SCIENCE & FAITH
FRIENDS OR FOES?

C. John COLLINS

CROSSWAY BOOKS

A DIVISION OF
GOOD NEWS PUBLISHERS
WHEATON, ILLINOIS

Contents

Acknowledgments 9

1 Introduction to the Questions and Survey of the Book 11

SECTION I: PHILOSOPHICAL ISSUES

2 Science, Faith, and Rationality: A Short Course in Good Thinking 19

The Importance of Philosophy
Principles of Sound Thinking
Testing a Truth Claim
A Word About Rational Christian Faith

3 Must Science and Faith Be At Odds? 29

Defining "Science"
Defining "Faith"
Premises of the Methods of Science
Science and Knowledge
Operating Relationships of Science and Faith
Conclusion

SECTION II: THEOLOGICAL ISSUES

4 This Is My Father's World: The Biblical Doctrine of Creation 59

How Many Creation Accounts Does One Religion Need?
Literary Relationships of Genesis 1 and 2
Outline of Genesis 1:1–2:3
What Is Genesis 1:1–2:3 About?
Is Genesis 1:1–2:3 Supposed to Be a Historical Record?
Does Genesis 1:1 Teach "Creation from Nothing"?
Does Genesis 1:1–2:3 Give Us a Chronology?
Is Genesis 1:1–2:3 a "Scientific" Account of Creation?
What Does It Mean That Creation Was "Good"?
How Did God Make the World?
Summary of the Doctrine of Creation in Genesis 1:1–2:3
What Does This Mean for Us?

5 WHAT KIND OF DAYS WERE THOSE, ANYHOW? 77
Preliminaries: The Key Issues At Stake
Features of Genesis 1–2 That We Must Account For
An Interpretation That Accounts for All of These Features
What About the Fourth Day?
Other Possible Interpretations of the Days
Comparing the Different Views
Conclusions
6 OTHER BIBLICAL PASSAGES ABOUT CREATION 97
Old Testament
New Testament
7 IS THE EARTH YOUNG OR OLD? BIBLICAL ARGUMENTS 105
Did Jesus Think the Creation Period Was Short?
The Genealogies in Genesis
Conclusion: Does the Bible Have a Position on the Age of the Earth?
8 WHAT A PIECE OF WORK IS MAN! HUMAN NATURE AS IT WAS CREATED 111
You Are a Human Animal
Body and Soul
The Image of God
Are Adam and Eve Our Ancestors?
The Possibility of Science
9 THE GLORIOUS RUIN: HUMAN NATURE AFTER THE FALL 135
God's Arrangement with Adam and Eve
The First Sin
Human Nature After Genesis 3
Is Science Possible for Fallen Man?
10 HOW "FALLEN" IS NATURE? 147
The "Curses" in Genesis 3
What Did Lions Eat Before Man's Fall?
Why Does the Creation Groan?
Some Conclusions for Science in a World of Fallen Mankind
11 HOW DOES GOD RULE THE WORLD? THE BIBLICAL DOCTRINE OF PROVIDENCE 161
The Traditional Christian Picture of God's Providence
The Biblical Evidence

Definitions That Restate the Biblical View of Providence
Other Views: Are They Truer to the Bible?
Providence and Science
12 GOD REVEALS HIMSELF IN HIS WORLD: SCIENCE, FAITH, AND APOLOGETICS 181
Defining Terms
Natural Revelation in the Old Testament
Natural Revelation in the New Testament
Faith and Reasons
Science, Natural Revelation, and Apologetics
13 CARING FOR GOD'S WORLD: THE BIBLICAL VIEW OF THE ENVIRONMENT 203
The Original Plan
The Modified Plan
The World Still Serves Man
Ethical Considerations for the Environment

SECTION III: SCIENCE AND FAITH INTERACT

14 SCIENCE, PROVIDENCE, AND MIRACLE 215
Modern Science and the Supernatural
Science and Reliable Natural Properties
Chaos Theory
Uncertainty, Miracles, and Human Freedom
Providence and the Problem of Evil
15 HOW OLD IS THE EARTH? COSMOLOGY AND GEOLOGY 229
Cosmology and the Big Bang
Geology and the History of the Earth
Realism, Anti-Realism, and Appearance of Age
Is the Big Bang the Same as the Absolute Beginning?
Are the Geologists Wrong?
The Anthropic Principle
16 WHERE DO ANIMALS COME FROM? BIOLOGICAL EVOLUTION AND DARWINISM 255
What Does Darwinism Claim?
How Did Darwinism Develop?
How Does Neo-Darwinism Impact Christian Faith?

Is Neo-Darwinism Credible?
Evolution and "Progress"
Summary

17 IS INTELLIGENT DESIGN A DUMB IDEA? ANSWERS TO OBJECTIONS 285
What Is "Intelligent Design"?
What Would Make Intelligent Design a "Dumb Idea"?
Are These Objections Valid?
Conclusion: Is Prohibiting Intelligent Design a Dumb Idea?

18 SCIENCE AND THE ARGUMENT FROM DESIGN 301
What Is the Argument from Design?
What Is the History of This Kind of Argument?
Is the Argument Any Good?
What Place Should Science Play in the Argument Today?

19 THE HUMAN AND SOCIAL SCIENCES 317
Maintaining Sound Thinking
The Brain, Mind, and Soul
A Genetic Basis of Behavior
Counseling and Psychotherapy

SECTION IV: CONCLUSION

20 CULTURE WARS AND WARRIORS: FAITH, SCIENCE, AND THE PUBLIC SQUARE 331
Dealing with Disagreements Between Christians
Christians in the Public Square

21 LIFE IN A CREATED WORLD 339
Outline of a Christian World-and-Life View
Participation in the Sciences for Christians
How to Give Our Kids a Scientific Education

APPENDICES

A. NOTES AND COMMENTS ON THE CHAPTERS 351
B. OTHER RESOURCES 419
C. THOMAS KUHN AND PARADIGMS: A REVIEW ESSAY 421
GENERAL INDEX 434
SCRIPTURE INDEX 442

2

Science, Faith, and Rationality

A Short Course in Good Thinking

The Importance of Philosophy

This chapter and the next cover some issues in the philosophy of science; but if I'm going to write about that, I'd better first defend myself against a flurry of objections. If I don't defend myself, you might easily fall prey to the temptation to skip these chapters so you can get right to the red meat. But these chapters are foundational to most of what I will argue later, so please bear with me.

Philosophers, with their endless questions and uncertainties, frustrate people in the sciences: if these philosophers had any experience in the lab, they wouldn't get so hung up over whether the scientist actually knows anything or deserves to be believed. In my six years as an undergraduate and graduate student at MIT, never did anyone official suggest that any of us would learn something worth knowing from a philosopher. So why should I think there is anything to be gained from even mentioning philosophy?

And in the Christian world there won't be a much warmer reception. Doesn't Scripture warn us not to be taken captive through philosophy (Col. 2:8)? Isn't philosophy just the wisdom of this world, which gets in the way of genuine faith (1 Cor. 1:21)?

Let me start my defense by saying that there is a difference between philoso*phy* and philoso*phers*. Philosophy is the discipline that studies how to think clearly: to know what is a good argument that deserves our agreement because it makes its point, and what is a bad argument that we should reject. If an ornithologist (a scientific bird-watcher) tells me that my favorite canary is safe with his falcon, I want to know how he knows: is it just because he's never seen his falcon go for a canary, or what? This is, as it turns out, a question in the philosophy of science: has the ornithologist made a sound con-

clusion? Actually, in matters of faith we have similar issues: if someone tells me I should (or should not) have my children baptized, I want to know how he arrived at his opinion. That, too, is a kind of philosophical question, one in the subject that theologians call "hermeneutics" and "theological method"; but at bottom it's all about drawing sound conclusions.

G. K. Chesterton put it well:

> Men have always one of two things: either a complete and conscious philosophy or the unconscious acceptance of the broken bits of some incomplete and often discredited philosophy. . . . Philosophy is merely thought that has been thought out. It is often a great bore. But man has no alternative, except between being influenced by thought that has been thought out and being influenced by thought that has not been thought out.

In reference to a man who responds to miracle claims with, "But my dear fellow, this is the twentieth century!" Chesterton observed:

> In the mysterious depths of his being even that enormous ass does actually mean something. The point is that he cannot really explain what he means; and *that* is the argument for a better education in philosophy.

Now if we look at it this way, we can see that what Paul warned the early Christians about was bad philosophy, namely the kind that kept people from believing that the Christian message is true. And what about the philosophy that my fellow MIT students and I despised? Is that bad philosophy too—or were we following a bad philosophy of our own? To answer that we need this chapter.

Here is my basic claim, which I intend to develop throughout this book: our conclusions, whether in science or in religious faith or in any other area, are sound only to the extent that they follow the principles of good reasoning. (Just what those principles are will come soon.) In this I am following the lead of C. S. Lewis, who observed,

> The distinction thus made between scientific and non-scientific thoughts will not easily bear the weight we are attempting to put on it. . . . The physical sciences, then, depend on the validity of logic just as much as metaphysics [philosophy] or mathematics. If popular thought feels 'science' to be different from all other kinds of knowledge because science is experimentally verifiable, popular thought is mistaken. . . . *We should therefore abandon the distinction between scientific and non-scientific thought. The proper distinction is between logical and non-logical thought.*

I put the last two sentences in italics because they sum up my case. Science and faith are "good" to the extent that they obey the rules of rationality. So the key to a solidly Christian way of thinking about science is sound critical thinking.

Now there are two groups who will disagree with this idea. Some will say that science *defines* what rationality is. The answer to that is simple: they have made a claim, and the way to decide whether the claim is true or not is to evaluate whether it makes sense. So the very claim itself has to answer to the rules for rationality. Others will say that there is no such thing as "rationality," because that is a human invention (this group is called "postmodern"). The problem with that objection is that in everyday life we know it's not true: we know that getting hit by a flying stone is bad news, and typically we take steps to avoid it; we know that some materials make better knives than others (flint is better than sand, and steel is even better). A good philosophy will start from everyday rationality and build on it, and refine it. The principles of sound thinking that come next are just such a development.

Principles of Sound Thinking

To return to my example of the ornithologist, how will I know whether I should believe his assurances about his falcon and my canary—that is, how will I know whether or not I am reasonable to believe him? And the answer is, of course, if he has followed the rules for drawing sound conclusions from his experiences. So then: what are the rules?

To begin with, we need to understand what are the parts of an argument. (I use the word "argument" to mean the process of drawing a conclusion, not the quarrels that erupt between brothers and sisters.) Then we can decide whether the parts are all in good working order.

The first part of the argument is its *data*—that is, the raw facts. What has my bird-watching friend seen his falcon eat? What has he seen it pass by even when it's hungry? A good argument has data that are honestly reported—no fudging, no editing out of inconvenient facts—and are as complete as possible. It is of course a judgment call when someone decides what is "complete enough"; in fact, that is one thing that makes science interesting, because people do not always agree in their judgment calls, and sometimes people make mistakes in them. It is often true that my data are second-hand: someone reports it and I believe it. (Much of what I know about the animal world comes from such reports—Audubon Society *Field Guides,* documentary

films, and so on.) In this case my data are good if I have sound reason to believe that the source is trustworthy.

The second part of the argument is the *premises*—the things you take for granted, often without even thinking about them. Both I and the ornithologist take it for granted that falcons eat something; we also, based on our experience of falcons and birds like them, assume that they eat other animals. So some premises may seem too obvious to need stating; but we have to be careful even then: what's obvious to you may not be obvious to me, and not only because I'm thickheaded. For example, suppose someone says, "The universe started either by the Big Bang or by divine creation." He's taking for granted a number of things, such as that creation and a Big Bang are the only alternatives, and that creation *by means of* a Big Bang is not possible. He's also taking for granted that the universe exists, and that it started. Our speaker has taken these assumptions as starting points, perhaps because he has thought it through before, or perhaps because he hasn't. But in any case he owes it to you to acknowledge his premises and expose them to evaluation.

I want to introduce a special kind of premise that I call a *touchstone truth*. By this I mean the sort of thing you have to take for granted before you can even start thinking: you take for granted that you exist, that you are a self (which means that you make real choices that matter, and that when you reason soundly you come to valid conclusions), and that other selves exist and can communicate with you. (These are just examples: there may be more.) I call them "touchstones" because if they're not true then there's no way you'll know if anything else is true. It follows that if someone contradicts one of these touchstone truths, then his argument falls apart. You don't have to argue to prove that a touchstone truth is a valid premise, although you may have to show that some particular belief has the right to touchstone status. (You can see that some premises *do* need to be shown valid.)

Here is an example of why I call these premises touchstone truths: J. B. S. Haldane, a British biologist who in the early twentieth century helped develop what is now known as neo-Darwinism, said:

> If my mental processes are determined wholly by the motions of atoms in my brain, I have no reason to suppose that my beliefs are true . . . and hence I have no reason for supposing my brain to be composed of atoms.

The notion that our thoughts are determined by the way the atoms in our brains move about is called "materialism"; and if materialism is true, then I cannot know whether my thoughts are true. It also follows that my choices

are the products of these atomic movements as well, so that they cannot really be called "choices" at all (who thinks a rock *chooses* to fall when I let it go?). But this means that my belief that I am a self is false. The trouble is, you have to rely on that belief to *argue* that materialism is true. So we're far more reasonable to conclude that materialism is false (or if it's true, who cares?).

The next part of an argument for us to consider is its *terms*—the definitions of the words used for the argument. We want to know if they are clear or not; if they are used consistently; and if they are standard usage for the words, or specific to one person or a small group. We have to recognize that most words have more than one meaning, and in order to know what someone is saying we have to know which meaning he is using. For example, in *Mere Christianity* C. S. Lewis has a chapter on "The Great Sin," which is pride. But, as he shows, the word "pride" has more than one meaning: the sin of pride is that of comparing yourself to others in order to prove that you're superior to them, and of wanting the world to revolve around you. But there's a "pride" that we take, say, in our parents or children or school; and if by that we mean that we "have a warm-hearted admiration for" them, that's not the *sin* of pride—though we may be boring if we talk too much about them. (We may, of course, commit the sin of pride if we use our children's talents to prove how superior we are.) We also have to be careful of taking a word that is in ordinary use and giving it a peculiar sense that no one ever uses: for example, some historians use the word "history" to mean an account of things without any reference to God. In such a case they could say, "Even though 'In the beginning God created the heavens and the earth' is not a *historical* statement, I'm not saying it didn't happen"—and this sounds to most people like nonsense.

You will find that in the chapters that follow, I keep trying to make sure we know what we mean by our terms. I realize that this may make me tiresome—J. Gresham Machen once acknowledged, "nothing makes a man more unpopular in the controversies of the present day than an insistence upon definition of terms"—but I want us to think clearly.

The fourth part of an argument is the *logic*—the process of arranging conclusions in a step-by-step sequence to produce an inference. If I add two marbles to a cup holding two marbles, it is sound logic to believe that the cup now has four marbles in it (taking as a premise that no one is interfering). If I see a hawk eating a rabbit, I infer that at least this hawk eats rabbits from time to time; but if I watch a number of hawks in different places eat rabbits, I infer that rabbit is part of their diet. (To have an idea of how big a part of their diet it is requires that I compare the number of rabbit kills to the num-

ber of other kinds of kills.) If the last cookie is missing from the cookie jar, it is reasonable to suppose that someone took it; but it is not reasonable to blame my brother, who lives two thousand miles away. To know whom to hold responsible I need to know who has been in the kitchen since I last checked, and something of the habits of the potential suspects. My children don't pinch cookies from the jar, while my wife does snack on them; so she's the most logical candidate.

There are different kinds of inference: the marble example is *deductive,* depending on the rules of math, while the hawk diet is *inductive,* making generalizations from observations. The who-ate-the-cookie example is more complicated; it is like what detectives do, and we can call it a *historical inference,* trying to explain the cause of a specific event in terms of what I know about the possible causes. We have to follow the rules for the particular kind of inference we're making.

The fifth part of an argument is its *scope*—the realm of ideas in which our inference is supposed to apply. We might also call this the *with-respect-to-whatness* of our inference. (Sometimes the best way to answer a question is with "With respect to what?") For example, if an astronomer tells you that the earth is not the *center* of the universe, his scope is the realm of physical location. If a theologian tells you that the earth is the *center* of the universe, his scope is the realm of God's attention. To say that these two have contradicted each other you have to show that they have similar scopes—and I think anyone who tries to show such a thing with these two statements is talking foolishness.

And finally, there is the *gradation of confidence*—what level of confidence I am entitled to give this conclusion in view of the data, the premises, and the kind of inference. For example, if I have seen two hawks eat nothing but rabbits, I can be confident that they eat rabbits. But if I want to be confident that hawks primarily eat rabbit, I have to watch many hawks, and see what they do when given a choice between rabbit and squirrel, and find out if hawks live where rabbits don't. In the case of adding marbles to the cup, my inference is certain provided my premise that no one interferes is solid. In the case of the missing cookie, the level of confidence to which I am entitled depends on whether I have considered all the options, and how well I know the possible suspects.

If you study critical thinking or logic you will get a list of "fallacies" to look out for. These fallacies generally have to do with failures to be careful in one or more of the components of sound thinking that we are discussing. For example, the "fallacy of equivocation" happens when we use a word

without paying attention to the distinction of meanings: it is a problem in the "terms" component, and our "pride" example illustrates an equivocation if we call being "proud" of my daughter's courage when she gets a painful shot an instance of sinful pride. The fallacy called "non sequitur" (Latin for "it does not follow") is a problem in the "logic" component: if I see a hawk catching a rabbit, it does not follow from this fact that the same hawk—let alone other hawks—will not eat squirrels.

There's a Latin phrase that warns us against a very common logical mistake: *abusus usum non tollit,* "abuse does not take away proper use." The idea is that we must distinguish between the actual idea we are discussing, and the trappings that wrap around it. For example, people have used the Bible to defend the African slave trade; but the only way that fact can be a sound argument against the Bible is if defending the slave trade is part and parcel of the Bible's teaching. If defense of slavery is an abuse of biblical teaching, then we can say that defending the slave trade is inconsistent with the Bible. People have also used Darwinism to defend racism; and the only way that can be a sound argument against Darwinism is if the racism is bound up with the very essence of Darwinism. The English proverb that goes along with this is "one bad apple doesn't spoil the whole bunch": you can't refute Christianity, or Darwinism, or anything else, just by pointing to the buffoons who have used it for base purposes; you have to examine the ideas themselves. (Recall how I began this chapter by making a distinction between philoso*phy* and philoso*phers.*)

There is another kind of logic problem that we need to think about, because of how it applies to the sciences—especially to those with a historical component. Suppose you find a stone on the ground, and after looking at its sharp edges you decide that some person sharpened it. You then want to figure out why he sharpened it and how it came to be where you found it. In each of these inferences—that it was sharpened, the purpose it was sharpened for, and what train of events led to it being where you found it, your reasoning probably follows a sequence like this: you imagine a scenario, you look for reasons to support or refute that scenario, you consider other possible scenarios, and you try to support or reject each of those scenarios. For example, to decide that someone sharpened the stone, you imagine some natural process—say, wind and weather—that could have made it sharp like it is. You test that scenario by asking whether these natural processes produce such a clear pattern, and whether they would have made the stone in such an oblong shape. You don't think so—and besides, you've seen other similar stones that you know were sharpened by a person.

The key thing is that you have to give reasons to go from "I can imagine this scenario" to "this is a possible chain of events that led to this," and from there to "this is the likely chain of events." Unless you can give those reasons, you don't have the logical right to make the shift.

TESTING A TRUTH CLAIM

When I am faced with a claim that something is true, how can I know whether or not to believe it? Well, I should at least decide whether or not the argument that produced the truth claim is sound. Now, just because the argument might have some flaws in its components doesn't mean that the conclusion is untrue. For example, I have seen an argument for the truthfulness of Scripture based on fulfilled prophecy, where I disagreed with the writer's way of interpreting prophecy (which was an unargued premise for him), and therefore thought his argument was a bad one—but I still think that Scripture is true. To show that this writer's conclusion about the truthfulness of Scripture is false would require someone to show that the flaws in his argument undermine his conclusion altogether, or else to show that there is a better explanation for the data of prophecy (which doesn't happen in the case of Scripture's truthfulness).

Can we go beyond deciding that an argument is not simply false, to deciding that it is likely true? I think we can, if the argument meets the following conditions.

(a) The set of data is large enough, and the conclusion covers all of the data. For example, I have observed enough hawks and accurately reported what I have seen them eat.

(b) The argument openly says what premises must be true for the argument to hold, and offers reasonable grounds for believing those premises. For example, my premise that no one is interfering with the marbles in the cup is good if I am looking inside the cup.

(c) The argument covers the data without introducing unnecessary complicating assumptions. This is often called Ockham's razor: it means that the simplest conclusion that covers the facts is to be preferred. For example, when the cookie is missing, it is simpler to suppose one person pinched it than to imagine a UN conspiracy.

(d) The logic of the argument is sound and self-consistent.

(e) When the conclusion challenges other beliefs I hold, it shows why the other beliefs are wrong; but in any case it is consistent with my touchstone beliefs. This is just another way of saying that reasonable people don't want

to hold contradictory beliefs if they can avoid it. For example, if I thought hawks ate only rodents like mice and chipmunks and then I saw hawks eating rabbits—rabbits aren't *rodents,* they're *lagomorphs,* with two pairs of upper front teeth instead of one pair— then I have to reject my previous belief. But if someone argues from brain science that my beliefs are determined by the chemical properties of my brain, than I should reject the argument, even if the advocate wears a lab coat—because it contradicts a touchstone belief.

Sometimes, though, even if my other belief is not a touchstone, I might hold on to it and reject the new conclusion. For example, if my detective work on the missing cookie leads me to conclude that a space alien pinched the cookie with a transporter beam, I may decide that my disbelief in transporter beams is strong enough to make it reasonable to reject the conclusion. If a psychologist tells me that a tendency to alcoholism is related to one's genes, and I think it is a moral issue, I have to be careful to sort out just what is and is not in conflict. (I will look at this kind of question when I discuss the human and social sciences.)

(f) It lists the possible refutations and counterarguments fairly and honestly, and answers them. For example, someone might argue that the cookie disappeared because my son broke his habit of not pinching from the cookie jar; but if his habit is well-established, and he denies having done so, and he is truthful, and I know that my wife gets hungry, then the counter explanation doesn't look promising.

(g) It helps if we can describe a way of testing it. For example, if I have concluded that hawks eat rabbits, I should be able to set up a blind in a place where there are hawks and rabbits, and see it happen. I could test the two marbles plus two marbles gives four example, too, if I wanted to—but, since it's a deductive inference, I wouldn't be testing the inference itself but instead would be testing my premise that nothing is interfering.

In the rest of this book I will put these principles to work to help us achieve good faith and good science.

But for now I want to emphasize again that this is what you do—or at least should do—every day.

A Word About Rational Christian Faith

I have stressed that good faith as well as good science needs sound rational thinking. I know that many will either not understand this just yet or will think they are reading something heretical: after all, faith is in the heart, not the head, they will say. Or they will point out that God reveals Christianity

through Scripture, not through human reason. I will talk more in the next chapter about what "faith" is, and how it relates to reason. Before I move on, though, let me say a few things in clarification, so that you don't hear what I'm not saying.

To begin with, by "reason" and "rationality" I don't mean what theologians usually mean when they contrast reason with revelation: they are speaking of the process of reasoning that takes for its premise the notion that only what we can discover by study *without God's help* is reasonable. I am instead speaking of the process of thinking soundly in general. So this objection is based on failure to be clear that I use the word "reason" with a different meaning than the objector does. In fact I don't believe for a second that it is at all "reasonable" to do without God's help in understanding his world!

Another thing to clarify: I haven't at this point said anything about the role of reasoning in how we come to believe in Christ; instead I have been focusing on the responsibility every convinced Christian has, to use and develop his reasoning ability in service to his faith and life. I will come back in a later chapter to the role of rational arguments in coming to faith.

The theological discipline that studies how to use rational arguments to support faith is called apologetics. Christians don't all agree on what place these arguments should play in bringing someone to believe in God. Some say that no arguments are needed; some say that sound faith requires evidence; some say that you have to challenge the unbeliever's worldview before he can even think rightly about God.

One of the things that distinguishes these schools of thought is their answer to the question, "Where does belief in God come in?" Some say that belief in God is actually a *datum*—that is, you just know God directly, and what you need is to get in touch with that knowledge that you've been suppressing. Others say that belief in God is a *premise*—unless you take God's existence for granted, you have no basis for sound reasoning of any sort. Still others say that belief in God is an *inference*—a conclusion from a chain of reasoning—which is why you need evidence and strong arguments.

As it turns out, each of these schools of thought has something to offer—rather than "either-or" I prefer the "both-and" approach. This is because these different schools seem to mean different things by "belief in God" (an expression we'll examine in the next chapter).

3

Must Science and Faith Be At Odds?

In this chapter I will examine some of the issues in the philosophy of science that come into play when we think about the interaction of science and faith. The first of these issues is the definition of "science" as well as that of "faith." This will lead us to look at some of the questions of proper scientific method, the connection between science and knowledge, and the possible operating relationships between science and faith.

In each of these areas I will start by giving what I take to be the most common way of thinking in our culture, and show how this leads to problems if we try to analyze it. I will then offer a way of thinking that serves us better.

Defining "Science"

Would you be surprised to learn that defining "science" is actually controversial? Well, it is—because if we want to be any more informative than "what scientists do," we run into all kinds of difficulties. Philosophers do not agree on whether there is something like *a* "scientific method" that unites all the different sciences; and they also don't agree on what is the essence of science that would allow you to define it. Further, many of them disagree over the connection between "science" and "knowledge." And finally, a good definition should help us to distinguish between what *is* scientific, and what is *not*—but that creates problems because "scientific" is a power word in our culture. If you're a scientist people have to listen to you, and if you're not—well, no one wants to be dismissed as "unscientific." In a case like this, it's easy to set up a definition that sneaks in any number of philosophical premises that need to be examined. As I told you in the last chapter, I am one of those who often finds philosophers tiresome and unhelpful; but here they have a point. I think we can arrive at a reasonable definition of science, but we do need to be careful.

I recall being taught as a boy that "science" is, at its simplest, the collecting of data from observations of the world, and then the organizing of those observations in a way that leads to a generalization called a "law." The best laws are in the form of an equation that allows you to predict what will happen next. The thing that makes science so superior to everything else, I was told, is that it is "objective," which means it is free from bias and not subject to disagreement (I think of the character in Chesterton's Father Brown story who says, "I don't believe in anything; I'm a man of science"). Christian, Buddhist, and atheist will all agree that the ball traveled 25.6 meters. This makes science a safer path to knowledge than any other kind of study, such as religion or philosophy, which can never get anywhere because they are so full of disagreements: "scientific proof" is the end of disagreement.

My hunch is that this definition captures the elements of the popular view of science; it was certainly the standard view of science in my college days. The three features that stand out are the empirical nature of the work (the collection of data), the production of laws, and the objectivity (or freedom from all bias).

The big problem with this kind of definition is that it's not true to what scientists do. In the first place, we have neglected the fact that scientists are people, and no one is free of all bias—nor should they be. The search for laws actually takes for granted that such laws exist: it is biased in favor of finding mathematical regularity in nature. (I think that the biblical teaching on creation and providence make this bias quite reasonable, as we'll see later.) But even more importantly, many scientists have held to their ideas with the persistence of a bulldog even when it looked like they were wrong. Some cosmologists (physicists who study the origin and history of the universe) dislike the Big Bang theory because it implies a beginning to the universe—and such an idea is repulsive to them.

Speaking of cosmologists, Stephen Hawking, in his book *A Brief History of Time,* writes about the assumption that the universe looks the same in every direction as seen from any other galaxy, just as it does when seen from ours. He says,

> We have no scientific evidence [*note:* what does he mean by that?] for, or against, this assumption. We believe it only on grounds of modesty: it would be most remarkable if the universe looked the same in every direction around us, but not around other points in the universe!

In other words, they're biased in favor of modesty (good thing, too).

Unfortunately, for many in our culture, "bias" is a negative word, because we think it leads us to distort our view of the world, like "rose-colored glasses." As Sherlock Holmes said more than once, "It is a capital mistake to theorize before you have all the evidence—it biases the judgment." But not every bias distorts: some biases can help us decide ahead of time what is worth paying attention to and what is not. As Holmes said in another story, "It is of the highest importance in the art of deduction to be able to recognize out of a number of facts which are incidental and which are vital." I am biased against the possibility that the number of puppies in a litter has anything to do with the number of legs the father has, so I would never pay anyone money to study what the relationship is. But some biases *can* distort: people who think that all human behavior can be explained by our genes have a bias that blinds them to moral realities. So we cannot promise that "science" is without bias; and we have to assess—by critical thinking—whether that leads to sound or unsound conclusions.

The second way that the popular definition of science causes trouble is its emphasis on laws, or regularities. Some sciences do in fact concern themselves with such regularities: Newton's laws of motion, as well as quantum mechanics and relativity, are examples of laws. But what about theories of the origin of the universe, or the geological history of a mountain range, or the history of life on this planet? These are unique historical events, and what makes them interesting is exactly their uniqueness: and yet we usually group cosmology, geology, and evolutionary biology among the sciences. (We may think that these events were produced by regularities, but that is a philosophical assumption, which I will address later.) So we have to allow science to study *both* the regularities *and* the unique historical chains of cause-and-effect.

Finally, the bit about the empirical nature of the work is good, so long as we are reasonable about what data we might legitimately consider. The science writer John Gribbin, in *Almost Everyone's Guide to Science,* draws on the famous physicist Richard Feynman to get a crisp definition of science:

> That is what science, and scientific models, are all about. *If it disagrees with experiment it is wrong.*

Gribbin here limits the empirical data to the kind you can collect in an experiment—and that's clearly wrong. Does this mean that the guy who hides in a blind and watches animals to see their natural behavior, is no scientist? And what place does this have for the sciences that study unique events? Are they

not sciences either? It is much better to speak of "observation" or "experience," recognizing that "experiments" are a special kind of experience (and an artificial one at that, since they purposely exclude "irrelevant" factors). It's even better to speak of observations that are "publicly accessible"—that is, anyone else can get the same data. For example, you can come over to my house and watch the birds and squirrels, and see if what I report about them is true. You can mix the same five chemicals at the same temperature, and blow up your lab just like I did mine. Mind you, this kind of data isn't the only kind there is: I know what I dreamed about last night and you only have my report. In research projects that involve this kind of data (say, to discover the connection between rapid eye movement and dreaming), the researcher really only has access to the person's *report*—and that's the part that is publicly accessible.

No one has a problem with physics, chemistry, geology, and biology being sciences (they are often called "natural" or even "hard" sciences); but what should we do about "social" sciences such as linguistics, sociology, and anthropology, or the "human" sciences such as physiology or psychology? Admittedly, people in the "soft" sciences want the social prestige that comes from being called "scientists," just as some in the "hard" sciences want to be able to exclude them as not really science; but we should look for some definition that is not part of a social strategy.

This last point brings up a further difficulty in definition. Most of us want to have some way of distinguishing between those who do legitimate work and those who don't. We'd like to be able to say that the cranks and quacks aren't "real" scientists, so that we don't have to believe them. Some people whose theories put them on the fringe (such as UFO researchers) would like to be called scientists so that we will hesitate to dismiss them. Similarly, there are many who want to keep some ideas out of the science classroom, such as any criticism of Darwinism, by calling them "religion" or "philosophy" and not "science" (and the sub-text is, if it's not science no one needs to believe it). So the scramble for the right to use the prestige title compounds the definitional difficulties.

We can find some help from the history of usage. We get our word "science" from the Latin word *scientia*. The great scholars of the Middle Ages—who built on the ideas of the Greek philosophers, especially Aristotle (who lived from 384 to 322 B.C.)—used *scientia* to speak of a particular area of disciplined and rational study, worthy of the investment of the time and energy it took to gain knowledge. These areas of study included such fields as physics, biology, mathematics, ethics, politics, grammar, theology, and what

we now call philosophy. When we use the word "science" today, we tend to focus on the natural or physical sciences, such as physics, chemistry, and biology, and to leave mathematics as a tool rather than a science. The term "scientist" was apparently coined by the Cambridge philosopher-scientist William Whewell (1794–1866) and appears in his 1840 book, *The Philosophy of the Inductive Sciences,* "to describe a cultivator of science." Generally, our culture tends to treat physics, which is heavily mathematical and able to make very accurate predictions, as the prime example of "true science"; some even go so far as to make it the prime example of "true knowledge." (This explains the pressure on the "soft" sciences such as sociology to put their results in mathematical form.) Though the principles I set out in the previous chapter should lead us to resist such a tendency, we are foolish not to be aware of it.

Further, we can throw into the mix a clarification that C. S. Lewis offered:

> Strictly speaking there is, I confess, no such thing as 'modern science'. There are only particular sciences, all in a stage of rapid change, and sometimes inconsistent with one another.

Lewis correctly represents both the history of usage of the word "science" and the practice of modern scientists. He also shows why John Gribbin is talking nonsense when he says,

> Both evolution and the Big Bang (and all the rest) are based on the same principles, and you can't pick and choose which bits of the scientific story you are going to accept.

There is no reason for us to accept this before we look into the specifics, and there is every reason to suppose that this makes no sense at all. It is quite possible that the Big Bang theory satisfies the criteria for sound thinking while evolutionary theory does not—and vice versa. The hidden premise—that there is one "scientific story"—needs to be brought into the light.

A few paragraphs ago I mentioned that the medieval sciences involved disciplined and rational study. This brings up two other aspects that we normally think belong to science: *discursive reasoning* and *distantiation*. "Discursive reasoning" means that you can put your reasons into words and defend them. (This is not the only way to knowledge, of course: you can recognize your daughter's voice even if you can't say *why* you know it's hers.)

"Distantiation" means you try to put some emotional distance between yourself and the object of your study, so that you can keep your cool and

think clearly. (Holmes warned Watson, "It is of the first importance not to allow your judgment to be biased by personal qualities. . . . The emotional qualities are antagonistic to clear reasoning.") We may agree with those who say there's no such thing as pure neutrality—and who would want to meet someone who had no commitments?—but we *can* distance ourselves and be self-critical. The idea is that we should be honest, and willing to follow the evidence wherever it leads. We ought further to say that this is an *ideal,* and scientists—being human—don't always meet it.

If we put all these things together, we can see that "science" typically involves publicly accessible data, discursive reasoning, and personal distantiation. We can then come up with the following definition of "science":

> A science is a discipline in which one studies features of the world around us, and tries to describe his observations systematically and critically.

Some sciences focus on the regularities (the laws), while others focus on chains of cause-and-effect that produced unique events (the histories). It helps us to group them into those that study the material world (the natural or physical sciences, such as physics, chemistry, biology, geology, astronomy), those that study human beings (the human sciences, such as anatomy, physiology, and psychology), and those that study the ways that humans interact (the social sciences, such as linguistics, textual hermeneutics, anthropology, and sociology). If we still want to use the word "science" as an umbrella for all these activities, we may, but we should be wary of the pitfalls that such a usage can lead us into.

If we describe the sciences this way, we will find several advantages for thinking clearly. The first is that it captures the empirical nature of the work, and reminds us as well that science is a human activity. It also makes the sciences subject to the rules of sound thinking.

This kind of description will also help us when we are faced with statements that begin with, "Science says . . ." We will immediately ask, "*Which* science?" And then we will move on to see that "a science" doesn't say anything; scien*tists* do. So then we can ask, "Which scientists? And have they reasoned so well that I should believe them?" This is especially helpful when someone makes a statement on behalf of all science; or when an expert in one science (say, physics) tries to speak authoritatively about some other field (say, linguistics or psychology): just because he's a scientist doesn't mean I am obli-

gated to believe him. (Of course, if someone speaks as an expert in his own field, then I ought to pay closer attention.)

But I will be honest: this description has one big disadvantage, namely that most people don't use the word "science" that way. I think that's because most people aren't aware of the problems we have been talking about; but in any case we have to listen to them and hear what *they* mean by the words they use, and help them to see why the description here has advantages over popular usage. Because I think the popular usage leads to fuzzy thinking, I don't intend to go along with it.

In any case, the first thing to do when someone mentions science is to figure out what he means by it, and whether he has said anything sensible. For example, Sherlock Holmes called himself a scientific detective; and he meant that he was careful in his collection of information, and that he had an extensive knowledge of how things work, and that he was rigorous in his process of reasoning. Since his intent was to contrast his methods with the haphazard guesswork of the official police, he was saying something worth saying.

On the other hand, Father Brown exposed the idiocy of the American Grandison Chace, who spoke of the "science of detection," with the following critique:

> Science is a grand thing when you can get it; in its real sense it is one of the grandest words in the world. But what do these men mean, nine times out of ten, when they use it nowadays? When they say detection is a science? When they say criminology is a science? They mean getting *outside* a man and studying him as if he were a gigantic insect: in what they would call a dry impartial light, in what I should call a dead and dehumanized light. . . . So far from being knowledge, it's actually suppression of what we know. It's treating a friend as a stranger, and pretending that something familiar is really remote and mysterious. It's like saying that a man has a proboscis between the eyes, or that he falls down in a fit of insensibility once every twenty-four hours.

In this case the "scientific" approach meant that you didn't use all the information at your disposal—and if that's science, it's bad science, because it's irrational.

Defining "Faith"

If we are looking for what most people mean when they use the word "faith," I'll bet that the definition of faith in *Webster's New World College Dictionary* (4th edition) nails it:

1. unquestioning belief that does not require proof or evidence;
2. unquestioning belief in God, religious tenets, etc.

And in the list of synonyms under "belief," they say that *faith* "implies complete, unquestioning acceptance of something even in the absence of proof and, especially, of something not supported by reason."

Well, we can't expect a dictionary to be a manual of theology; but don't ever read these definitions into any biblical passage, please! I have found J. Gresham Machen's book *What Is Faith?* to be more helpful than the dictionary if we want to know the traditional Christian view of faith, and I recommend it to you.

When biblical writers (and responsible Christians) use the word "faith," they are usually speaking in one of two ways. The first sense of "Christian faith" is trust toward God because you are persuaded that he is trustworthy. The second sense is "*the* faith," that is, the set of truths that Christians believe. Let's talk about each of these in turn.

We'll begin with the first sense, "faith-as-trust." This idea of faith has two dimensions: to begin with, it is directed toward a *person;* the Bible writers tell us to believe *in* God, to trust that he speaks true words and to entrust ourselves to him. The other dimension is that it is *rational:* we become persuaded of God's trustworthiness because he gives us things to believe and reasons for trusting him. You can see why Christians think of faith as a moral matter: it goes beyond accepting certain things as true (believing *that*), to committing oneself to a person (believing *in*). This also shows why some people will not become Christian believers: they don't want to give themselves to God, and this is not a purely intellectual matter.

This leads to a subject that could take pages, but that I'll just outline: namely, that in the Bible, reasoning and knowing are functions of what it calls the "heart." When Bible writers speak of the heart, they're speaking about the center of our inner life, from which we do all our thinking, feeling, and choosing. As Proverbs 4:23 puts it,

> Keep your heart with all vigilance,
> for from it flow the springs of life.

There's much more to say, but for now we have to see that when we think and know, it is the heart at work. This means that our discursive reasoning is a function of the heart, and the other functions—our feelings, our commitments—can come into play (for better or for worse). Hence we can dis-

tinguish these different functions of the heart, but I don't think we can separate them. And this means that our heart's disposition—our loyalties, our likes and dislikes—will play a part in our thinking and knowing. I don't consider this to be a shortcoming, but it does mean we have to be honest (remember what I said about distantiation).

Therefore when it comes to faith, no sound Christian would really think that the intellectual content of his or her faith is separate from the relational commitment to God.

The Old Testament commonly appeals to the great things God has done for his people, in order to remind them of the reasons for their trust: for example, Psalm 136 lists the creation, the deliverance from Egypt, the giving of the promised land, and the constant care for his people as reasons why Israel should keep their faith in God, even in trouble. In the New Testament, Jesus says (John 10:37-38),

> "If I am not doing the works of my Father, then do not believe [or *have faith in*] me; but if I am doing them, even though you do not believe me, believe the works, so that you may know and understand that the Father is in me and I am in the Father."

No shunning of evidence here!

You see too that this faith has content: we believe that certain things are true about God. (We could probably take "mere Christianity"—to use C. S. Lewis's term—as the solid core of these truths, and we build other beliefs around that.)

We can learn a lot about faith by thinking of our trust in other people. I am sorry to admit it, but I have teased my daughter by serving her a bowl of ice cream and then picking up the spoon as if I were going to eat it myself. The first time I did it she was alarmed; but when she saw that I wouldn't really eat it—and I reminded her that I'm her daddy who loves her—she never worried about it again. And when I pulled the same trick on her younger brother, she settled him down by reminding him that it's Daddy and we don't need to worry about it.

But they have also learned that they can trust me to be looking out for their best interests, and that they can show their trust by obedience—even when they don't understand *why* I have given a command. For example, we read books as a family before bedtime—books like *The Hobbit* or *The Secret Garden.* One evening we got to an exciting part, but had to stop because it was time for the kids to go to sleep. My son was displeased, telling me that

it was a cliffhanger (it wasn't as bad as he thought, though). He was focused on the short-term goal of relieving the suspense of the story; I was looking to the bigger picture of what he's like the next day if he doesn't get enough sleep. At his level of development, the bigger picture didn't mean anything to him. I found a reasonable break in the story, and asked him to trust my judgment and go to bed. To trust and obey would be rational for him.

Now God never teases us; he assures us that he always has good, wise, holy, and loving reasons for what he does—but he doesn't promise to tell us what those reasons are. Instead, because we have learned that he is trustworthy, we can take him at his word and keep on trusting him—and this means, keep on obeying his commands as we know we should.

C. S. Lewis hit the target when he said,

> Faith, in the sense in which I am here using the word, is the art of holding on to things your reason has once accepted, in spite of your changing moods. For moods will change, whatever view your reason takes.

Now let's turn to the second sense in which biblical authors use the word "faith": they speak of "*the* faith," that is, as the set of truths that Christians believe. When Paul says that he has "kept the faith" (2 Tim. 4:7), or when he wants Timothy to be "nourished on the words of the faith" (1 Tim. 4:6, NASB), this is the sense he is using. These truths are contained in the Scripture, and no serious Christian claims that he understands everything in the Scripture (for example, how the Trinity works, or the way the human and divine natures of Christ are joined); nor does he claim that he must understand them in every detail and prove them philosophically before he accepts them. Instead, the process of accepting *the* faith involves faith-as-trust: in the final analysis, I believe the Scripture because it has shown itself to be the reliable voice of the God who gave it, who is himself reliable. (That doesn't mean I don't try to understand, and to justify as well as I can, what the Bible teaches; but it does mean that I recognize my limitations.)

Now this discussion will help us because a number of conclusions follow from it. One conclusion is that faith and reason are not at odds with each other. Faith is in fact rational behavior: given who God is, and the reasons he's given for trusting him, it's unreasonable *not* to trust him. It is true that faith goes beyond what I can verify; but that's true of every kind of relational faith: when I married my wife, I trusted her claim to love me. How else could I verify it but by taking the "risk" (though I would never call it that)? Was

that unreasonable? No: to have waited until I could verify her love would have been unreasonable. As Blaise Pascal observed,

> Reason would never submit unless it judged that there are occasions when it ought to submit. It is right, then, that reason should submit when it judges that it ought to submit.

Not only does reason help faith, but faith helps reason: I see my life more clearly because of my faith in God. For example, we often hear encouragements to serve the rest of humanity, and I agree that this is good, but a secular mind gives me no reason *why* it is good. As Machen pointed out,

> The [human] race is worthy of a man's service not if it is composed of mere creatures of a day, whose life is essentially like the life of the beasts, but only if it is composed of men with immortal souls.

I think most people can recognize the duty to serve others; and solid faith supplies the reason that actually energizes the service.

Another conclusion is that doubt is not always the same as lack of faith. Many of the Psalms (Psalm 73 is a good example) express deep distress over God's mysterious ways of running the world, and some people would use the word "doubt" to describe the feelings there. (There we go again: what do we mean by our words?) In the midst of this distress, however, the psalmist holds on tightly to his loyalty toward God—the Psalms are prayers and hymns after all. If we resolve our doubts of this kind—using our reason as well as our prayers and our Christian friends—our faith grows stronger. On the other hand, if by "doubt" we mean divided or wavering loyalty, then this kind of doubt is dangerous to faith (just like divided loyalty is dangerous to a marriage). This kind of doubt hasn't come from our reason, but from our emotions; and the remedy is repentance.

The last helpful conclusion that I'll mention is that our discussion shows us where confidence and assurance fit in. That is, I can be assured in my *faith-as-trust* because I am confident of the person I trust. And the solid core content of this faith does not change unless I decide the whole thing is rubbish. On the other hand, I should never claim to be so confident that I know every bit of *the faith* that I won't be willing to reconsider it. I ought to hold views on other things beyond the core content of the faith, say on baptism or predestination or church government; but how tightly I hold to these other views should be related to how well I have thought them through. (As I said before,

that doesn't make them unimportant or divisive or any of those things: but we do have to keep them in perspective.)

PREMISES OF THE METHODS OF SCIENCE

Does being a scientist commit me to certain premises beyond the touchstone truths? And if it does, what are those premises? In our discussion of bias, we have seen that of course we must take for granted that we can find regularities in nature; for some of these regularities we assume that mathematical equations are legitimate descriptions. We have also seen that we are biased in favor of simpler solutions.

None of these biases is (or at least should be) controversial. But here I want to examine a few issues that should be controversial, especially because they affect the way science and faith will interact with each other.

The first of these issues is what is called "methodological naturalism." In order to understand it we can start by citing a description of science from the National Science Teachers Association (NSTA):

> Science is a method of explaining the natural world. It *assumes the universe operates according to regularities* and that through systematic investigation we can understand these regularities. The methodology of science emphasizes the logical testing of alternate explanations of natural phenomena against empirical data. Because *science is limited to explaining the natural world by means of natural processes,* it cannot use supernatural causation in its explanations. Similarly, science is precluded from making statements about supernatural forces, because these are outside its provenance. Science has increased our knowledge because of this insistence on the search for natural causes.

I have highlighted the key phrases: Science *assumes the universe operates according to regularities* and *science is limited to explaining the natural world by means of natural processes.* These statements seem to hide a very debatable premise: namely that the scientific approach to describing everything is "methodological naturalism"—we require that all our descriptions be in terms of *natural causes* only. This premise is debatable because the statement makes no distinction between the study of regularities and the study of historical events. That is, it may be a quite right, when we are studying a regularity such as the laws of motion, to assume that the steel balls always move in the same way when the forces on them are the same. (That's how we can call the right ball and pocket in a game of pool.)

But if we're talking about a historical event—well, that's a lot tougher. For example, if I see a scratch on my son's leg, I think I'm on solid ground to suppose that he scraped his leg on something hard and sharp—that natural causes can explain how the scratch got there on his skin. But should I consider his thoughts and choices a "natural process"? Well, I don't mind, so long as you don't mean "purely material process" (remember Father Brown's lecture to Grandison Chace). But the NSTA hasn't made it clear what it means by "natural process": it seems to include it under "regularity," and, as we'll see when we talk about human nature, that won't account for human reason and choice.

And what of such events as the origin of the universe, or of life? What about the parting of the Red Sea, or the resurrection of Jesus? Must we insist that science can only describe these in terms of natural processes and the orderly function of regularities? The only way this insistence is rational is if we know beforehand that only natural factors are involved. And if we don't know that—well, then such insistence is not rational, and we have no reason to suppose the story it tells is true. Under those circumstances, we have done science a disservice by wrenching it away from rationality.

So the NSTA statement involves a premise that it should have explained and defended. And to defend the premise, it would have had to make a philosophical claim about natural processes being adequate to explain everything we study—in fact that's a *theological* claim, too, since it touches on the ways we're allowed to imagine God's interaction with the world. In other words, the NSTA statement actually has made a statement about supernatural forces (it claims they're irrelevant to science), exactly what it says science may not do. It contradicts itself.

What the statement needed to say in order to be more reasonable was that the natural, human, and social sciences take natural causes as far as they can go in describing the world around us. The scientist *as a scientist* does not have to say whether God or gods were involved in the events they study. We will come back to this in our chapter on "Science, Providence, and Miracle."

You will of course notice that the NSTA statement also assumes a definition of "science" that creates problems as well: they are defining science by the methods of the natural sciences when those sciences are describing regularities. I have no doubt that they would not follow Aristotle and call ethics a science; but I cannot tell from their description whether psychology meets the criteria for a science.

I think that I can guess what the NSTA people were trying to accomplish, though: they wanted to preserve a kind of "ordinary science" that doesn't

depend on whether you're a Christian, Jew, Hindu, or atheist. When you're looking at how billiard balls move, or studying quarks and leptons, or designing new drugs, your religious commitment should not affect your results—and if those commitments affect what you're willing to work on, well, that's ethics, not physics or chemistry. I suppose they also wanted to allow physicists, say, to speak about the Big Bang without having to say whether or not this is a creation event (that is, without having to commit themselves to saying the event was supernatural). This can be helpful because it keeps science from being pressed into service either in the cause of atheism or in the cause of Christian apologetics. If that's the sort of thing they were after—and anyone who's ever worked in a research lab will welcome such goals—they failed, because they overstated their position. The effort to promote *methodological* naturalism—appealing only to natural processes in your explanations—slides over into *philosophical* naturalism—the belief that natural processes are all there is.

The next issue to discuss is called *reductionism*. Reductionism is the view that, in order to explain something, you have to explain how its components work. For example, you can describe the way a virus attacks you by describing the way it gets inside your cells: its chemistry fits the chemistry of your cell membranes in such a way that it is allowed to get inside. You can then go deeper to describe the chemical bonds that produce the shapes, and the electron interactions, and so on until you get to the most elementary particles and forces. So we have explained something biological in terms of its chemistry, and have explained the chemistry in terms of its physics. (This is one reason physics is considered the science that underlies all others: it studies the things at the bottom of this ladder.)

Like naturalism, reductionism comes in both the methodological kind and the philosophical kind. The methodological kind says, as a matter of method we study the complex in terms of the simple. The philosophical kind says that at bottom, there is *nothing but* the simple components (some call it "nothing-buttery").

Even the methodological kind of reductionism can lead to foolishness. For example, you can understand the workings of my watch by talking about the physics that underlies the LCD numbers and the semi-conductor chips, but that hardly explains why the watch *tells time:* someone has imposed a pattern on the components, that makes use of the physics and makes the parts work together to achieve some goal. But this working together involves *more* than the physics of the components. So the reduction tells only part of the story, and hence the method isn't very good if what we want is the true story.

Philosophical reductionism is just what the name says: it is a philosophical position, not a scientific result or a necessary premise for science. It says that this purring cat in my lap *is really* a set chemical reactions. I say it is really a *cat,* a living structure built out of its chemical components and their reactions.

The last issue we will examine is the role of *modeling* in science. When you make a scientific description, you have to make a *model*—you decide which features of the subject you're studying are important, and which you can leave out. For example, if you are studying the motion of billiard balls on a table, you can leave out the colors of the balls. You will probably also assume the balls are perfectly round, and you might even leave out the effects of friction. It is probably reasonable to ignore these factors for the sake of having a model you can work with. If you are studying human behavior, though, you would be silly to leave out color—in American society, color has a deep impact on a person's experiences.

Reductionism, as we have seen, works by leaving the pattern out of the model it makes, and is therefore an inadequate kind of modeling. Some psychologists study the electrical and chemical reactions in the brain when people think or feel in different ways. They then go on to speak as if these thoughts and feelings *are* the electro-chemical reactions they have studied. In other words, they have made a model that leaves things out, and then have acted as if the model was all there is. There is a famous parable about a man studying deep-sea life using a net with a three-inch mesh. After bringing up many samples, the man concluded that there was no deep-sea fish that was smaller than three inches in length. Our method of "fishing"—our scientific model—sets limits on what we can find.

Our culture is obsessed with measurable things, as if that alone guaranteed objectivity. But it would be laughable to decide that, since you can't measure the strength of one's will, you can ignore it in a "scientific" description of a man.

Science and Knowledge

All of this raises the question of what the relationship is between science and knowledge. Of course some think that science is the only path to knowledge (and that is usually linked to a naturalistic worldview). There are others who deny that science produces knowledge at all—either because its basis in experiment always leaves you wondering whether you have done enough trials, or because the world is not knowable anyhow.

The big difficulty in all of this is to define "knowledge"—and that's as tricky as defining "science"! If we mean, as some do, to know something in all its details without error or precommitment, well, then, no one knows anything (except, apparently, that they don't know anything). But no one except a philosopher ever means that when he says he "knows" something or someone. I know that I am sitting here in front of the keyboard. I know that my daughter has brown hair that shows red highlights in the sun. There have been times when in talking with my children about a difficulty, I have known just why they behave the way they do. I believe it is right to say I know my wife and children—though I don't know everything about them. By that I mean that I know that they think and feel in some ways and not in others, and I can base my own behavior on these known patterns.

But let's think about some other examples. Suppose I ask my daughter if she slept well last night, and she says "yes," and I believe her. May I say that I *know* she slept well? And try this one: one winter morning I looked into the backyard and saw a hawk on the ground, stooping over and tugging at something with its beak. A couple of hours later I went outside and found dozens of feathers scattered all around where the hawk had been. I checked with the local Department of Conservation to be sure I identified the hawk rightly (it was a red-tailed). "Knowing" what I know about their eating habits (to be precise, believing the booklet that the Department sent me), I inferred that the hawk had caught and eaten a bird—probably a mourning dove or mockingbird, based on the color of the feathers. Now, then: do I *know* that the hawk ate a bird there?

When philosophers talk about knowing, they often contrast it with believing and inferring. I find this confusing because they usually don't use the words in the same way that we do in ordinary speech. So let's just think about the English verb "to know." There are four basic patterns in which we use the verb.

1. I know *that* <a> is true

Think of some sentences in this pattern: "I know that I'm sitting here"; "I know that my wife and children love me"; "I know that I don't own a dog"; "I know that a squirrel made these tracks in the snow"; "I know that the hawk ate a bird." In each case, I'm saying that I have a good reason to believe that <a> is true. There seems to be some idea of a threshold of confidence level, though: in the last sentence, if I'm not sure, I might say, "I *think* that the hawk ate a bird." This threshold varies with context—it probably

depends on just how important the topic is. (It matters more to me whether my wife and children love me, than whether a hawk ate a bird, so I set the confidence bar higher for that.)

2. I know *how to do* <b>

A sample sentence would be, "I know how to cook eggs." The idea is that I have a skill, and can reliably carry out the actions needed to bring about some goal.

3. I know <*person* c>

Consider some sentences: "I know Diane"; "I know George, but not well." The idea is that I have experience of the way person <c> behaves—and that my experience is enough for me to be able to say what her likes and dislikes are, how she thinks, what principles govern her actions. The sentence "I know God"—in a Christian context—includes all this, with love and delight.

4. I know <d> *from* <e>

For example, "I know good apples from bad" means that I know what the difference is, or how to tell the difference—which makes this a variation either from pattern 1 or from pattern 2.

When we are talking about science, we're generally talking about pattern 1; so our question is, Does scientific study lead us to "know that" some statement is true—say, *that* hawks eat birds, or *that* the earth is $4^1/_2$ billion years old? What we are asking is, Does it give us good reason to believe that such a statement is true?

When we're using pattern 2 (know how to do) and pattern 3 (know a person), we're building on knowledge *that,* and taking it further.

Some philosophers, as I said, distinguish between knowing, inferring, and believing: I *know* things that I observe directly; I *infer* things when I draw conclusions; I *believe* things that others tell me. Now, I don't think this distinction corresponds to ordinary usage either, but it does introduce a useful distinction. I have no reason to doubt that lions eat wildebeests, or that bears hole up for the winter, even though I have never seen one do so. Nor do I have reason to doubt that squirrels eat acorns—even though, strictly speaking, I have only seen a few do so, and I am making a generalization. I don't doubt

that Romans executed certain criminals by crucifixion. Nor do I doubt that the hawk I saw ate a bird. Am I wrong to refer to these items as "knowledge"? I don't think so, but I should recognize that there are different categories of knowledge—knowledge by direct observation (I have seen squirrels eat acorns), knowledge by believing reliable reports (others tell me they have seen squirrels eat acorns), and knowledge by inference (I conclude that squirrels in general eat acorns when they can find them).

So how can we apply these ideas to science? Well, it follows that I can say without embarrassment that I know things scientifically. I know a part of what squirrels eat; I know how to sink a billiard ball (the angle of incidence equals the angle of reflection, as I learned in high school physics). I know how the Greek and Hebrew verb tenses are used.

This also helps us to see where science fits in to the general project of knowing. Science, as I argued earlier, depends on discursive reasoning; and discursive reasoning depends on accepting touchstone truths (such as that reasoning is valid). But this means I know some things apart from discursive reasoning—I know that I exist, I know what I dreamed last night, I know my wife's voice. But also, not all discursive reasoning is science—because, for instance, the data might not be publicly accessible. When I try to figure out why I'm tired, and then realize it's because I woke up too early because I had a yucky dream and couldn't go back to sleep—well, that's all very rational, but I wouldn't call it "science." This means that we have a ladder: knowing-in-general, which includes discursive reasoning, which in turn includes science. The higher the rung, the broader is the coverage. And each lower rung is subject to the rules of the rungs above it: that is, discursive reasoning depends on things that I know directly; science depends on discursive reasoning. This shows why I have to evaluate scientific results for the quality of their reasoning; it also shows why I can't make science—or discursive reasoning—the be-all-and-end-all of knowing. Each has its place.

The common thread in the things I listed above—what squirrels eat; how billiard balls travel; how verb tenses are used—is that I can see them with my own eyes (or can accept others' eyesight) and test them in my experience. But what about things I can't test this way—such as the existence of protons and electrons, or the shape of a molecule, or the components of a distant star? These things result from a chain of inferences based on their effects—in the examples given, mostly electronic measurements. Now, this in itself isn't bad: if I see deer tracks in the woods I know by inference that a deer has gone by (unless someone is pulling a gag). So really the inference is as good as the chain of reasoning that produced it, and we're back to the features of sound

thinking in chapter 2. For example, cosmologists think the universe has lots of what they call "dark matter": but the only way to detect it is by its gravitational effects (that's why they call it "dark": you can't see it). Likewise, how can we find planets around other stars, when they're too far away for us to see them? Astronomers look for wobbles in the movements of a star, assuming that the gravitational pull of a planet causes the wobble.

But things are a bit more complicated than that. Remember that science proceeds by making models; and this means that the inference takes for granted that we have made a good model. If we want to be really careful, we should say "matter behaves *as if* it were made of protons and electrons and other stuff, and I don't see any reason to doubt that it really is"; "molecules reflect X-rays *as if* they had such-and-such a shape"; and so on. If my model for the motion of billiard balls doesn't include the friction from the table (as it commonly doesn't in high school physics), then the model is not good enough for the real world.

The work of Thomas Kuhn, a historian of science, comes in here. He used the term "paradigm" for the generally accepted models of a scientific community. Most of the time scientists are filling in the details of these models, and sometimes the problems with a model get so severe that the only thing to do is to adopt a new model and chuck the old one. For example, in the Middle Ages, people thought that the earth was a sphere, fixed in the middle of the universe, and that the stars and planets were stuck in crystalline spheres that rotated around the earth. They also thought that all change took place within the orbit of the moon; outside that orbit, nothing changed. This was their model; science involved figuring out how the stars moved along the surfaces of the spheres to give us the patterns we observe. In 1572 Tycho Brahe found that a "new star" had appeared, and he called it a "nova" (that's Latin for "new": today we'd call it a supernova). This was also the age of Copernicus (1473–1543), who suggested that the earth revolves around the sun. The model that we hold today—we go around our sun, which is a star in the Milky Way, which is a galaxy among innumerable others—looks like it does a better job of accounting for the observations.

Another feature of Kuhn's notion of paradigms, though, is that paradigms don't actually get you nearer to the truth: they just gain general acceptance and set new problems for scientists to work on. The topic is too big for me to do it justice here; I've put a critical review of Kuhn's theory in an appendix to this book. For now I'll say that I don't think he's really made his case, but he has done us the service of showing how many different factors are involved when a scientific model gets accepted.

And then there is the problem of our generalizations: when can we make a sound one, and when should we refrain from making a generalization? For example: in every American presidential election since 1940, the outcome of the election is tied to whether the Washington Redskins win their last home game before the election: if they win, the party in power stays in power, and if they lose, the party out of power wins the election. The record is 100 percent, and has been since the 1940s. Since the football game comes first, we can say that it "predicts" the outcome of the election, can't we? (Some columnists complained that George Bush's campaign slacked off a bit just before the November 2000 election, and they almost lost because of it: do you suppose that the Redskins' loss that year made them too cocky about winning?)

Another example: the natives of the New Hebrides in the South Pacific observed that people in good health usually had body lice, while sick people very often did not; hence, they concluded, body lice produce good health.

Both of these generalizations are unsound, despite the force of the statistics (that is, the apparent grounding in solid empirical data). What makes a statistical generalization sound or not is the presence of an *explanation*—can we give a reason why the relationship should be so? As to the football example, no one has a reason that makes any sense, and so no sensible person will waste time looking for some deeper connection. In the case of body lice in the New Hebrides, what we know—or think we know—about body lice makes it hard to swallow; and once we think it through, we find another explanation that fits the data and is more consistent with what else we know. As Darrell Huff put it in his *How to Lie with Statistics,*

> More sophisticated observers finally got things straightened out in the New Hebrides. As it turned out, almost everybody in those circles had lice most of the time. It was, you might say, the normal condition of man. When, however, anyone took a fever (quite possibly carried to him by those same lice) and his body became too hot for comfortable habitation, the lice left. There you have cause and effect altogether confusingly distorted, reversed, and intermingled.

Of course these explanations might themselves be based on a fabric of inferences and premises, so they need to be put under the microscope, too.

Consider how we now have an international standard for telling time: the atomic clock, based on the cesium atom. James Trefil tells us,

> Every electron in every cesium atom in the universe behaves in exactly the same way, so the cesium standard is both universal and reproducible.

I expect that this claim is true—true down to thirteen decimal places, anyhow. What makes it worth believing? Has anyone actually examined "every electron in every cesium atom in the universe"? (Has anyone actually examined *any* electron?) The answer is no; but the generalization is based on a model of the atom, which is itself based on a network of inferences.

The Scottish philosopher David Hume (1711–1776) had his doubts over whether you could ever make a valid inference from your experience. He wrote,

> It is impossible, therefore, that any arguments from experience can prove this resemblance of the past to the future, since all these arguments are founded on the supposition of that resemblance. Let the course of things be allowed hitherto ever so regular, that alone, without some new argument or inference, proves not that for the future it will continue so. . . . My practice, you say, refutes my doubts. But you mistake the purport of my question. As an agent, I am quite satisfied in the point; but as a philosopher who has some share of curiosity, I will not say skepticism, I want to learn the foundation of this inference.

He's asking us to supply a reason for thinking that the world is regular and knowable by discursive reasoning. In the final analysis, we can't prove that these inferences are valid; we have to take this principle as a given in order to do anything. As a matter of fact, that's just what we all do, and we need a jolly good reason for dropping it.

Hume's doubts don't provide that good reason, and here's why. Let me quote from my own book, *The God of Miracles:*

> Hume's doubts offer no compelling reason, and his own reference to himself as an agent is the key. He has started from the wrong end of the stick. He should have begun, not with "By what right do I assume the reliability of the world and of inductive inference?" but with, "What is it about us and about the world that explains why we are such successful agents?" [He] offers an impoverished epistemology, because he suggests that the only way we "know" is either through logical deduction or through experience; he makes no allowance for the possibility that as agents created by the God who made the world we are endowed with the capacities to function in that world, and even to understand it to some extent.

There are some things you don't have to prove: in fact, the Christian message explains them better than any other system of thought does.

Even though we have a right to draw inferences from our experience, we

still have to be careful. Some studies only allow us a modest level of confidence—and honesty demands that we admit it. Medical research is a good example of that. When I was a baby, doctors taught that mother's milk wasn't anywhere near as good as formula; when my children were born, though, they told us just the opposite. They were quite sure in both cases. Some researchers seem to be getting the message now: have you noticed how most new studies on the effects of different kinds of food close with "eat a balanced diet and get regular exercise"?

The approach to knowledge and science that I favor is often called "critical" or "qualified" realism—it is realism because it takes for granted that there is a real world for us to know, that we can know it, and that our scientific models can describe it accurately; and it is critical or qualified because we have to recognize the limitations of our studies and models. In a later chapter I will argue that this is the approach to knowledge that the Bible itself supports. In another later chapter, on the age of the universe, I will discuss whether critical realism is appropriate *both* for ordinary and for historical contexts.

Most working scientists embrace some kind of realism; for example, Michael Behe, a biochemist, writing in his *Darwin's Black Box,* meets head-on the idea of some that science is a game that can set its own rules (such as the methodological naturalism we already looked at):

> Most people, from ordinary taxpayers to prominent scientists, would more likely view science not as a game but as *a vigorous attempt to make true statements about the physical world.*

Or, as Machen—my hero in this chapter—put it,

> Science, in other words, though it may not in any generation attain truth, is at any rate aiming at truth.

OPERATING RELATIONSHIPS OF SCIENCE AND FAITH

Suppose Doctors Hatfield and McCoy work in a coroner's office, and they both have to give their opinion on how someone died. Imagine the following four conversations:

MCCOY (to the police captain): He's dead.

1 HATFIELD: He died from the bullet through his heart.
MCCOY: No, he died from strangling.

2 HATFIELD: He died because the bullet pierced his heart.
MCCOY: He died because his number was up.

3 HATFIELD: He died because the bullet pierced his heart.
MCCOY: He died because someone killed him.

4 HATFIELD: The bullet entered from the back.
MCCOY: No, the bullet entered from the front.
HATFIELD: Actually, the wound in front is the exit wound.
MCCOY: Oh, you're right.

These conversations illustrate the four possible relationships between two statements. In conversation 1 we are looking at a *conflict*—there are two competing claims about the same thing, and at least one of them is wrong. He died from the bullet or from strangling or from neither, but not from both. In conversation 2 we have an example of *compartmentalization*—the statements have two different scopes, and do not interact at all. There is no conflict, but McCoy isn't really doing what coroners are supposed to do. In conversation 3 we have *complementarity*—the two statements are about separate parts of the same thing, and fill out the total picture. McCoy and Hatfield might both be right, and they are both doing the coroner's work (it wasn't suicide). And conversation 4 gives us an instance of *coordination*—the two statements are about the same thing (or at least they have some overlap), and apparent conflict triggers a revision in interpretation that yields a harmony. They both saw the same things, and agreed on what they saw (wounds in front and back); but McCoy corrected his interpretation of what he saw and agreed with Hatfield.

When we come to consider which of these categories might describe statements from science and statements from Christian faith, we have to think first about whether it is possible for these statements to come into any contact at all. By that I mean, we can acknowledge that scientists try to say something true about the world we all experience. Newton's laws of motion are intended to describe the way the balls on my pool table move. But does Christian faith speak about this same world? Many people think not: they say, science is about *what* and *how,* religion is about *why;* or, science is about *facts,* religion is about *values*. By such a reckoning it is impossible for science and religion ever to conflict so long as they keep to their proper spheres; so the relationship is one of *compartmentalization*. Stephen Jay Gould calls this arrangement "non-overlapping magisteria" (NOMA).

The trouble with this view, however, is that neither those who practice science nor those who hold to Christian faith can rest content with such an arrangement. Biblical faith rests on a number of historical assertions—the universe really had a beginning (creation); Adam really did sin and bring us all with him (fall); Abram really did answer God's call, and receive promises from God (covenant); the people of Israel really did pass through the Red Sea while the Egyptians drowned; and Jesus rose from the dead (redemption). When Paul defended himself before the crowd in Jerusalem, he said that "the high priest and all the Council of the elders can testify" about his former way of life (Acts 22:5, NASB); and before King Agrippa he declared that "the king knows about these matters [the words of the Prophets and the resurrection of Jesus] . . . for this has not been done in a corner" (Acts 26:26, NASB). These things are open to investigation (historical science), even for those who are hostile. Paul also claims that the world speaks to everyone of its Creator (Rom. 1:19-20). It is at least possible that this means that a soundly scientific study of the world should support Paul's claim (we will come back to this in a later chapter). When anyone tells religion that it may not speak to matters of fact, he is making a pronouncement about the content of religion: in other words, to follow the NOMA rule means to violate the rule. And further, as usual, the question is not whether "science" can interact with these claims, but which particular science we are speaking of.

So we have to take each statement on its own. Once when my son was about three I saw a scab on his leg and asked him, "How did you get that?" He told me, "God put it there." Now if I had wanted him to affirm his belief in God's providence, I couldn't have asked for better than this. But instead I was asking for the particular chain of events that led to the wound—he fell, or was swinging a chain saw, or whatever. Now since I could say, "God put it there by designing the human skin with the properties of softness and self-healing, and by so arranging events that my son scraped his leg, and the wound began to heal," then I can say that the answer my son gave and the one I was looking for are *complementary.* They fill out the total picture.

We considered in chapter 2 the possibility that "the earth is not the physical center of the universe" conflicts with "the earth is the center of God's attention." But these statements cannot conflict—they can't even come into contact—because their scopes are so different. That is, they come from separate *compartments* of a description of reality.

From time to time people have proposed the theory called *polygenesis*—

the idea that the different types of human beings came about separately (*poly* for several, *genesis* for origin), either by separate creation or by separate evolution. This is in direct *conflict* with the most common interpretation of the biblical Adam. Some have tried therefore to reinterpret the biblical role of Adam; I think they've been unsuccessful, but we'll come back to that in our chapter on human nature. So in that case, I can either reject the biblical picture or reject the scientific theory. I will give reasons later for sticking with the common interpretation of Adam (and hence for opposing the theory of polygenesis).

On the other hand, we consider it legitimate to *coordinate* the dates of events in the Bible with the dates we gather from our studies of ancient Egypt and Mesopotamia. In the film *The Prince of Egypt* the Pharaoh is called Rameses, and, because many believing Egyptologists think that what they know about Rameses II best matches the biblical account, that's a real possibility. Again, if you read what the Old Testament books of 1 and 2 Kings say about the lengths of the reigns of different kings, you get an impression of timing that you can't harmonize with what we find in the other inscriptions from the ancient Near East. Now you could just decide that those pagans got their dates wrong; but it's better to do what most Old Testament scholars do, and learn from the dating practices of the ancient world. It turns out that there was a practice called "co-regency," where a son was co-regent (sort of a joint king) with his father as on-the-job training. Then we realize that some accounts in the Bible may use the beginning of the co-regency for the date of a king's reign, while others may use the date of the father's death. Using this we get a nice harmonization between the Bible and archaeology (a science that studies the remains of ancient civilizations).

In order to decide what the relationship is between a biblical statement and one from the sciences, we have to ask whether they are about the same thing, that is, whether they share the same scope. We will also have to decide whether they are using their words in the same way. We also need to know just what kind of communication is going on, and how it meets the needs of the first readers. There's a big difference between ordinary language and the kind of language we might use in the sciences.

Some sciences—say, chemistry—will mostly be *complementary* to the interests of our faith. This is because chemistry is primarily about the normal operations of the things it studies, and our faith is mostly based on claims about what it means to be human, and what works God has done for us in history. When the relationship is one of complementarity, that doesn't mean that the biblical view of the world is irrelevant—since, as we'll see, that view

provides a set of premises that encourage scientific study, namely that the world is good, stable, and knowable, and that God made us to know the world.

Other sciences will overlap with the content of our faith: for example, when they deal with the origin of the universe (cosmology), or with the origin of man (anthropology), or with human nature (psychology). The closer we get to what it means to be human, the more opportunities we have for overlap; and, as it turns out, the more one's personal commitments come into play in scientific theories.

The sciences can play a role in our ethics. For example, the Ten Commandments tell us not to murder (Ex. 20:13). But what is a human life? Specifically, is the thing that develops in the womb a "human"—and when does it become one? There is some biblical material that helps us (say, Ex. 21:22-23; Ps. 139:13-16); however, while such passages take us into the womb, they don't decisively settle the kinds of questions we face today (say, the difference between fertilization and implantation; or, is the first brain wave important?). But fetology, the study of how the human embryo develops, does help. It shows that there is no point along the way at which the embryo "becomes human," which means that it's a human life from the get-go. Such studies helped in the process of a leading abortion advocate, Bernard Nathanson (raised as a secular Jew), becoming first pro-life and then a Christian.

CONCLUSION

Let's bring this to a conclusion. Science and faith each have a relationship to knowledge; and this means that there is the potential for them to overlap in what they speak about. In particular, if science is *defined* as "giving a naturalistic explanation for every thing and every event," then conflict is inevitable. But there is no reason that justifies defining science that way: neither from the history of science, nor from the rules of reason.

The discussion of this chapter allows us to evaluate the views of any writer or speaker who addresses how science will bear on our faith. We can ask five diagnostic questions:

1. What is his definition of "science"?
2. What is his definition of "faith"?
3. What does he think is the relationship of science or faith to knowledge?

4. What does he think is the operating relationship between science and faith?
5. What is his model of God's relationship to the world?

In most cases you'll have to tease the answers to these questions out of what he says; few authors will give you these up front.