THEOLOGY AND SCIENCE

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Introduction

Like all religions, Christianity offers a distinctive world-view. Christian theologians engage in conversation with partners who hold other, different world-views.

The principal conversation partners of Judaism and early Christianity were other religions. Today there is a renaissance of conversation between Christianity and other religions.

From the first century Christianity engaged in a fruitful conversation with Hellenistic philosophy. Much of the development of early Christian theology is a product of that conversation.

In the twentieth century, Christian theology entered into a conversation with Marxism. Marxism offered a world-view just as religions and philosophies do. Many Marxists insisted that their world-view was atheistic, but not everyone agreed. Christian theologians have engaged in conversation with other forms of atheism also.

In view of this history, it was only natural that when modern science arose, Christian theology would engage in conversation with it.

This conversation is complicated by the fact that the science is a contested concept. One view is that, since science comprises only scientific methods and what is learned from the application of those methods, it is religiously neutral. The other view is that philosophical and anti-religious ideas have found their way into the methods and conclusions of science.

Theology and the Rise of Modern Science

Human beings have always been observers of the world in which they live, but there is nevertheless an important difference between the conventional observation of the world and modern science. The philosopher Francis Bacon offered one convincing account of the difference, namely that, whereas traditional observers take the world more or less as it presents itself, modern scientists formulate questions and then probe the world for answers. Scientists, Bacon wrote, ñput nature to the question.ò Here is R. G. Collingwoodôs comment on Baconôs epigram:

> What [Bacon] was asserting was two things at once: first, that the scientist must take the initiative, deciding for himself what he wants to know and formulating this in his own mind in the shape of a question; and secondly, that he must find means of compelling nature to answer, devising tortures under which she can no longer hold her tongue. Here, in a single brief epigram, Bacon laid down once for all the true theory of experimental science.

Modern science originated early in the 17th century in Europe. The most celebrated early modern scientists were Galileo, a Roman Catholic, and Isaac Newton, a Christian who held some unorthodox views. Galileo remained a loyal son of the church even after the church required him to stop promoting his view that the Earth goes around the sun. Newton wrote commentaries on apocalyptic books in the Bible and felt that his work on the Bible was more important than his work on optics and gravity, a view no one today shares.

Historians of ideas naturally ask why modern science arose first in Europe. After all, the civilizations of India and China are much older than that of Europe, and they are literate and immensely sophisticated. Why did

modern science arise in Europe rather than in those civilizations?

One answer to this question was proposed by the mathematician-philosopher Alfred North Whitehead in 1925:

> I do not think, however, that I have even yet brought out the greatest contribution of medievalism to the formation of the scientific movement. I mean the inexpugnable belief that every detailed occurrence can be correlated with its antecedents in a perfectly definite manner, exemplifying general principles. Without this belief the incredible labours of scientists would be without hope. It is this instinctive conviction, vividly poised before the imagination, which is the motive power of research: that there is a secret which can be unveiled. How has this conviction been so vividly implanted on the European mind? When we compare this tone of thought in Europe with the attitude of other civilizations when left to themselves, there seems but one source for its origin. It must have come from the medieval insistence on the rationality of God, conceived as with the personal energy of Jehovah and the rationality of a Greek philosopher.

Whiteheadôs proposal about a rational and personal God has been widely accepted. In *Religion and Science* Ian T. Barbour elaborated on it, suggesting that four Jewish-Christian ideas contributed to the birth of modern science.

First, as Whitehead had noted, a rational God creates a rational universe. Rational human beings can understand the universe precisely because it is rational.

Second, God is a personal and therefore a free God who chose what kind of universe to create. As a consequence, human beings cannot understand the universe simply by reasoning about how it ought to function. Instead, they must examine the universe in order to discover what kind of universe God chose to create. In other words, they must be empirical as well as rational. In this modern science differs from the earlier Greek science. The Greek philosophers believed that the One (God) is rational but not personal. In Greek science it was assumed that the way to understand the world is to reason back to first principles. When the church silenced Galileo, it was defending Greek science as much as the Bible.

Third, a good God created a universe that is good. This suggests that taking the trouble to understand the universe is a worthwhile activity. This is in contrast to religions in which the universe is worthless or worse and in which the goal of religion is to escape the universe in order to enter a more spiritual realm.

Fourth, God and the universe are distinct in something like the way a composer and her music are distinct. God is divine, and the universe is not. This means that it is not a sacrilege to study the universe and even to dissect parts of it in order to understand it. This is in contrast to religions which teach that the universe or the Earth is the deity and which therefore discourage the use of many of the methods of modern science.

Doubtless factors other than these theological ideas contributed to the rise of modern science. Economics, technology, and the presence of universities throughout Europe probably made contributions. Nevertheless, all four of these teachings are found in Christianity, they are not all found in the religions of India and China or in Hellenistic science, they do open a space for modern science, and modern science was born into that part of the world where these teachings were available and sometimes prominent.

Relationships between Theology and Science

In our country today only a few people are aware of the contributions of theology to the rise of modern science. Far more people are aware of conflicts between science and theology. Many people know that the

church silenced Galileo. Many Americans are familiar with the Scopes trial of 1925 in which a public school teacher in Tennessee was fined for teaching evolution. It is regrettable that so many Americans know about conflicts between religion and science but do not know about the close associations between them.

Some people actually find it difficult even to imagine any relationship between science and theology other than that of conflict. In the mid-ônineties at a party in New Orleans I spent more than an hour in conversation with an environmental scientist, on the topic of science and theology. He was unable even to entertain the idea that there might be any relationship between science and theology other than conflict. Several years later he and I were talking again, and I mentioned to him a then-recent book by Francis Collins entitled *The Language of God*. At the time Francis Collins was the director of the Human Genome Project, the largest scientific research project in human history, and he is now the Director of the National Institutes of Health. Collins grew up as an agnostic, became an atheist, and then became a convinced Christian. When I told the environmental scientist about Collinsôs turn to Christian faith, he replied, ñHeôs just preparing for his finals.ò

Nevertheless, there are other relationships between science and theology than conflict. Ian Barbour has proposed that four relationships are possible. In addition to *conflict*, there is *independence*, that is, a relationship of separate domains. Stephen Jay Gould coined the phrase ñnon-overlapping magisteriaò (NOMA) for this relationship.

The idea behind NOMA is simple. Science asks one set of questions, and theology asks another. Science asks how the world works. Theology asks why there is a world and what it means. Problems begin to occur only when theologians say things like ñGod made the world, so itôs 6000 years oldò or when scientists say things such as ñthe universe evolved, so there is no God.ò People who believe the Bible are in a position to say why there is a universe (ñGod created itò) but not how old it is, and scientists are in a position to say how old the universe is (ñabout 13.8 billion years oldò) but not why there is a universe.

Failures to observe the boundaries between science and theology are sometimes described as *ism*s. Itôs creationism rather creation to say the world has to be 6000 years old. Itôs scientism rather than science to write, as the physicist and Nobel laureate Steven Weinberg has famously done, that ñThe more the universe seems comprehensible, the more it also seems pointless.ò

Clearly there is some truth to the separate domains idea. The best theological use of this idea with which I am familiar is found in *The Beginning of All Things* by Hans Küng.

But separate domains canôt be the whole story. For one thing, many individuals are both scientists and people of faith. Not all of them are willing to keep their science and their faith in separate compartments. They want to understand how to correlate their theological convictions and their scientific convictions.

Also, scientists, functioning entirely as scientists, sometimes ask questions that in principle, as they sometimes acknowledge, cannot be answered by science. These questions have been called limit questions or meta-questions. An obvious example is, ñWhat existed before the Big Bang?ò

In view of these things, many thoughtful people today believe that a *dialog* between science and theology is needed, and this is Barbourôs third relationship. Theology can benefit from understanding what science has to say about the nature, history, and operations of the world, and science can benefit from understanding theologyôs account of the meaning of the world in general and of human existence in particular.

This brings us to Barbourôs fourth relationship, namely, attempts to *integrate* science and theology. Barbour supports these efforts. Several theologians have done integrative work, among them Thomas Torrance, Jürgen Moltmann, Ted Peters, Wolfhart Pannenberg, and Hans Küng. Some philosophers have done integrative work

also, among them Nancey Murphy, Richard Swinburne, and Philip Clayton. The physicist-theologian John Polkinghorne believes that the people who are in the best position to do integrative work are persons who are both scientists and theologians. He has written a book entitled *Scientists as Theologians* about the work of three such persons, namely, Ian Barbour, Arthur Peacocke, and himself.

Polkinghorne has proposed a revision of Barbourôs taxonomy. He thinks that the best integration of science and theology requires us to identify consonance and to avoid assimilation.

Polkinghorne wrote: ñThe search for consonance is the basis of my own approach to the question of interrelationship.ò One of the consonances that interests him is the consonance of the methods of science and theology. In both science and theology disciples are apprenticed and socialized into a community of discourse in which there already is agreement about many matters. Both allow their acolytes to challenge the established agreements. In both there is a place not only for gathering information but also for the elusive quality of judgment which is important both in creating hypotheses and in adjudicating between conflicting claims.

Practitioners of both science and theology are critical realists They are realists because they intend to describe reality as it actually is. They are critical because they are aware that they are not simply recording reality in the way film in a camera records a scene. Instead, they contribute to the construction of their understanding of reality by their use of language (and, in the case of science, by the use of mathematics). Even so, their work is not merely functionally successful but is the creation of verisimilitudinous accounts of reality that display the way the world really is. Critical realism occupies a place between the simple certainty to which the Enlightenment aspired and the relativism which present-day deconstructive critics proclaim.

The risk for those who search for consonance is that they will accept too easy an assimilation. One example of this is the description of Christ as a new emergent in an evolutionary sense. Polkinghorne thinks that this proposal, made famous by the paleontologist Pierre Teilhard de Chardin, is a seriously defective Christology. Another example is a proposal by Wolfhart Pannenberg that ñModern field theory offers a way of thinking about spirit.ò Polkinghorne responds, ñTo a physicist a field is about as spiritual as a tenuous gas!ò

To summarize: Christian theology contributed to the creation of modern science. Although conflict does occur between science and theology, it isnôt inevitable. Scientism and creationism should be avoided. Up to a point science and theology occupy separate domains, but that is not the whole story. A conversation between science and theology is to be welcomed. It is important, when seeking consonance between the two, not to accept too easy an assimilation.

The Standard Account of the Universe

Modern science has generated a standard account of the universe. It is shared by the majority of working scientists, though some scientists dissent from some parts of it. The standard view is taught in schools and appears regularly in the media, so many members of the general public are familiar with its broad outline.

It is an evolutionary world-view. It says that the universe is about 13.8 billion years old. The universe began in an explosion of unimaginable force and heat. Following this Big Bang the universe expanded rapidly, and it continues to expand today. The basic building blocks of the universe are sub-atomic particles and the four fundamental forces (electro-magnetism, gravity, and the weak and strong nuclear forces). Initially the particles coalesced into lighter elements such as hydrogen and helium, and these coalesced into stars. Some of the stars expanded as they aged. They then collapsed, and in their collapse they acted like giant furnaces, crushing the lighter elements together and thereby creating heavier ones such as carbon. These stars, called *supernovas*, then exploded, scattering the heavier elements across the universe. Planets were formed out of heavier and lighter elements.

It was in this way that about 4.5 billion years ago Earth came into existence. About 3.5 billion years ago life emerged on our planet. Gradually living beings who possessed consciousness appeared. The dating of the origins of the earliest humans is only approximate, but somewhere between 250,000 and 50,000 years ago there were beings on Earth who were either pre-human or human.

Christians disagree about whether this standard scientific account is compatible with the Christian world-view. Some who think it is not compatible simply ignore it. Others reject parts of this account such as, for example, the evolution of life, that they think are incompatible with Christian teaching and untrue. Others see this account as compatible with the Christian world-view and occupying a domain separate from it, and they seek for consonances between the two world-views. I take this view.

The usual assumption is that, in a conversation between science and theology, science is the dominant partner. To the public it was sensible to ask Albert Einstein what he thought about God, but no one would have thought to ask Mother Teresa what she thought about general relativity.

Scientific Methods

The various sciences exist in a kind of hierarchy. Here are a few examples. Physics is the study of the particles and the fundamental forces. Chemistry is the study of the components of matter which are listed in the periodic table. Biology is the study of living creatures. Psychology is the study of human consciousness and personality. Sociology is the study of human communities. History is the study of the lives of human beings in the past. Astronomy is the study of the universe beyond the atmosphere of Earth. Some sciences transcend these distinctions such as, for examples, biochemistry and astrophysics.

Theologian Thomas Torrance has pointed out that each science employs methods that are suited to its subject. For example, psychologists gather data by means of questionnaires, but questionnaires are of no use to chemists. Astronomers gather data by means of telescopes, but telescopes are of no use to biologists. Naturally this suggests the question, What method is appropriate for studying God?

In a book entitled *Method in Theology* Bernard Lonergan proposed that there is a general method which transcends the specific methods of the various sciences. He thought that the general method is an accurate description of all of the ways in which human beings acquire knowledge. He expressed the method in terms of four imperatives: Be attentive, be intelligent, be reasonable, be responsible. To be attentive is to observe carefully. To be intelligent is to create hypotheses to account for what one observes. To be reasonable is to test oneôs hypotheses. To be responsible is to be truthful about what one initially observes and about the results of testing hypotheses, truthful to oneself as well as to others.

I believe this is an immensely helpful analysis. However, it doesnôt seem to allow for the fact that human beings sometimes grasp reality intuitively and imaginatively. Even professional scientists such as physicists use their imaginations. That is how they create hypotheses. The scientist-philosopher Michael Polanyi has emphasized the importance of tacit knowledge in scientific work as well as in ordinary life. The scientist-theologian John Polkinghorne has emphasized the indispensability of judgment in the attempt of scientists to understand the world.

Now we are in a position to answer the very important question: Is science the only way to know about reality? If by the word *science* we mean the work of modern, professional scientists, then science cannot be the only way of knowing reality, since human beings clearly knew something about reality before modern science arose. Moreover, a mother knows her newborn baby in ways that are not available to a scientist qua scientist.

It is curious that anyone should ever have suggested that science is the only way of knowing about the world. Moreover, the claim that science gives us the only knowledge we have of the world is itself not a scientific statement, in that it is not a result of observing how people know about the world. We could say that it is unscientific to claim that science is the only way we can acquire knowledge.

Science and God

Can modern science be a means by which we know about God?

In the past Christian theologians said that human beings possess a knowledge of God that comes from nature without any input from divine revelation. It was said, for example, that this natural theology can tell us that God exists, but only revelation can tell us that God is Three Persons.

In my judgment, natural theology and revealed theology are not ideal categories. I think that anything we know about God has been revealed by God. All true theology is revealed theology.

Therefore it is more helpful to speak of general revelation and special revelation. Special revelation is the revelation given in the history of the Jewish people and recorded in the Bible. Its fullest expression is Jesus who is the visible image of the invisible God (Col. 1:15).

General revelation is a self-revelation that God has given that, at least in principle, is available to all people. But has God given such a revelation?

Some twentieth century theologians believed that there is no general revelation. For example, the brilliant Swedish Lutheran theologian and bishop Gustaf Aulén said that any god known through science or philosophy is an idol, not the true God. Aulén would say that, because I am here affirming that there is a general revelation of God, I am introducing a pagan god into this conversation.

I disagree with Aulénôs view. I think that God has given not only a special revelation but also a general revelation by which all people can know about God. Although we cannot know God as fully by the general revelation as we can by the special revelation given in Jesus, the general revelation gives a true and meaningful understanding of God as far as it goes.

One reason I think this is that the Bible teaches it. Here are two passages that speak of Godôs general revelation (there are several others):

> We bring you good news, that you should turn from these worthless [idols] to the living God, who made the heaven and the earth and the sea and all that is in them. In past generations he allowed all nations to follow their own ways; yet he has not left himself without a witness in doing goodï giving you rains from heaven and fruitful seasons, and filling you with food and your hearts with joy (Acts 14:15-17).
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> The heavens are telling the glory of God; and the firmament proclaims his handiwork. Day to day pours forth speech, and night to night declares knowledge. There is no speech, nor are there words; their voice is not heard; yet their voice goes out through all the earth, and their words to the end of the world (Psalms 19:1-4).

In the first passage Paul tells his Gentile audience that the natural world, which provides human beings with their food and thereby makes them happy, is a witness to Godôs existence. In the second passage the psalmist says that the heavens and the earth, the days and the nights, all bear witness to Godôs glory.

Pre-scientific peoples learned about God by observing the natural world. What happens when our observation of the world becomes scientific? Does science suppress the worldôs witness about God?

Some Christians believe that in the world as described by science there is evidence that God exists. They are prepared to use that evidence to argue for the existence of God. Today the most popular argument of this kind is the argument from intelligent design. Michael Behe makes this argument effectively.

I hold a more modest view. I think of the universe described in the standard scientific account as something for whose existence a personal, purposive God provides a plausible and intellectually satisfying account.

Here is the best example I know. Scientists alerts us to the fact that the universe must be of a particular kind in order to produce and sustain conscious life as we know it. There are multiple factors which must be precisely ordered in order for human life as we know it to exist. One of these is the strength of gravity and the attendant rate of expansion of the universe in the first moments following the Big Bang. According to Stephen Hawking (who is emphatically not a person of faith) in his wildly popular book, *A Brief History of Time*, if the rate of expansion of the universe at the Big Bang was 1/1,000,000 faster (or gravity that much weaker), it would have been too rapid for stars to form; that means there would have been no heavy elements, no planets, and therefore no life as we know it. On the other hand, if the rate of expansion had been 1/100,000,000,000,000,000 slower (or gravity that much stronger), the universe would have collapsed long ago, and that also means there would have been no life as we know it. The initial rate of expansion of a universe which could give rise human life had to fall within a range that is razor thin.

These are facts known to scientists, who refer to them as ñthe anthropic principle.ò They lead naturally to the question: ñHow does it happen that we are here?ò One response is simply to say, ñWell, we got lucky.ò This answer, though understandable, is effectively a refusal to engage in the quest for understanding that characterizes both science and theology.

John Polkinghorne says that there are basically two possible answers to the question raised by the anthropic principle. In his book *Belief in God in an Age of Science* he wrote: ñEither there is one world whose fruitful potential is the expression of divine purpose or there are many worlds, one of which just happens to be right for the evolution of life.ò

Both of the available accounts of the anthropic principleð a purposeful Creator or multiple universesð are plausible. Science cannot adjudicate between them. Science cannot prove either account or disprove either account.

As a Christian, Polkinghorne believes that ñthere is a divine purpose behind this fruitful universe, whose fifteen-billion-year history has turned a ball of energy into the home of saints and scientists.ò But he is careful about how he describes this: ñThe theistic conclusion is not logically coercive, but it can claim serious consideration as an intellectually satisfying understanding of what would otherwise be unintelligible good fortune.ò

So far we have been thinking about the worldôs witness concern the existence of God. The psalmist said that the heavens declare, not just the existence of God, but the glory of God. Does science say anything about that?

Science has dramatically increased our knowledge of the size, age, and functioning of the world. With our increased knowledge comes an enriched understanding of the Creator of the world. For example, Godôs wisdom is more subtle than we had realized. Godôs interest in the non-human world is greater than we knew. Since God employed a process for creating human beings that required billions of years, God is much more patient that we were aware.

Genesis says that human beings are made from the dust of the earth. Science says the same thing, and it also tells us the origin of that dust. As we have seen, it says that the heavy elements such as carbon were created when stars collapsed and crushed lighter elements such as hydrogen and helium together, thereby forming heavier elements such as carbon. These stars then exploded, scattering the heavy elements across the universe. This in turn led to the formation of planets such as our Earth. Since we human beings have emerged from the heavy elements of the Earth, we are, quite literally, made from stardust.

In our scientific era, as in the distant past, the heavens are declaring the glory of God.

Science and Human Origins

One of the most famous and enduring conflicts between science and theology was launched in 1859 with the publication of Charles Darwinôs *The Origin of Species*. Darwinôs thesis was that many things in nature which appear to have been designed, such as the human eye, can in fact be accounted for without reference to design or a Designer. Rather, they have come about because random mutations which occur in living organisms from one generation to the next happened to equip certain organisms to survive and procreate. Given enough time, mutations appeared which seem to have been designed, but in fact they occurred accidentally.

Darwinôs thesis constitutes a challenge to the Christian faith at four points.

First, this account of the origins of human life differs from the account in Genesis. Genesis says nothing about evolution. Where Genesis speaks of each creature reproducing ñafter its kind,ò evolution speaks of the inter-connectedness of all life on this planet.

Second, the evolutionary account undermines a popular argument for the existence of God. Known as the teleological argument, it says that, because things such as the human eye seem to have been designed, there must be a Designer, and that is God.

Third, the evolutionary account of human origins seems to undermine the biblical teaching that human beings are unique bearers of the image of God and therefore possess a special dignity.

Fourth, the evolutionary account of human origins seems to suggest that death occurred long before human beings had evolved far enough to know right from wrong and therefore to be capable of committing sin. Where Genesis speaks of death as a consequence of sin, evolution speaks of death as having occurred for millions of years before sin entered the world.

While I can understand how these four arguments seem plausible, I nevertheless believe they are mistaken.

It is true, of course, that Genesis and the evolutionary account of the origins of human life differ. But they come into conflict only if we take the Genesis account as a scientific account. I donôt know of any good reason to do that. There are other accounts of creation in the Bible, and no one takes them as scientific accounts. For example, in Isaiah 45:9-12 we read this account of creation:

> Woe to you who strive with your Maker, earthen vessels with the potter! Does the clay say to the one who fashions it, ñWhat are you makingò? Or ñYour work has no handlesò? Woe to anyone who says to a father, ñWhat are you begetting?ò or to a woman, ñWith what are you in labor?ò Thus says the Lord, the Holy One of Israel, and its Maker: Will you question me about my children, or command me concerning the work of my hands? I made the earth, and created humankind upon it; it was my hands that stretched out the heavens, and I commanded all their host.

In this passage are four distinct images for the Creator: God is like a potter who makes pottery, like a father who begets a child, like a woman who gives birth to a child, and like a nomad who puts up a tent. In Genesis we see a different image of the Creator: God is like an oriental monarch who issues commands such as ñLet there be light,ò and these are carried out. I know of no hermeneutic which requires us to interpret Genesis as science which would not also require us to interpret Isaiah as science, and no one does that. It seems to me, therefore, that we should understand Genesis and Isaiah as true and important accounts of creation, but not as scientific ones.

The second argument is that evolution undermines the teleological argument for the existence of God. This is true, up to a point. However, Christians are not required to embrace the teleological argument, so the loss of that argument should cause them no great concern. In retrospect we can see that it was never a good idea to call on God to fill in the gaps in our knowledge of particular things in the world, gaps such as how an eye can have the power to see things. On the other hand, it seems to me to be possible to see design in the universe as a whole. A good example of this is the anthropic principle mentioned above.

As for the third argument, that evolution undermines the teaching that human beings are made in Godôs image, it is worth remembering that Genesis also speaks of modest origins for human beings. It says human beings were made from dust. If the biblical teaching that human beings were created from dust does not undermine the image of God in them, why should the scientific teaching that they were created from lower animals do so? In my judgment, Darwinian evolution does not undermine the dignity of human beings. Those who embrace the standard evolutionary account of human beings are still free to pray with the psalmist, ñYou have made [human beings] a little lower than God, and crowned them with glory and honorò (Psalms 8:5).

The fourth argument is that evolution undermines the teaching of Genesis that death is a consequence of sin. It is true that the evolutionary account includes that all living creatures are naturally mortal and eventually die. Genesis teaches that, for human beings, death has an additional meaning, a second face. Death is not only an inevitable, natural event but a symbol of human sin and alienation from the living God who commanded: ñIn the day you eat [the forbidden fruit] you shall dieò (Genesis 2:17). Evolution does not undermine that second meaning.

Science and Human Freedom

If the evolutionary account of human origins does not rule out the dignity of human beings, what about scientific determinism? Is it not the case that science describes a universe in which everything that happens is an effect of a previous cause, and therefore that everything is causally determined? Can there be freedom in such a universe? And if human beings are not free, can they be morally responsible? And if they are not morally responsible, how much dignity remains for them?

I think that the dignity of human beings does depend on their possessing freedom. I also think there is room in the scientific account of the universe for human freedom.

When we reflect on our experience of the world, we notice three kinds of events. Some events appear to be determined, as when a tree limb that breaks falls to the ground. Others appear to be random, as when a tornado uproots one tree while leaving its neighbors untouched. Still other events appear to be freely chosen, as when a homeowner decides to plant a tree in her front yard. I will refer to these as determined, chance, and free events.

Because this is what we observe around us, when scientists argue that everything is causally determined, they are de facto making a claim that we have misinterpreted our experience. They are saying that the chance and freedom that we think we observe are actually illusions. All events are causally determined.

Some scientists do affirm that chance and freedom are illusions and that everything in the world is determined. Albert Einstein wrote: ñI am a determinist. Everything is determined . . . by forces over which we have no control. It is determined for the insect as well as for the star. Human beings, vegetables, or cosmic dust, we all dance to a mysterious tune, intoned in the distance by an invisible player.ò But he added: ñI am compelled to act as if free will existed because if I wish to live in a civilized society I must act responsibly. I know that philosophically a murderer is not responsible for his crime, but I prefer not to take tea with him.ò He also denied that anything happens by chance: ñGod does not play dice.ò

On the other hand, Einsteinôs younger friend and frequent sparring partner Niels Bohr denied that everything that happens is causally determined. He said that events in the sub-atomic world occur randomly. Bohrôs view of quantum mechanics is now part of the standard model of particle physics. On one of several occasions when Einstein said, ñGod does not play dice,ò Bohr countered with, ñEinstein, stop telling God what to do!ò

Today neuroscience provides a challenge to human freedom that is at least as great as the challenge from physics. Neuroscience has made it clear that the human mind is dependent on the human brain. Since the mind, and therefore the self, is dependent on the brain, and since the brain is a physical organ, itôs difficult to understand how the self could be free to make choices.

Of course, the same is true of life. The bodies of human beings are composed entirely of physical compounds, none of which is alive, and yet human beings are alive. Life is an emergent quality of our physical bodies. Might not freedom be an emergent quality of our bodies in the same way that life is?

The debate about freedom and determinism has a parallel in Christian theology. Some theologians affirm a theological determinism (predestination) at the expense of human freedom (and also of chance). For example, the Protestant theologian John Calvin said that God has foreordained every event that occurs, and that human beings are not free in the full sense of the word. He also denied that there are any chance occurrences. He wrote, ñGod does not permit, but governs by his will.ò

On the other hand, other Christian theologians have affirmed that human beings are free in the full sense of the word. They think that God did not foreordain every event that occurs. Some events happen by chance, and others happen because human beings chose to make them happen.

The same argument exists in philosophy as well as in science and theology. Some philosophers make the case for determinism at the expense of freedom and chance. Others affirm freedom and chance as well as determinism.

In view of these ancient disagreements it seems probable that freedom will remain an essentially contested concept. The idea of essentially contested concepts was proposed by a Welsh philosopher, W. B. Gallie, in a paper published in 1956. I think we may say, without trying to be witty, that in a situation like this we are free to choose whichever view commends itself to us.

What commends itself to me is that what we observe around usð some determined events, some chance events, and some freely chosen actionsð are what they seem to be. These are not folk concepts to be discarded now that science has provided us with more sophisticated ones. I think our experience of all three is veridical, truthful.

If this is the case, then most of the history of the universe has resulted from the fruitful interplay of determinism and chance. The third factor, human freedom, is a latecomer. Since the emergence of human beings, the world exists as the result of the fruitful interplay of determinism, chance, and human freedom.

Conclusion

To sum up: In the past Christian theology engaged in conversations with other world-view-providing entities such as religions, philosophies, and Marxism. Today it engages also in a conversation with modern science. As in the other conversations, theology accepts some things in this conversation partnerôs account of the world and rejects other things. And, also as in the other conversations, Christians disagree among themselves about which things to accept and which to reject.

For myself, I accept the standard scientific account of the age, size, and operation of the universe. I reject a scientism which denies that human beings have any knowledge of reality other than that given to them by professional scientists. I welcome a reductionism that understands that the universe is composed of particles which operate by forces such as electro-magnetism, but I reject an eliminative reductionism which denies the reality of new emergences such as life, consciousness, and freedom. I accept that human minds have emerged from brains and remain dependent on them, but I reject that this means that minds are merely epiphenomenal. I think that freedom has emerged and that top-down causation occurs. The world as we now experience it is the product of the fruitful interaction of determinism, chance, and freedom.

I do not think that the scientific discoveries about the world either prove or disprove the existence of God. I am not sure whether scientific discoveries about the world constitute evidence for or against the existence of God. I think that, in light of the anthropic principle, it is a plausible and intellectually satisfying account of this world to think of it as the creation of a personal, intelligent, purposive God. I am not aware of any alternative account that is more plausible or more intellectually satisfying.

I believe in God, and I trust in God. I do this not because of science but because of Jesus whose story is told in the New Testament. Having heard his story, I have exercised my freedom and put my trust in Jesus and in the One he taught us to call *Abba*. I realize that others have made other choices. I respect them and their choices, and I enjoy and benefit from conversations with them. But I think when they deny that the world was created by God, they have misunderstood the world.

I am aware, of course, that someone has to be wrong about this, and I know that in principle it may be that I am wrong and my agnostic and atheistic friends are right. But I donôt think so, and I go on trusting in the Lord. The fact that I recognize that in principle I could be wrong does not mean that my trust in God is tentative or superficial. I hold it with deep conviction, and it profoundly affects how I live. I think that this puts me in a place that is similar to that of the author of Hebrews who wrote: ñIt is by faith that we understand that the world was created by the word of Godò (Hebrews 11:3).