beginnings

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preface

In his book *Rocks of Ages: Science and Religion in the Fullness of Life,*[1] Stephen J. Gould wrote favorably about a commonly held principle. The principle is that science and religion are separate realms that don't conflict because they don't overlap. In Gould's view, the field of science deals with what the universe is made of and why it works the way it does. Religion, on the other hand, focuses on questions of ultimate meaning and moral value.

Gould wrote that these two fields are separate "domains," each with its own appropriate tools of study. He posed this concept as a solution to what he called the "false conflict between science and religion."[2] Implicit in his approach, which many others also follow, is the conviction that if science and Scripture conflict, we must alter our understanding of Scripture, because the natural world doesn't lie.

In recent centuries, scientific interpretations have contradicted biblical interpretations, and in some of these conflicts, the scientific side has prevailed. Some people have concluded that this outcome has demonstrated the validity of Gould's approach. In this book, I will examine the suspicion that this trend has gone too far and that people have, without sufficient reflection, limited religion—Scripture—to *only* the realm of "ultimate meaning and moral value." I propose that we establish the most constructive relationship between science and religion when we allow findings in each of these fields of knowledge to challenge us to analyze the other more carefully. I believe that this feedback process can improve our understanding of both fields. Conflicts between the two force us to dig deeper in both as we seek for genuine resolution that does not relegate either to a secondary role.

In other words, I believe science and religion are complementary and not exclusive of each other. This doesn't mean that we can easily resolve conflicts between the two. Neither scientific results nor the words of

Scripture tell lies. However, sometimes we read something between the lines that isn't really there. And, as you'll see in this book, in our study we encounter some questions that we have to place on a shelf until better data or better research methods can resolve the conflict.

This approach is built on the belief that Scripture speaks not only to meaning and morals but also to origins and the history of life on earth. We may misunderstand what Scripture says regarding these issues. In fact, I believe we can demonstrate that such misunderstandings have occurred. But the fact that a task is difficult and we make mistakes along the way doesn't mean that we should abandon the task. Ask any great explorer about that.

In the following pages, I explore the interactions between science and religion in a wide range of topics involving geological history and biological origins and history. I won't answer all the important questions, because we don't have adequate answers for some of them. In each topic, though, I candidly outline the strengths and weaknesses of various views and make suggestions for further research. My goal is not to present new scientific data but to illustrate a method of understanding science from a Christian perspective and then to apply that method to actual case studies in the integration of science and Scripture. In my approach, I retain the scientific method of observation and experimentation, but I also allow study of Scripture to open my eyes to things that I might otherwise overlook and to suggest new hypotheses to test. This approach is not just a theory; some of us have been using it for years with success.

I don't adhere to the naturalistic assumption that the cosmos has never known supernatural intervention. I certainly don't wish to invoke supernatural causes when none are needed, but the other extreme also inhibits objectivity. To search for truth wherever the facts lead is a more worthy goal, and I believe we can do this without the complications that improper approaches to the integration of science and religion sometimes introduce.

I assume the readers of this book have a basic knowledge of biology, but I don't assume any knowledge of geology. I explain geological concepts sufficiently so that readers who haven't studied geology can understand the principles presented.

In this book, I make a number of references to literature written by authors who don't support the interventionist interpretation. I cite this literature only for specific data or concepts; I believe my reinterpretation of these data and concepts accords with the evidence.

This book has benefited from numerous suggestions made by James Gibson and several anonymous reviewers and from input I received regarding a previous book of mine: *Faith, Reason, and Earth History.*[3] Conversations with students and colleagues through the years have also contributed a great deal to correcting problems in my thinking. However, the informal nature of these conversations makes it impossible for me to give credit to these individuals for their contributions. Any problems that remain are entirely my responsibility.

figure credits

The following figures are all from *Faith, Reason and Earth History,* 1997, by Leonard Brand. Used by permission of Andrews University Press.

Figure 6.2, 6.3, 7.2, 7.3, 7.5, 7.6, 7.10, 9.15, 10.4, 10.5, 10.7, 10.8, 10.9, 11.1

Figures are by the author except for the following:

By Carole Stanton - Fig. 10.5; by Robert Knabenbauer - Fig. 5.2, 5.4, 6.2, 7.2, 7.3, 7.5, 7.6, 7.10, 10.7, 10.8, 10.9

chapter 01

science: its power and its limits

I was on a research trip, studying the fossilized tracks that small animals—reptiles or amphibians—had left in the Coconino Sandstone of northern Arizona. Tim, a student who was working on a graduate degree in biology, had accompanied me. He knew nothing about geology or fossil trackways; he'd come with me because he wanted to do something productive during his spring break. (See fig. 1.1.)

I parked our truck and walked across a flat face of rock to the sloping layers of sandstone where I knew I'd find the tracks. While I began to study the abundant trackways there, I noticed that Tim was examining the flat area I'd crossed. I was just about to tell him that looking there was a waste of time when he called me over to look at all the tracks he'd found.

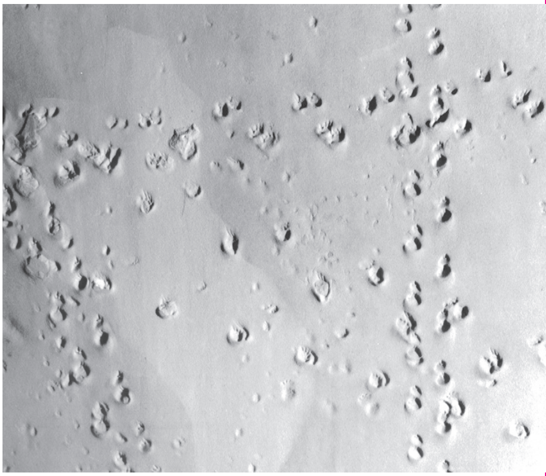

Figure 1.1. Fossil vertebrate tracks in the cross-bedded Coconino Sandstone of northern Arizona. Notice that in all cases the toes are pointing toward the top of the photo but that some trackways show progress toward the top of the photo, while other trackways show progress across the photo. These latter trackways indicate that the animals were moving sideways.

I was the expert, and I had walked across that flat rock face several times, so why hadn't I seen the tracks there?

The answer is clear: I'd walked right over those tracks because I "knew" there weren't any there. I "knew" the tracks would be on the sloping layers, not on that flat area. But Tim's mind was open to all possibilities.

Of course, I had a role in this discovery too. Without me, Tim wouldn't have known why the trackways were worthy of study, and he wouldn't have been there. Trained researchers know what is worth looking for and (generally!) where to find it. However, the expertise of trained researchers comes at a price. That price is a narrowed vision that may be less likely to see something truly new and unexpected. That's why it's often helpful for people with differing experience and opinions to work together. Each is apt to discover some things that the other will miss—as long as both are willing to learn from the evidence and from each other.

Similarly, science and Scripture, working together, can broaden our perspective as we seek to understand the subject of this book: our world and, particularly, its physical history. The Bible doesn't answer all our questions, but it does give us an important perspective on what to look for and how to think about earth history. If we take both science and Scripture seriously, they can each challenge us to think more carefully.

Biological history: attitudes and evidence

The words *evolution* and *creation* rouse strong emotions in many people. Often, bitter controversy surrounds these terms. The issues involved are emotionally charged because the belief systems of those on each side differ deeply. They're emotionally charged because of the battles people have fought over what public schools should teach about earth history. And they're emotionally charged because people on each side of the issues have misunderstood what those on the other side actually believe and what kind of people they are.

Evolution is a broad term. It can refer to small biological changes that we can observe—for instance, the changes in insects over several generations that make them resistant to pesticides. But it also refers to the presumed development of worms, frogs, and monkeys from a common ancestor sometime in the ancient past. Parts of the theory—such as the observed changes in insects—are compatible with a creationist view. Parts are not.

In this book, rather than using the term *creationism,* I'll usually use the terms *interventionism* or *informed interventionism.* These terms refer to the belief that there has been intelligent intervention in earth history. Interventionist views about earth history vary; I will be discussing a version of interventionism based on my belief that the story of origins in the biblical book of Genesis is true.

I prefer the term *interventionism* to *creationism* for two reasons. First, creation is a process that generates something: an earth, animals, and so forth. But we need a term that covers not only the original creation of life forms and their habitat but also the subsequent biological changes and geological history after Creation. *Interventionism* includes all that.*

Second, *creationism* is an emotionally charged word. A wide variety of people portray themselves as creationists, and the faulty methods and conclusions of some of them have tainted the name. Additionally, some of these people project a condescending attitude—or worse—toward those with whom they disagree. Some of them picture evolution as an illogical theory that only foolish people would believe. But is it reasonable to think that all the scientists who are evolutionists are so unintelligent as to believe a weak, unsupported theory? Actually, those who understand the theory of evolution can present strong evidence in its favor. And this theory has been very successful in stimulating and guiding scientific research for over a century. So, while we can also make a strong case for creation, it's a mistake to think that we can easily brush evolution aside.

Nevertheless, it's always legitimate to ask hard questions: Are all parts of the theory of evolution equally well supported? What alternate interpretations of the data are feasible? Is the logic as strong as it appears to be? We'll examine the strong points and also the weak points of both explanations of earth history and consider what research would help us to answer our questions.

The scientific process

In part, science consists of knowledge: the things that scientists have learned and the system of organizing that knowledge. But even more important to science is the process of discovering new things through repeated experimentation and observation. Understanding the scientific process of discovery—the scientific method—will help us examine the theories of origins.

Basically, the scientific method is a simple, two-step process: (1) collect data, and (2) interpret data. In using this process, scientists formulate hypotheses, conduct experiments to test these hypotheses, and then interpret the results of the experiments. The step of interpretation—

developing ideas and applying them to make sense of the data—is the most rewarding and creative aspect of research.

Science is quite freewheeling; there is no standard method for doing the research. Different people operate in different ways within the basic framework of cycling repeatedly through the collection and interpretation of data in the process of discovery.

Here's an example of how a researcher uses the scientific method: In my study of those fossil trackways that I mentioned earlier, I first observed and photographed many examples *(data collection).* Then I pondered what I'd found, attempting to understand how the animals were walking and what sand conditions would produce tracks like those that I'd observed *(interpretation).* Some tracks were easy to explain because they were just like animal tracks we see today. Others were puzzling—they seemed to represent an animal moving sideways. Most geologists interpret the sandstone in which I found the tracks to be fossilized desert sand dunes. I couldn't think of a way (and still can't) that such skewed tracks could be made by an animal on a dry desert sand dune.

I began to wonder what kind of tracks an animal would leave if it were walking up the slope of a dune *underwater* and a current were pushing it sideways *(more interpretation).* So I did experiments to test this hypothesis. I got a Plexiglas® chamber through which I could flow a current of water. Then I laid a bed of sand in it, placed salamanders on the sand, and observed them trying to walk forward while crossways to the current. Sure enough, the salamanders often drifted sideways as they progressed *(data).* These results don't prove the fossil tracks were made this way, but the drifting-animal hypothesis explains the fossil data better than any other hypothesis that has been proposed *(interpretation).*

Experiments and the resulting data often answer only part of the question under study, and they often raise additional questions. When that happens, scientists formulate research plans for further data collection and hypothesis testing. Scientists continue to make progress as long as their research generates a stream of questions that helps them decide what experiments to do next.

When scientists have analyzed their data, they publish their conclusions. Then other scientists examine the data and conclusions critically and publish their own conclusions on the topic, sometimes disagreeing with the original investigators. This critical discussion between scientists brings a degree of objectivity to the process, helping to reveal truth.

The role of science

Science is a very productive activity—a powerful way of improving our world and of approaching truth. It works best in studying objects and processes that we can observe and quantify—things that we can see happening and things that we can measure, count, and/or weigh. Some truths may not be suitable subjects for scientific study because we can't test them. Understanding the limits of the scientific method can help us decide which questions we can expect it to answer reliably.

Beauty, music, poetry—how could we study these scientifically? We can study how sound waves affect the receptors in our ears, but science can't reveal to us the real essence of music and of our reaction to it. Nor have people done very well at using scientific knowledge to discover the moral values that bring happiness. Perhaps our studies of different behaviors are too limited to reveal their long-term consequences. I think this is why God told us the basic moral principles we need to know.

Religion also makes claims that science can't test. This doesn't mean that these claims are false—it's just that they're outside the realm where science works. For instance, the Bible says that Jesus healed people and that He instantaneously changed water into wine. No set of scientific observations can test the accuracy of these claims. Nor can science take us into the past to determine what happened then. We try our best to understand the evidence that ancient animals and geological processes left behind, but that's not the same as being there to observe the processes firsthand. An honest approach to the philosophy of science will need to admit these limitations.

And finally, the scientific method will never bring us to the point where we can say, "We've discovered the truth, and it will not change." Science doesn't give us absolutes. Scientists are ever searching for better, more complete explanations of nature. It's always possible that the discovery of new data will displace some currently favored theory. We can't study every rock, fossil, or animal—or even a large percentage of them. We can't go back to see what happened in the ancient past. We study a very small sample of the world around us in a brief moment of time, and then we do our best to explain what we see.

Our scientific knowledge, then, is always merely a progress report along the road to understanding. One philosopher put it this way: "The old scientific ideal of episteme—of absolutely certain, demonstrable knowledge—has proved to be an idol. The demand for scientific objectivity makes it inevitable that every scientific statement must remain *tentative forever.*"[1] If an idea is not tentative, it has become dogma, and dogma is not science because it can't be questioned.

So, scientific theories have a lifespan. They may look good for a while, but they must change as new data and new interpretations reveal errors in them. We need to be ready to move on as science progresses.

We can't expect to put all science in a box and then either believe everything or doubt everything. We have to make the effort to do some thinking and evaluating, some critical analysis of what we read. We have to make some thoughtful personal choices regarding the roles of science and religion in our lives and belief systems.

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*Some of us also believe that God continually upholds the universe and His laws of nature, and that He does so in a constant, predictable way. This book won't discuss this belief.