positive values. I think that one reason for the need – not the only reason, but a very important one – for scientific literacy, is to correct the perception of so many people, sometimes even teachers, and certainly many children in the schools, that there is a fundamental conflict between science and religion. Curiously, most people respect what scientists do because they see the great practical and economic benefits that ensue, but they conclude that somehow much of science must be wrong because they believe that many conclusions of science contradict their religious beliefs.

At the University at California at Irvine we get some of the best students in California. We only accept the top 12 percent of the high school graduates, so one would expect them to have better science education than the average. Yet, at the introductory biology class that I teach each year to over 1,000 students, a majority arrive persuaded that if they were to accept what I am teaching, evolution in particular, they would have to reject their religious beliefs. That leads to a very unfortunate dilemma, because they are learning about the origin of species and of humans, and writing the correct answers in the exams, but with great discomfort and even doubts, at least at first. Gradually, through their years in college, they come to accept science. But because of the

perceived conflict with which they started, some conclude they must now reject their religious beliefs.

The students' perceived conflict between science and religion stands at this moment very vivid in my mind, because just two days ago I had lunch with an undergraduate in her third or fourth year at UCI who very much wanted to talk with me about these matters. She had been very religious – I knew because of conversations we held when she was a freshman in my introductory biology class – but she now thought that her religious beliefs were untenable. What was the solution to her conflict? I tried to persuade her, as so many others, of my conviction that science and religion deal with two different realms of human experience. Scientific knowledge is one way of knowing; religious experience and religious knowledge are another. There is not necessarily a conflict between them. Indeed, one may see them as two complementary dimensions of human life.

In many ways the perceived conflict between religion and science is the same as if somebody said that studying the humanities or becoming sophisticated in art appreciation would contradict the conclusions of science. Obviously, literature and art are valid ways of knowing about the world and about human life, even if different from science. I try to convey to students that they can both be religious and have a good science education.

SLACK: It's not surprising to me that your students feel this conflict between the study of evolution and their religious upbringing. So much popular discussion and so much debate among scientists and philosophers poses this opposition. It is common to hear in discussions about evolutionary biology that religious thinking obscures Darwin's main insights and their ramifications. Richard Dawkins and Daniel Dennett are two who are constantly banging this drum. Would you talk a little bit about the way in which Christianity and evolutionary theory can fit together? Both Christianity and evolutionary biology pose very specific, but rather different, pictures of how the world is structured.

AYALA: I think it is a practical mistake for religious people, for Christians, to see science as a crutch or an apology, or a

foundation for religion. I think that is ultimately damaging to religion. Some theologians and people of faith have tried to use scientific arguments to prove the existence of God. More often yet, some use current unknowns about the world and its origins as evidence of God's existence. I am persuaded very strongly that this is a mistake from the point of view of religion. It is the God of the Gaps approach to justify religious beliefs. There are events in the world whose causes we don't know and they conclude that therefore we can only attribute them to God. Science can, in principle, provide a complete view of nature, within its own sphere. The God of the Gaps approach leads to a continuous retreat as more and more natural phenomena become explained by science. And this reduces the credibility of religion in the eyes of many.

I once presented a paper in which I argued that the vision that emanates from Darwin completes the Copernican revolution. Physical science had provided a way of understanding the material world according to scientific principles, that is, a view of the physical world as matter in motion, where natural phenomena can be explained when the appropriate causes are known. Now, what the Copernican revolution had left out was an explanation of the origin and diversity of organisms, particularly their "design." There can be no doubt that an eye is made to see and a hand is made for grasping. So in the early nineteenth century, in England in particular, there were written the so-called Bridgewater Treatises, and also a book, *Natural Theology*, by the famous theologian William Paley, who also was a good naturalist. These books argued that the existence of design in living things proved that there was a Designer. Well, Darwin did away with that. Darwin made it possible to see the "design" of organisms as a consequence of a natural process – natural selection. And in that sense, he completed the Copernican revolution by making it possible to see everything in the world of nature as the consequence of natural processes and thus subject for scientific analysis.

There are recent versions of the God of the Gaps approach. Some theologians and philosophers say – and I'm including some people I very much respect – that in Heisenberg's indeterminacy principle one may see a little corner for divine

action, for God to enter the world. I frankly think this is a categorical mistake, to see evidence of God in a particular equation – which only says that the product of two numbers expressing the precision with which we can measure two variables, position and momentum, is a constant; from which it follows that as one variable becomes very precisely known, the other variable becomes less and less well known, more uncertain.

SLACK: A retreat to God in the shrinking Gaps?

AYALA: Yes, absolutely. What if tomorrow some physicist finds out that Heisenberg's indeterminacy principle actually can be done away with? Say a deterministic explanation is found. Would we then reject the presence of God in the world? I don't want to underestimate the intelligence of people who think differently, but in my view science can now approach the entire natural world, and seek to describe it with the methods of science. But the questions that science asks are not the only questions of interest in trying to understand the world.

Let me return to imaginative literature and the arts. They are completely outside of the scientific realm. Artistic experience is outside the way of knowing that science represents. And yet the arts are a valid way of acquiring knowledge. Not just a valid kind of experience, but actually a valid way of acquiring knowledge. Shakespeare has a lot to say about human nature and our place in the world. This is knowledge, but it is not science. It is a different kind of knowledge. But it is valid. It is meaningful.

Trying to apply scientific standards to Shakespeare would be silly. It would be making what philosophers call a category mistake. Say that in a sonnet Shakespeare refers to his beloved as a rose. A scientist could say, "This guy is an idiot. A woman is not a rose." Of course the idiot would be the one who made that comment. Of course Shakespeare knows she is not a rose! But that doesn't mean that a man describing his beloved as a rose is not telling the world something meaningful about her, about his feelings, and about what love is like.

In this context, one of my favorite examples is *Guernica*, the famous painting by Picasso. One could describe the

pigments, the canvas, the dimensions, the configuration of the images and so on. One could give a complete physical description of the painting, but still not have begun to tell us anything about what is important about the painting: the aesthetic experience, the message it conveys about human nature. Picasso had been commissioned by the Spanish Republican government to paint a large mural for a world exhibit in Paris. It was in April 1937, during the Spanish Civil War. The city of Guernica was completely erased by massive bombing by Nazi airplanes. It was the first time in history that a civilian population was completely destroyed from the air. The Germans were supporting Franco and they were trying out this modern form of warfare on the small town of Guernica. When Picasso heard about the bombing, he went into a fit of creative fury and sketched the huge painting (26'x12') in just a few days. Now, this historical circumstance is also something interesting to know about this painting, because it adds to its meaning and to the aesthetic experience. The meaning that *Guernica* conveys about human nature, about man's inhumanity to man, is completely outside the physical description of the painting.

My point is that the scientific description and understanding of the world tell something that is very valid and very important, especially for its technological and economic consequences. But in terms of fulfilling the human spirit, there is a lot to be said about the world – whether it is the physical world or the living world – which remains outside the realm of science.

So, back to your question: I see religion and science as addressing different realms of human experience. Religious experience gives us a different way of knowing, a different kind of knowledge, just as artistic experience gives us a different kind of knowledge.

SLACK: Would you describe it as two different ways of knowing a single truth? Or are the truths that we strive to access through science and through religion different in nature?

AYALA: I think these are semantic distinctions. A scientific and a religious view of the world do not overlap, but they concern different sources of knowledge. But I don't believe that they

can be contradictory, that one can say that something is white and the other one say that that something is not white. They are just dealing with different dimensions of reality, different levels of experience.

They are views orthogonal to each other. They operate in different dimensions. They should be compatible, but, whether one calls them one truth and one world or many truths and many worlds, to me, is just semantic.

SLACK: There are areas where many people believe science and religion chafe. Biologists often object to the purposefulness Christianity ascribes to human life, and to the rest of the natural world for that matter. The most reductionist geneticists view life as not being purposeful in any grand sense, but being the product of the repeated application of an algorithm. And I know that the chafing between these two views causes a lot of people—

AYALA: Well, you have raised so many issues! First let me say in passing that precisely because of what you have said about purpose, I want to state that one issue that has interested me for more than twenty-five years is to explore philosophically and scientifically the meaning of the terms “purpose” and “teleology,” and the roles that teleological explanations play in understanding evolution and organisms.

I would argue that evolutionary biology calls – but, of course, not only – for teleological explanations. Some forms of teleological explanations are scientific explanations. Anybody who thinks that everything in the world can be explained in a reductionistic way is just naive, even if he or she might be a very profound thinker, which individual reductionists often are. What I mean is that in order to understand the vertebrate eye we need to understand the function it serves – seeing – and also that it came into existence through a long evolutionary process precisely because it serves for seeing and seeing was helpful to organisms in survival and reproduction. We can take advantage of the seasons to grow crops, but the seasons did not come about because of this use, they are a consequence of the earth revolving around the sun. But eyes with their complex organization would never have come to be if it were not for the function they serve. This is a teleological explanation.

Not long ago I published a review in *Science* of the last book, *The Demon Haunted World*, by the late Carl Sagan. He was a very distinguished scientist and educator. Much of the book is very good. It deals critically with pseudo-science and anti-science. But when Sagan tries to explain what science is, he takes such a simple-minded, reductionistic approach that one can only be shocked. He says, for example, that, because the discovery of the structure of DNA showed that heredity is carried in the sequence of the nucleotides of DNA, biology has been reduced to the laws of physics and chemistry. So, he says, now everything can be explained by the laws of physics and chemistry. Well, I said in the review that that kind of “reductionism” is false; the reduction of biology to the laws of physics and chemistry is not possible. Let anybody try to explain the origin of species, or language, or the evolution of humans with the laws of physics and chemistry. You cannot get very far.

SLACK: How about the laws of natural selection?

AYALA: If Dawkins thinks that natural selection is sufficient to explain everything about the origin and make-up of organisms, I would say okay, at a certain level of the world, yes, natural selection is very powerful. But how do I explain language, or, for that matter, thought and so many other things – artistic experience – in terms of differences in reproductive success, which is what natural selection is. That is not to say that one has to imagine that there are some little spirits or extra things floating around inside humans. One doesn't need to claim that there are other entities (objects) besides those that are the subject of science. But there are different ways to understand reality. This relates to the one truth, many truths question that you raised before.

How can one explain freedom in terms of the laws of physics or the laws of biology? Now Sagan or Dawkins might say that we will be able to do this in the future. Well, that's hardly a scientific response. That is an act of faith.

SLACK: Aren't you posing a kind of God in the Gaps argument, where the gap is the unexplained area between different levels of scientific description, say, between physics and biology?

AYALA: No. That's not the same as the God of the Gaps. It's an argument for different levels of knowledge and of experience, and these can be justified in other ways as well. In any case, a reductionist answer is not justified at present even within the realm of science, because there are so many things about organisms that cannot be fully explained by the laws of physics and chemistry.

SLACK: Dawkins also claims that the kind of metaphors employed in religious thinking and religious description are intellectual hurdles in taking Darwinian theory to heart.

AYALA: I think this kind of attitude is as unfortunate as the one taken by religious people who think that science is in religion's way. We go back to the beginning of this conversation. Much of my interest in trying to work out the relationship between religion and science has to do with removing the obstacles before those people for whom religion plays an important role. And there are more of them than there are scientists. I want them to understand that science is not in the way of their religion. And then one hopes also to persuade some reluctant scientists that religion doesn't need to be in their way either.

A few months ago, the governing council of the National Academy of Sciences acknowledged a renaissance of attacks against the teaching of science in the schools on fundamentalist religious grounds and decided to act in various ways to protect that teaching, while acknowledging that science and religion belong to different realms of human activity. This had already been stated by the Academy some years earlier. I had been very involved in the early eighties at the National Academy of Sciences in dealing with these attacks against science and the teaching of science, specifically of evolution, in the schools. The National Academy of Sciences produced a booklet that eventually was used as part of an amicus brief presented to the Supreme Court of the United States. This booklet, which I mostly drafted, was also distributed in the schools and used in many other ways. But at that time some members of the Academy were not completely sure that the Academy should get involved with the issue of teaching science in the schools. I remember a conversation with the

newly elected president of the National Academy, Frank Press, about this. This was 1980 or 1981. He was asking me, rhetorically, I suppose, in a private meeting, whether I thought the National Academy of Sciences should get involved. I said yes, I thought it should, because what was at stake was not the teaching of a particular scientific discipline, evolution, but rather survival of rationality in this country. If we allowed the Book of Genesis to be taught as science, as the state of Arkansas had legislated, this would be as bad for science as it would be for religion. Many religious authorities agreed. Incidentally, when the trial – *McLean vs Arkansas Board of Education* – took place in Little Rock – where Stephen Gould and myself and a couple of others were witnesses as scientific experts, among the plaintiffs who had initiated the lawsuit against the state of Arkansas were local bishops, the Methodist bishop, the Baptist bishop, the Catholic bishop, the Anglican bishop, as well as educational organizations and others. The booklet published in the early 1980s has now been revised and again published. I have played a role in preparing this 1999 revision of *Science and Creationism: A View from the National Academy of Sciences*, by chairing the committee in charge of it.

I believe that in the last few years we are entering a new era in the dialogue between science and religion. Rather than warfare we seek mutual respect and understanding.

SLACK: Or at least reconciliation.

AYALA: Yes, but more than reconciliation, mutual understanding. Moreover, the scientific and religious communities share some goals. We want the citizens of the United States, and of course the world, to live full lives and mature lives. Scientific literacy contributes to it, but there are other dimensions. The religious dimension is one.

Scientists should not be trying to make people religious, nor should ministers or theologians seek as a primary purpose to teach science. But many general goals are common to scientists and people of faith, such as improved education and a good life. We should work together towards those common goals, and for the rest, for the parts where our interests do not overlap, we should seek to make it clear they are not in opposition.

Unfortunately, there are scientists who think that there is conflict between science and religion. And there are religious people who think that the two are incompatible. Thus some Christian fundamentalists still want to see the Book of Genesis taught as if it were an elementary book of science. This is bad science. In my view, it is also harmful to religion.