

Introduction

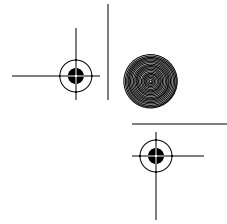
Richard F. Carlson

For many serious Christians the so-called creation controversy, sometimes referred to as the evolution versus creation issue, shows no signs of being resolved or disappearing. At least part of the reason for this state of affairs is that the issues are subtle and involve a number of specialized disciplines such as natural science (physics, biology, geology and cosmology), systematic theology, biblical studies and philosophy (including philosophy of science). Very few people have had experience or have a background in all of these areas. But for a person to understand creation-evolution issues, it is necessary (or at least very helpful) for that person to have some acquaintance or experience in each of these areas.

In addition, the peculiarities of the historical sequence of development in the natural sciences (in particular, in earth science and biology) and in modern philosophy have played a role in setting the stage for possible conflicts with Christianity. Even the particular individuals who chose to become involved in the issues, especially in response to Darwinism, have played a crucial role in the determination of the current “state of the game” in the United States in particular.

Let me make one thing clear from the beginning. I am convinced that there is no *single distinctly Christian viewpoint* on matters of the relationship of natural science and Christian faith. There are, however, *distinct viewpoints held by Christians*, and these distinct viewpoints are found in particular Christian subcultures, subtraditions and groups, but these groupings cut across all sorts of Christian boundaries. One thing shared in common by



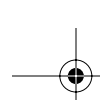


Christians concerned with these matters is that all viewpoints try to answer the same question: *How is Christian faith related to developments in contemporary natural science, especially to biology, earth science and cosmology?* And how do I, as I try to be a faithful Christian believer, respond to the pronouncements of contemporary science? Is science a help or a hindrance to belief? Or is science related at all to belief?

Another question I have pondered is the following: is it possible to identify a single key issue in the creation-evolution debate? I think the answer to that question may be yes, and if the answer is yes, then a strong case can be made that the key issue is this: *How does a faithful Christian read the Bible?* If this is not the single key issue, then I believe that it is among a small handful of key issues. I have discussed this with a number of Christians who hold a wide variety of viewpoints on this and related matters, yet there seems to be agreement on at least one fundamental point—nearly everyone I have discussed this with holds a very high view of the Bible and wants to take the Bible seriously. But this positive attitude toward the Bible does not always result in agreement on creation-evolution issues. What appears to divide many Christians here is not their high view of the Bible *but how they read the Bible and then apply it to questions which arise in the science-faith arena.*

A fairly recent (May 1995) presentation on the Public Broadcasting System, “In the Beginning—The Creationist Controversy” examined the status of the creation-evolution issue in the United States. Three principal positions were presented—two Christian positions and a position associated principally with scientists who did not identify themselves as Christian believers. I would classify all three positions in one way or another as having a significant or at least some element of *conflict*.

What do I mean by this? None of the scientists on this particular presentation takes religion seriously; each scientist sees religion in conflict with science; and each scientist regards science rather than religion as the avenue to truth, with at least one of them regarding science as the *only* avenue to truth. I classify this position of scientific preeminence or scientific imperialism by the term *scientism* or *scientific materialism*, and I will immediately dismiss this position as a viable possibility for any Christian believer. This position will not be discussed in any detail in this book as my purpose here is to present only the principal positions that Christian



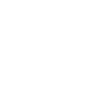
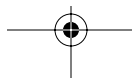
believers hold, especially in the United States.

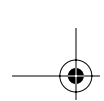
The two Christian positions in the PBS presentation are variations of what could be called *creationism*, which in a certain sense are also conflict positions. As in the case of scientific materialism, creationists see at least a certain amount of conflict between Christian belief and science, but in the case of creationism it is Christianity that is preeminent. However, advocates of these positions accept some scientific work and some scientific theories but find themselves rejecting other scientific conclusions. Creationism could be simply defined as a belief system that places principal or final authority in the Bible, many times (but not always) in terms of a literal reading of the Bible that is regarded as inerrant or infallible. In any conflict arising between scientific and theological conclusions, the science is taken to be defective or incomplete or inadequate or at least suspect, for the Bible is seen to be free from any error and is the final authority in all matters concerning faith. Over the years there have been a number of variations of creationism including differing views on the age of the universe (and earth), differing views on whether or not some evolution has occurred (although no creationist believes that humankind has descended from some earlier subhuman form) and differing views on the historical actuality of the flood associated with Noah.¹ The variety of creationism depicted on the PBS presentation is a six-day creation followed later by a literal flood of forty days involving Noah and a complete covering of the earth by water.

Currently, two forms of creationism are playing important roles in the United States. One form, the form represented in the PBS presentation, is usually referred to as *creationism*—young-earth, anti-Darwin and literal interpretation, inerrant Bible creationism (a thoroughly antiscience position), represented by such organizations as the Creation Research Society and the Institute for Creation Research.

A variation of creationism (or at least a distant cousin)—usually called *intelligent design*—was also presented on the PBS program. This is a relatively recent development by people such as Phillip Johnson, Michael Behe, William Dembski, Stephen Meyer and others. In this latter form of

¹For a fascinating account of the history of creationism in the United States, see Ronald Numbers, *The Creationists* (Berkeley: University of California Press, 1993).



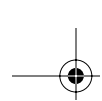


creationism, two areas of contemporary science are generally under attack—Darwinism and chemical evolution. Especially in the writings of Phillip Johnson contemporary Darwinism is dismissed as invalid science.² In the PBS presentation Johnson was the only representative of this position, and he concentrated his critical remarks on evolutionary science in particular but also mainstream science, which he classifies as being metaphysically naturalistic in general. But in the writings of others in this group the scientific idea of chemical evolution (the formation early in the history of the development of life on our earth of crucial molecules and assemblies of molecules necessary for the development of life) is strongly attacked both from the scientific side and also in terms of questioning the philosophical foundations of the entire scientific enterprise. This group advocates an alternative to current scientific theoretical accounts of certain data sometimes under the label of *intelligent design*, sometimes under the label of *qualified agreement*, advocating that the best way to explain the scientific data is to extend science beyond a purely naturalistic methodology and to posit a designer as the only satisfactory way to explain how, for instance, the first proteins were assembled, with the implication that the designer is a transcendent Being. In this book this position will be referred to as *qualified agreement*, for advocates of this position do accept much of contemporary science, including contemporary cosmology and physics, reserving their criticisms mainly toward contemporary Darwinism and theories of chemical evolution.

I believe that the PBS presentation was accurate as far as it went in identifying the three positions discussed so far—the three conflict positions. But I am convinced that this is not the entire story; I am convinced that there are additional possible ways to see the creation-evolution controversy and that *there exist additional possible positions for Christians to consider*, positions that some Christian believers do hold at the present time. In contrast with the three conflict positions, advocates of these additional positions, while also taking their Christianity very seriously, tend to be more accepting of the results of science; that is, they do not see contemporary science as the threat to Christian faith that supporters of the two creationism positions hold.

²For example, see Johnson's books such as *Darwin on Trial* (Downers Grove, Ill.: InterVarsity, 1993); and *Reason in the Balance* (Downers Grove, Ill.: InterVarsity, 1995).



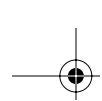


The first of these additional positions is *independence*, where even though both science and Christianity are valued in themselves, each enterprise is seen as parallel and hence not interacting. Here there is no common ground that science and Christian theology share, and hence there is no possibility for conflict. This has been a popular position in the past and remains a viable position for many Christian believers. For example, Langdon Gilkey argued from this position in the Arkansas textbook trial in 1982.

The position which I believe completes the spectrum of creation-evolution positions is a more complete form of integration than found in the intelligent design position. Here integration varies from what could be called hypothetical consonance to full integration in which Christianity and science work together as partners and must influence each other. Here again there is an appreciation for both Christianity and essentially all of the achievements of science. In this category people ask what each enterprise might contribute to a question, and the contribution from each enterprise is valued. Here people look for those places where there can be dialogue between the two enterprises. Hence, science is not seen as a threat to faith but something that can enhance faith. Also, Christian theology is seen as an enterprise that can inform science. Supporters of this position take developments in theology and science seriously in the sense that they do not hesitate to use both as tools in trying to understand our universe and our lives in general. And here people tend to accept contemporary scientific conclusions regarding the age of the universe (15 billion years or so), the slow development over time of what we now experience on earth, and the evolutionary development of life from very simple beginnings (a few chemicals). This is a position in which Christian theology and science work in *partnership* in theorizing about important and relevant matters.

I realize that the science-theology (or creation-evolution) pie can be cut in many ways. But I believe that my identification of the four positions just discussed does an adequate job of representing the main possible positions for contemporary Christians. That there are as many as four distinct positions may be a surprise to some, but I am convinced that each of the four positions is a distinct position, and there is a sizable community of serious Christian believers to be found in each camp. I am also aware that there has been vigorous (sometimes even nasty and heated) discussion between



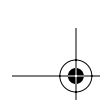


adherents of the various Christian positions. Whereas I fully agree that all Christians should reject (and know the reasons for this rejection) the anti-Christian position of scientism, I also am convinced that too much bad feeling has existed among Christian believers who find themselves opposed to other Christian believers from differing creation-evolution camps. And finally, but of crucial importance, I am also aware (as implied by the PBS presentation) that not all Christian believers are aware of all of the Christian viewpoints.

There is, I believe, a subtle danger—a danger that partially motivates this book. Most people recognize the fact of the extraordinary success modern Western science has enjoyed over the past three hundred years, a science that (interestingly) had its roots in medieval Christianity. What is a bit ironic is that too many people regard science as the only road to truth, concluding that religion (in particular, Christianity) has no relevance to our contemporary lives, and that our dependence on science has replaced our need for God. As Christians try to sort out the relationship of their religion to the culture in which they find themselves immersed, and in particular the relationship of their religion to the scientific culture, I am convinced that it is crucial that these believers become aware of the best thinking by Christian scholars who have devoted themselves to wrestling with the question of the relationship of contemporary natural science to their Christian faith. To that end I feel that it would be helpful for Christian believers to have before them a clear presentation of each of the four Christian options, presented by Christian thinkers, each of whom is an advocate of one of these positions. This is the purpose of this volume.

Each of the four types or viewpoints is represented in this book by articulate spokespersons. For the purposes of this book what I will refer to as the traditional creationism viewpoint is portrayed jointly by Drs. Wayne Frair and Gary Patterson. Dr. Frair has recently retired as chair of the biology department at The King's College (New York) and for several years (1986-1993) was president of the Creation Research Society, one of the principal advocates of creationism in the United States if not the entire world. Dr. Patterson is professor of chemical physics and polymer science at Carnegie Mellon University (Pittsburgh), and his honors include fellowship in the American Physical Society. Their position rests on an inerrant Bible as their primary source of knowledge and secondarily on what they term *effec-*

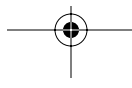


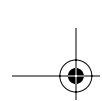


tive science. Whereas each coauthor has an appreciation for a number of aspects of contemporary science, they especially find some crucial aspects of neo-Darwinism and the idea of the origin of life on earth through chemical evolution to be scientifically suspect. Yes, there are areas of conflict between science and Christianity, but most of the crucial conflicts are resolved because they see the science in these cases to be defective. However, even though they regard the Bible as completely authoritative and inerrant, they do not advocate an entirely consistently literal reading of the Bible. While I do not want to unfairly criticize advocates of creationism, I note that relatively few active scientists are supporters of this position. As a result, as creationists Frair and Patterson are somewhat in a unique position, having earned Ph.D. degrees in science (biology—Frair) and (chemical physics—Patterson). Hence, as serious and well-regarded scientists they indeed have a true appreciation of contemporary science; they are, after all, professional practicing and teaching scientists. And as a result their judgments regarding contemporary science may well be taken a bit more seriously than those with less experience or training in science.

In chapter two Dr. Jean Pond, professor of biology at Whitworth College (Washington), fully accepts all aspects of Christianity and contemporary natural science, including evolutionary geology, biology and cosmology. But she sees science and Christian theology operating in two distinct and nonoverlapping arenas; she regards them as independent enterprises, and because of this *independence* there is no possible conflict between the two.

In chapter three Dr. Stephen Meyer, associate professor of philosophy at Whitworth College, advocates a position related to intelligent design as represented by Phillip Johnson on the PBS presentation. Here contemporary scientific data from cosmology and physics (data that are used to support the idea that our universe is exquisitely “fine-tuned” for the emergence of carbon-based life here on earth) are used to build a new philosophical argument for the existence of a transcendent intelligent designer. In addition, the lack of an adequate (or complete) scientific understanding of how primitive life initially arose on our earth is also used to build an independent argument for intelligent design. In my opinion this is a type of conflict position, for Meyer sees science as a metaphysically naturalistic enterprise and as an alternative to a Christian worldview. And yet he happily uses the “fine-tuning” scientific data and much of contempo-



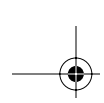


rary cosmology, physics and chemistry to support both his conclusions on design and their call for a new philosophical argument for the existence of God. Hence, except for his rejection of chemical evolution (and perhaps also neo-Darwinism), Meyer is in agreement with much of contemporary science. As a result I will label this position *qualified agreement*.

The final major presentation is found in chapter four by Dr. Howard Van Till, recently retired as professor of physics and astronomy at Calvin College (Michigan). As is the case with Jean Pond, Van Till values and accepts both Christian theology and contemporary science as valid enterprises, with these two enterprises as working together to formulate a more comprehensive picture of reality than either can do alone. He sees no threat to Christianity from science. In particular, Van Till sees the picture that modern biology has given us in terms of the development of life forms, including humans, as a depiction of how God endowed the universe with potentiality at creation. So Van Till sees science and theology as working together in *partnership* and not in any way in conflict with each other.

Each of the four positions—*creationism*, *independence*, *qualified agreement*, and *partnership*—that are presented in the following four chapters, are positions a significant number of serious Christian believers hold. Hence, my conclusion is that there is no one “Christian” position. Quite frankly, each position can be criticized in one way or another. Perhaps one of these positions, maybe with some modification, may eventually emerge as the consensus Christian position. But for now there is diversity, and it is my opinion that it is beneficial for Christians to be aware of all of the major positions before settling into one of them. And hence, the purpose of this book is to put these positions on the table, each of which is a preferred alternative to the atheistic materialistic position of scientism or metaphysical naturalism.





1 Creationism

An Inerrant Bible & Effective Science

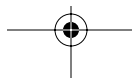
Wayne Frair & Gary D. Patterson

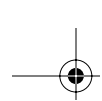


This chapter was written by two Christians who share a personal faith in Jesus Christ. We also share a lifelong commitment to science as an effective approach to searching for an understanding of the observable world and as a profitable way to “work with our hands” (1 Thess 4:11, 12). The senior author (Wayne Frair) was the head of the biology department at The King’s College (now emeritus). His collaborator is professor of chemical physics and polymer science at Carnegie Mellon University. He spent the early years of his career in the chemical physics department at AT&T Bell Laboratories.



We met at Camp-of-the-Woods in the Adirondack Mountains of New York, where Dr. Frair teaches a seminar on science and Christian faith. We discovered that we share a large number of presuppositions about the nature of science, scientific practice and the way scientific knowledge is obtained. These basic tenets are presented in parts one and two of this chapter. We also found that we share a common view on the authority of the Bible and its relevance to Christian faith and practice. The nature of theology and its approach to knowledge are the complementary section in parts one and two. We believe that scientists can be Christians and that Christians can contribute valuable insights to the practice of science. The relationship between science and Christian faith is discussed in part three. Wayne Frair was the president of the Creation Research Society from 1986





to 1993. He is a coauthor of the book *A Case for Creation* (1983). Gary Patterson has cotaught an academic course in the philosophy department at Carnegie Mellon University on Christianity and science, with support from the Templeton Foundation.

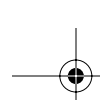
In part four the principles developed in parts one through three are applied to several issues of current interest. The “beginning” and the age of the universe are considered in section A. The subject of physics and the underlying levels of description used in the Bible and in science comprise section B. The subject of chemistry and the nature of the material world are explored in section C. The origin and biology of life are discussed in section D. And finally, the relationship of human history to the God of history is presented in section E.

The range of conclusions reached by scientists who subscribe to an inerrant view of the Bible is very large indeed. The conclusions presented by us here are within this set of positions, but we strongly reject any scholarly program that ignores the clearly established data and conclusions of science or that rejects the authority of the Bible. Within these parameters we are convinced that profitable discussion of presuppositions, the current status of the data, experimental procedures, methods of data analysis, interpretations of the data and the details of the conclusions can proceed. Both scientific and theological activities must be open to thorough examination and discussion. The present volume is evidence that a very wide range of conclusions is still possible! The common ground is a full commitment to the reality of the observable universe and to the saving grace of Jesus Christ.

Part 1: Aims of Natural Science and Christian Theology

A. What is science? Science is a human activity. One broad definition of science is the formal study of the observable world. Early scientific activity was concerned with those phenomena that could be observed directly by humans using the five senses of touch, taste, sight, smell and hearing. But many of the modern advances in science are associated with observations carried out with the aid of instruments such as telescopes and microscopes. One important concept associated with the process of observation is the protocol that allows any scientist to verify any reported observation. If other scientists cannot repeat the observations and obtain similar results,





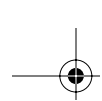
the phenomenon or data will be viewed with skepticism. Two recent examples of unverified phenomena are polywater and cold fusion.

The enterprise of scientific observation is guided by a conceptual framework that organizes previous observations and suggests profitable directions for further study. For example, the Egyptian astronomer Ptolemy (second century A.D.) adopted a frame of reference for the description of the heavens with the earth as the center, hence the name *geocentrism*. This approach did a very good job of accounting for the known observations of the night sky and was employed for hundreds of years. One of the most important improvements associated with the heliocentric (sun-centered) theory of the solar system was the ease with which more planetary bodies could be included in the model. The observational revolution inaugurated by the telescope required a more flexible theory to interpret new observations and to suggest new searches. The fruitful interplay between theory and observation continues unabated in astronomy. The current conceptual framework for astronomy is based on the idea that there is no special place in the universe. Stephen Hawking expresses this concept in the form: The universe has no boundaries, but it is finite in extent.¹

Science is motivated by the full range of human emotions and ambitions, and the history of science is replete with examples of human greed. Scientists rarely live up to the characterization of detached objectivity as suggested in school textbooks. However, the scientific enterprise has been extremely successful over time in extending the scope of its activity. One reason for this outcome is the self-correcting nature of science and engineering. Better observations and better conceptual frameworks tend to produce better outcomes. Another common motivation for scientific activity is personal prestige. Early scientists were employed in the courts of kings and princes. They were expected to accurately explain the world experienced by the kingdom and to make correct predictions. Failure was often punishable by banishment or death. The need to avoid error is often a strong motive to find the truth. Unfortunately, there also are all too many examples of cases where scientists were employed to provide supposed authority for particular worldviews derived apart from a firm observational base. Scientists today are not immune from the same kinds of pressure that are

¹Stephen Hawking, *Black Holes and Baby Universes* (New York: Bantam, 1993), chapter 9.

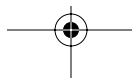


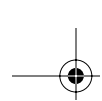


observed in the history of all societies. However, the faith of a typical scientist is that in the long run the establishment of a sound observational database and the creation of corresponding conceptual frameworks will allow humans to understand the world in which we live and will provide the knowledge needed to solve the ongoing material problems of human existence.

The history of science is not a record of monotonic steady progress. The ability to carry out new observations often awaits the introduction of new technology. The ability to interpret known observations often awaits the development of new conceptual frameworks. However, many episodes can be summarized in terms of an increasing concord between the known observations and the conceptual framework used to understand and organize those observations. Celestial mechanics could account for the observed trajectories of the objects in the solar system in terms of the concept of gravity and the mathematical formalism of Newtonian mechanics—or could it? The orbit of Mercury showed small deviations from the classical predictions. Could this observational discrepancy be explained as an experimental artifact? There are many such errors (or artifacts) littering the pages of scientific journals. Could a minor improvement in classical mechanics rectify the problem? The solution actually involved a scientific revolution. What is mass? What is space? What is time? What is gravity? The whole conceptual framework was recreated by Einstein in order to describe an experimental situation that was far removed from everyday experience. Today almost everyone knows the equation $E=mc^2$, but very few people understand Einstein's theory of relativity. The price of improved science is often a radical departure from the comfortable world of unaided human observations and intuitive common sense notions of physical reality.

Another common activity engaged in by scientists is speculative theory. The goal of such work is to explore and extend our understanding of physical reality. One early Greek model of matter proposed that all substances are composed of four elementary forms: earth, air, fire and water. However, no universally accepted protocol was established to measure the composition of an unknown substance in terms of the four elements. More modern efforts have been able to analyze most of the substances on earth in terms of their atomic composition and structure. Detailed protocols have been established to identify particular atoms. Speculative theory has estab-





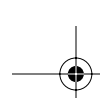
lished the range of atoms that could exist, and many atoms not found in the earth have been created by nuclear reactions. The creation of new substances is another important aspect of science. While some creative activity is serendipitous, the existence of good speculative theory directs creative efforts and helps to interpret apparently accidental discoveries.

B. What is theology? Theology is also a human activity. A broad definition of theology is: the study of God and his relationship to his created world. There are several key concepts that underlie this endeavor. First, “God is spirit” (Jn 4:24). Although a common challenge from atheists is to provide material evidence of God, the five senses are not sensitive to the Spirit. Second, “no one has ever seen God” (Jn 1:18). The search for God is not carried out with the same tools used in science. One essential tool for the study of God is faith. Third, “without faith it is impossible to please God, because anyone who comes to him must believe that he exists and that he rewards those who earnestly seek him” (Heb 11:6). God is not the conclusion to an argument but the premise on which all theology is based.

Information about God is received by revelation. “No one has ever seen God, but God the One and Only, who is at the Father’s side, has made him known” (Jn 1:18). The primary source of revelation for the Christian is the Bible. Everything we infer about the relationship of God to the created world is interpreted in terms of the biblical context. It is “by faith we understand that the universe was formed at God’s command” (Heb 11:3). Merely scanning the heavens does not lead to a direct observation of God. However, studying the stars has been found to be a profoundly satisfying activity for Christians who recognize that “the heavens declare the glory of God” (Ps 19:1). Christian astronomers have no reason to suppose that the universe has existed forever or that it will continue indefinitely. The Bible tells us that God is the Lord of history and that all created things, including the universe, have a history.

The initial act of God in creating the universe out of nothing is followed by the sustaining providence of God (Col 1:17). The ongoing activity of God is summarized in Jesus’ words “My Father is always at his work to this very day, and I, too, am working” (Jn 5:17). Any view of God that restricts his activity to one or a few miracles at the dawn of time is inconsistent with the biblical view of God’s incessant involvement with his created world. Rather than occasionally intruding on the universe, God is constantly at





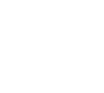
work, and the Bible helps us to recognize God's activity. The Bible explicitly identifies many specific acts of God in the history of the world. For "now we see but a poor reflection as in a mirror" (1 Cor 13:12), but the light of faith reveals God's presence in the history of the universe and humankind.

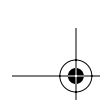
The Bible is God's Word to humans, but it is written in the form of human language. This means that it must be interpreted to be understood. The scholarly activity known as hermeneutics is highly valued by any Christian who seeks to understand the relationship of God to his creation. Interpretation of written documents is not a cut-and-dried procedure. Grant Osborne has described the process as an iterative protocol called the hermeneutical spiral.² After the philological and grammatical issues have been examined, and after the biblical and historical contexts have been established, proposed interpretations are subjected to comparisons with our knowledge base and revised accordingly. No text can be interpreted in isolation. The process of biblical interpretation must continue as long as the church is still on earth.

Theology is also motivated by the full range of human emotions and ambitions. While Christians should be guided by the principle of "speaking the truth in love" (Eph 4:15), the practice of theology has not produced the same level of consensus as is sometimes observed in science. One problem is the lack of agreement on the database. While for most Christians the historicity of Jesus Christ is beyond question, unfortunately even this central concept is rejected by some modern biblical scholars and theologians. One of the key problems is the impossibility of separating the presentation of Jesus Christ from the performance of miracles. If we cannot believe that God incarnate is constantly performing miracles, we will find it difficult to believe in miracles at all. If there are no miracles, the Bible is a fraud. If we reject the Bible as God's revelation to humanity, where will we look for our spiritual database?

The overall aim of science is to understand the observable world and to utilize this knowledge for the benefit of humankind. The overall aim of Christian theology is to understand the Bible and to use this knowledge to worship God, to enjoy his benefits, to serve his creation and to proclaim his

²Grant R. Osborne, *The Hermeneutical Spiral* (Downers Grove, Ill.: InterVarsity Press, 1991).



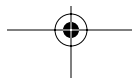


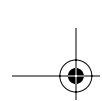
salvation to a lost and perishing world. Merely solving the material problems of existence will not benefit the people of this world in eternity. Only by leading them to Jesus will we fulfill the purpose presented in the Bible. This ultimate purpose must be remembered by all Christians as they carry out the scientific enterprise and by all Christian theologians as they interpret the Bible and analyze the present history of our world.

Part 2: Obtaining Knowledge in Science and Theology

A. Scientific epistemology. Scientific knowledge can be obtained in many ways, but it is most satisfying when the phenomenon under consideration can be explained in terms of other observable phenomena. One of the most powerful physical theories is thermodynamics. The essence of thermodynamics is the relationship between measurable macroscopic properties of physical systems. The fundamental quantities of thermodynamics such as temperature, pressure, heat and work are defined operationally in terms of one another. The macroscopic properties also can be explained in terms of more microscopic measurable properties using the theory of statistical mechanics. Then the quantities invoked are less familiar to us and are harder to imagine. One example is the potential energy of interaction between two atoms or molecules. This quantity can be explained in terms of even more microscopic quantities and the theory of quantum mechanics, at least in principle.

Every observation can be reported at many levels of description. The level chosen may vary with the goal of the exposition or with the intended audience. The description may vary with the chosen frame of reference. On human length and mass scales the notions of Cartesian space and separable time allow us to live our normal lives. But we cannot make sense of the whole universe from this perspective. On human length and mass scales the notions of classical mechanics imply that we can predict with certainty the past and future of a system that we know exactly in the present. These ideas fare poorly in the microscopic world of electrons and other elementary particles. We now know they fare poorly even in the terrestrial world of weather prediction. A scientist must choose the appropriate contextual framework in which to observe the world—the one that allows the results to be interpreted. Without a context, observations that fall outside the predictive ability of the current standard model will not be recognized.



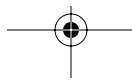


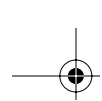
One goal of speculative theory is to be able to express concepts in mathematical form. The exceptional success of mathematical equations in the description of the created world has been noted by many scientists.³ But sometimes there are solutions of the mathematical equations that have no correspondence in physical reality. One goal of experimental science is to establish the limits of validity of mathematical theory. Creating the conditions in the laboratory that correspond with the assumptions of the theory is a challenge. One use of well-established theory is to help identify artifacts in reported measurements. The frequency of invalid experimental results is well-known to scientists but often not advertised. Theory and experiment are complementary activities in the healthy practice of science. Untested theory and uninterpreted observations are not profitable science.

One of the foundations of modern science is the ability to create in the laboratory the well-controlled conditions necessary to make reliable observations and to test theories. However, there are many phenomena that cannot be studied directly on earth. Observations of the extraterrestrial universe have become very useful in the study of high energy physics because phenomena in this realm have occurred or are occurring in this energy range. There is a general belief in science that the basic properties of matter are the same whenever and wherever they are studied. This belief suggests the possibility that observations made in the present will allow reliable information to be gained about the past and will allow predictions of the future. Any such efforts are subject to uncontrolled uncertainties, but humankind seems to have a great thirst for plausible explanations for phenomena that go beyond that which is directly observable. A plausible explanation invokes only processes that are known to operate and a history that has enough evidence to support it. Forensic science, as is used in crime laboratories, depends on these principles. The study of origins requires this kind of science. One example of this approach is the dating of objects based on their atomic and molecular composition. In order for this procedure to be valid, it is necessary to have historical data on the composition of known objects from each era. Since modern analytical techniques were not available at the time of manufacture for ancient objects, the more usual procedure is to carry out analyses in the present on objects that have been



³See Kitty Ferguson, *The Fire in the Equations* (Grand Rapids, Mich.: Eerdmans, 1994).





dated by other techniques and to develop an empirical database to be used to date objects of unknown provenance. While there is an inherent circularity associated with such procedures, many fields have progressed and obtained consistent results that are viewed as reliable.

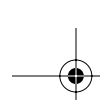
The issue of scientific epistemology is an area of intense current activity. Proper protocols and valid conceptual frameworks are usually developed and accepted by specific working communities of scientists. What is acceptable in one field may not be approved in another. It often is difficult for nonscientists to appreciate the intellectual heterogeneity of science. But most scientists believe that they can detect pseudoscience, at least in their own field. Any scientist who wishes to work in a particular area has an obligation to be in intellectual touch with the appropriate working community. Isolation is usually the worst enemy of science because it is assumed that valid science is the same at all times and in all places.

B. Christian epistemology. As noted above, Christian theology starts with the Bible. The text of the Bible is now accepted by the scholarly community with a high degree of consensus. The Masoretic text of the Old Testament and the current Nestle-Aland version of the New Testament provide a sound textual base for study and interpretation.

The practice of hermeneutics is also highly developed. The book by Osborne cited above is a good example. In order to interpret the text the full context must be determined. The literal words of Scripture have been the subject of exhaustive scholarly work, and the grammatical structure of the text has been established with a high degree of consensus. Newer approaches have examined the literary style with more tools; the Bible is not a flat text that reads like a textbook exposition. For example, some of the most profound poetry is found in the Bible. Because the issues are so foundational and deal with subjects that are beyond our normal experience, figurative language is used in many passages. An amazing variety of literary genre, or literary styles, is found in the Bible—from history to narrative, parable, proverb and prophecy. The biblical authors carefully chose a particular literary style to fit the purpose for which a given passage was intended in the life of the original readers. Hence, one cannot assume that every biblical passage uses language in a strictly referential (literal) way.

In spite of the potential misuse of this tool, establishing the cultural, social and historical context of a particular biblical text is essential for a





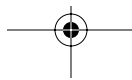
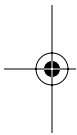
proper understanding. The words meant something to the people who first read them, and it is critical that we find out what that was. Words change meaning over time, and the entire context of a passage must be determined to understand the actual message to those for whom it was originally intended. Only then can we ask what the passage might mean to us today. Christians must use the best tools because they are servants of the Most High God. The use of defective hermeneutical protocols will not advance the cause of Christ.

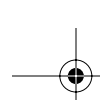
Although the Bible is the primary source of theological knowledge, other ways of obtaining spiritual insight have been suggested. One proposed source of spiritual knowledge is subjective personal experience. Early efforts in science were often characterized by subjective impressions, but greater progress occurred when more objective protocols were established and followed. The Bible is more than a collection of personal recollections; it was inspired by the Holy Spirit, who provides the ultimate conceptual framework! It was received by the people of God; a collective judgment was added to the claim of the authors that the words were from God, and it has stood the test of time as the principal reliable source of spiritual knowledge.

Another proposed source of spiritual knowledge is observation of the created world. This approach often is called natural theology. One of the most important insights in science is that there are no bare facts; all observations occur in some context. In the practice of theology observations of the created world must be carried out in a biblical context if a reliable interpretation is to be obtained. We derive our theology from the Bible, but if we have accurately formulated the principles of God's action in his created world, observations of that world can be interpreted in terms of our theology. God's ways are not our ways, and we cannot trust our own intuitive ideas about God to guide our observation of his world. Nor can we trust the popular prejudices or philosophical dogmas of our society. We can trust the Holy Spirit to guide our paths as we exercise faith in Jesus Christ and observe the world he has created. We are still capable of error in observation and interpretation, but we are not alone!

Part 3: Relation of Science and Christian Theology

The Bible is an essential part of the practice of science for a Christian. It





provides the context for the study of God's creation. A portion of Psalm 8 affords a good example:

When I consider your heavens,
the work of your fingers,
the moon and the stars,
which you have set in place,
what is man that you are mindful of him,
the son of man that you care for him?
You made him a little lower than the heavenly beings
and crowned him with glory and honor.
You made him ruler over the works of your hands;
you put everything under his feet. (Ps 8:3-6)

Only by understanding the proper place of humankind in the purposes of God can we correctly apply the consequences of science.

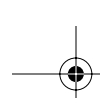
For example, the study of astronomy has produced a profound insecurity in many scientists because the vastness of space seems to leave no significant place for humankind.⁴ We are significant because God has declared humans to be so. By faith we can have peace in a universe that contains quasars and black holes! And we can rejoice in the study of the myriad of complex phenomena created by God. We worship the Creator, not the cosmos.

The study of geology has driven many scientists to question the significance of a species that they believe has existed for a trivial fraction of the age of the earth. The Bible tells us that the earth was formed for the express purpose of providing a home for humankind (Is 45:18). The significance of humankind is not based on our worthiness or on our longevity but on God's purposes revealed in the Bible. We worship the Creator, not Gaia (Mother Earth).

The study of biology also has left many scientists confused about the place of humankind in the animal kingdom. Without the clear revelation that we are unique because we are made in the image of God (Gen 1:27), science provides no context for acting as the responsible rulers of the animal kingdom. With the confidence inspired by the knowledge that we are

⁴Robert Jastrow, *God and the Astronomers* (New York: W. W. Norton, 1978).





stewards of God's creation, we are free to explore the wonderfully complex world that God has made. We worship our Creator, not his creatures (Rom 1:25).

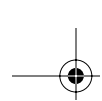
The purpose of theology is to systematize our understanding of the Bible and to bring us into proper communion with God. A consideration of those revelations in the Bible that relate to the physical world can deepen our understanding and devotion. However, we should not expect to find quantum mechanics in the Bible. One devotional approach to the text seeks to establish concord between the current standard models of physical reality and current interpretations of the biblical text. Several Israeli physicists (Orthodox Jews) have taken a leading role in this endeavor.⁵ Since both science and theology are human activities, and since there have been substantial changes in both the standard models of science and the interpretation of some biblical passages, no effort of this type can be considered final or even unique. But some contemporary research scientists have claimed that their faith was strengthened by such meditations.

Another level of analysis of the text seeks to discern general principles that can be understood in the human context. Humans live in a world where light is very important; light is a creation of God. Humans live in a world where both land and sea are very important; the current configuration of the earth is a creation of God. Humans live in a world where times and seasons are in a delicate balance; God is the architect of the current world order. Humans live in a world where plant life is essential for human life and well-being; God is the master gardener. Humans live in a world where other creatures constitute essential factors for our survival; God created the terrestrial zoo. Every aspect of human existence must be understood in relationship to God, and the Bible reveals those relationships.

There is much that occurs in our world that is beyond our direct notice. The Bible does not discuss the creation of bacteria; it does not present the kinetic theory of gases; and it does not introduce the wave theory of the electron. It does not tell us how God made Adam from the dust of the earth, but it does alert us to the fact that chemically humankind is made of the

⁵See Nathan Aviezer, *In the Beginning* (Hoboken, N.J.: KTAV, 1990); Gerald L. Schroeder, *Genesis and the Big Bang* (New York: Bantam, 1990), and *The Science of God* (New York: Free Press, 1997).



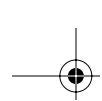


same stuff as the rest of God's creation. Modern biology tells us that humans share the same basic genetic material as other types of life. The Bible tells us that we are related by dominion to all life as God the creator's personal representative. Some scientists affirm that because of the long history of life, humankind is beyond freedom and dignity; yet, it was not science that compelled this conclusion. Materialistic presuppositions provided the impetus for these assertions. Without a source of knowledge of the place and significance of humans in the universe, unrestrained speculation inspired by the results of scientific investigation often produces arrogance or nihilism. Science will not be able to solve the problems of the human spirit or relationships. Only faith in Jesus Christ and trust in his Word, the Bible, will suffice for this need.

The understanding of the Bible has changed from the founding of the church in the first century to the present. For a number of centuries Christian theology was strongly influenced by Greek thought, and Christians during that period tried to make sense out of the Bible using familiar concepts. But Greek science and philosophy are not truly conformal with the Bible, and works by authors such as Origen (third century A.D.) make amusing reading today. Jesus addressed the fundamental issue metaphorically in terms of wine and wineskins (Mt 9:17); a person cannot put new wine in old wineskins. Christians during the Enlightenment also tried to force the Bible into their temporally determined modes of thought. And, of course, we do the same today! However, at any given time the best hermeneutics uses the best knowledge base and philosophical framework available. Skeptical analysis in the nineteenth century confidently denigrated the Bible as scientifically and historically inaccurate. However, by the late twentieth century archaeological and historical research have affirmed the biblical record much more than they have supported the challenges of biblical critics. Christians can only benefit from sound scholarship that produces a true understanding of science and history, since only when we have a valid knowledge base can we accurately interpret the Bible. We do God no favors by turning our faces from the light. The Bible cannot be interpreted properly apart from the valid tools of scholarly analysis. Evangelical believers must support the best analysis because we have pledged to obey the Bible; we actually care what it means!

The basic premise of our analysis is that the Bible is an inerrant revela-





tion from God. It is then vital for Christians to learn what the Bible means and to apply that knowledge to every aspect of human existence. We also assert that physical reality may be observed by humans and that a valid database can be compiled. It is then the responsibility of scientists to learn what the data mean and to apply that knowledge to solve the material problems of human existence. In the next section a number of topics of current interest will be considered within this framework. The current state of scientific knowledge will be briefly summarized and the theoretical framework used to understand this data will be discussed. The significance of these results for our understanding of the Bible will be assessed, and the relevance of the Bible for our application of the scientific conclusions will be presented.

Part 4: Topics of Current Interest

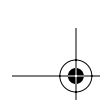
There are many issues wherein science and Christian theology have contributed to our considerations, and in this section we specifically address some of them. The current state of discussion in science is summarized for each topic and the interaction with Christian theology is presented from the perspective outlined above.

A. Cosmology and the Bible—The beginning and the age of the universe. The conceptual framework that includes a beginning for the physical universe has been strongly resisted by scientists ever since Aristotle. So it is not some philosophical presuppositions that have led to the popular belief in the big bang theory for the beginning of the universe. Even this particular model has had its opponents, among whom are those who have preferred to deny a beginning.⁶ A good summary of the basic ideas of this model can be found in *The First Three Minutes* by Steven Weinberg (1993) or in *A Brief History of Time* by Stephen Hawking (1988). Recent work on this topic has focused on the so-called inflationary process that is believed to have produced the remarkable but not perfect homogeneity in the temperature and mass distribution of the universe. Concepts of “the beginning” from various perspectives transcend the intuitive commonsense notions of most people,⁷

⁶Jastrow, *God and the Astronomers*.

⁷Stephen Hawking and Roger Penrose, *The Nature of Space and Time* (Princeton, N.J.: Princeton University Press, 1996).





but a beginning there was. Hawking confesses to deep distress on this subject,⁸ but his scientific insights could be a major advance in the description of the earliest moments.

The clear statement of the Bible is that “In the beginning God created the heavens and the earth” (Gen 1:1). This concept is amplified in Hebrews, “By faith we understand that the universe was formed at God’s command, so that what is seen was not made out of what was visible” (Heb 11:3). Of even greater note we find in Colossians that the scope of creation includes things “visible and invisible” (Col 1:16). Colossians also addresses the initial activity of the Son, Jesus Christ, in the creation of all things and the continuing activity of the Son in the maintenance of all things (Col 1:17). Global descriptions found in the Bible form the proper context for the overall scientific enterprise. Even though the theory of general relativity does not follow from reading the Bible, neither does it contradict it. A deep understanding of space-time strengthens our appreciation of God’s universe, which now is understood to be one whole without a boundary.⁹ This concept has been pictured or modeled by likening it to the surface of a balloon. The balloon expands, but the surface remains one surface without a boundary. We cannot visualize a three-dimensional world without a boundary, but Hawking assures us that this is the best description of the universe on a cosmic scale.¹⁰ Hallelujah!

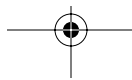
The finite size and limited age of the universe can be verified by anyone on a clear night: the sky is mostly black, whereas a very old universe of infinite size would be characterized by a bright sky at all times! Since the current scientific conception of the age of the universe is based on the observation that the universe is expanding,¹¹ at some finite time in the past the distance between objects would become small in this model. The scientific estimate for this time is approximately 15 billion years. There are substantial uncertainties regarding this date, but it is still well outside Bishop Ussher’s biblical estimate of a few thousand years for the age of the universe. Many Christians believe that the scientific estimate for the age of the universe may not be outside what could be understood on the basis of bib-

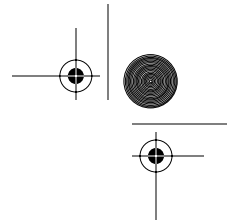
⁸Hawking, *Black Holes*, chapter 9.

⁹Hawking and Penrose, *Nature of Space and Time*.

¹⁰Hawking, *Black Holes*.

¹¹John North, *Astronomy and Cosmology* (New York: W. W. Norton, 1995).





lical comprehension. Because the observations of the stars and the interpretation of their spectra involve many assumptions, we should remain cautious about dogmatism regarding our conclusions.

The understanding of the age of the universe as virtually equivalent to the genealogical age of the first *adam* (human) is a popular Christian position, but it is not universally adopted by all Christians who believe in an inerrant Bible. The detailed exegesis of the early chapters of Genesis by Blocher is a good example of serious modern scholarly work.¹² There have been many attempts to achieve concordance between the current scientific consensus and current biblical interpretations of Genesis, and these views have changed over time. The hermeneutical spiral would suggest that we consider the findings and conclusions of astronomers before reaching our conclusions.

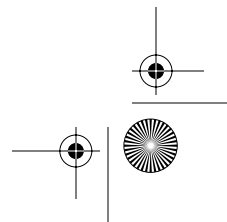
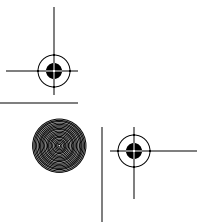
The whole issue of space-time and the perspective of the Bible will be addressed in the next section. However, some concordist attempts to deal with Genesis 1 and the age of the universe recently have been inclined toward appealing to general relativity.¹³ It is certain that Moses was not thinking of proper time or global frames of reference when he wrote Genesis, but the text of Genesis 1 was not determined by direct observation. Exactly how God revealed Genesis 1 is not known, but no person was an eyewitness of the events presented there. The more we discover, the clearer it is that Genesis is just as relevant today as it was when it was revealed to Moses. Modern astronomy has served to help clarify our appreciation of God's actions in creating the universe.

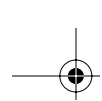
B. Physics and the Bible. The twentieth century indeed experienced a revolution in the description of the physical universe.¹⁴ The world looks pretty continuous to the unaided eye, but microscopes have revealed structure on smaller length scales. Powerful probes have revealed the atomic structure of matter on earth. More powerful probes have revealed the structure of the atom itself, and even more powerful probes have explored the structure of the nucleus of the atom. Even nuclear particles have been shown to have

¹²Henri Blocher, *In the Beginning* (Downers Grove, Ill.: InterVarsity Press, 1984).

¹³Gerald L. Schroeder, *The Science of God: The Convergence of Scientific and Biblical Wisdom* (New York: Broadway Books, 1998).

¹⁴Robert P. Crease and Charles C. Mann, *The Second Creation* (New York: Macmillan, 1986).





internal structure.¹⁵ Light looks continuous to us, but certain experiments have revealed that light particles (called photons) arrive one at a time. Light has no rest mass, but light particles with sufficient energy can create particles with rest mass. Whatever happened to Newton's simple clockwork picture of the universe?

The appropriate level of description of the physical universe is often determined by the phenomenon being examined. There is no point in adopting the frame of reference of the internal structure of the nucleus if macroscopic phenomena are being observed! One of the key elements of craft competence in physics is the ability to choose the most convenient perspective for each problem. While each level of description should not contradict any other, it is often the case that one level of description cannot simply be reduced to a lower level. Dogmatic reductionism is philosophical nonsense and bad science!

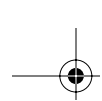
Not only has the microscopic world been discovered, but also the picture of the extraterrestrial world has changed radically in the last hundred years.¹⁶ Taken as a whole, the universe is remarkably uniform, with an ambient temperature everywhere in space close to 2.7K. But on a local scale enormous fluctuations occur. Very hot places exist, and there are believed to be strange regions like quasars and black holes. So in order to make sense of the large-scale structure of the universe, the theory of general relativity is necessary. At present there are many popular presentations of general relativity,¹⁷ but most people (including professional scientists) still find the detailed structure of the theory difficult to grasp. A few key concepts may help at least to reassure the reader that Einstein is comprehensible. Physicists now believe that the total energy of the universe is constant, and Einstein realized that mass is simply a measure of the local energy: $E=mc^2$. The presence of mass determines the nature of the local geometry of space. The concept that there is some absolute Cartesian frame of reference that determines all the geometry in the universe has been shown experimentally to be incorrect. It is very hard for humans on the earth to appreciate this fact, but understanding the Bible is much easier if there is no edge to the universe! All of space and all of time

¹⁵J. C. Polkinghorne, *The Particle Play* (Oxford: Freeman, 1979).

¹⁶North, *Astronomy and Cosmology*.

¹⁷Hans C. Ohanian and Remo Ruffini, *Gravitation and Spacetime* (New York: W. W. Norton, 1994).



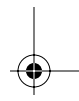
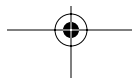


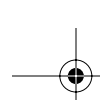
are contained *within* the universe created by God. There is no such thing as an independent space or independent time.

Einstein also realized that nothing in the universe can travel faster than the speed of light in a vacuum, c . The speed of light is measured to be the same by any observer in any frame of reference. One consequence of this fact is that there is no such thing as absolute time. The passing of time for any observer depends on the frame of reference. The existence of relativistic time also leads to new ideas about the simultaneity of events. Since information cannot be exchanged instantly but only at the speed of light, the relative ordering of events depends on where the observer is located and the relative velocity of the phenomenon being observed. Time appears to pass more slowly the faster our time-measuring devices go. This is called time dilation. It actually is observed in the world of elementary particle physics, where muons created in the upper atmosphere reach the surface of the earth because they are traveling fast enough to increase their apparent lifetime (the average time for them to decay to other particles). Some helpful books that continue the current discussion of the nature of time include *About Time* by Paul Davies (1995) and *Creation and Time* by Hugh Ross (1996).

The description of the world in terms of the classical mechanics of Isaac Newton dominated both the eighteenth and nineteenth centuries. A rigid determinism was often claimed to be a necessary implication of the mechanics of Newton, which in many cases was extended to all of thought. But the development of quantum mechanics shattered the uncomfortable world of Descartes and Laplace, where nothing was left to chance and God was excluded as a direct influence in the physical world. The empirical observations that led to the foundation of quantum mechanics leave no doubt that the energy spectra of matter are dominated by discrete rather than continuous energy states at the fundamental level. Physicists agree that the quantum description of matter (e.g., discrete states) is highly reliable; however, the philosophical implications of the theory of quantum mechanics are still being debated more than seventy years after the establishment of the quantum theory. When small distances and particles with small mass are involved, quantum effects are dominant, and paradoxical conclusions are all too common.¹⁸ While most people do not think in quantum terms on a daily basis,

¹⁸J. C. Polkinghorne, *The Quantum World* (London: Longman, 1984).





our bodies continue to carry out quantum processes that are the basis of life. All chemistry is quantum mechanical at its basic level.

Macroscopic (large scale) systems are now known that display chaotic behavior, where the future development of the system cannot reliably be predicted from the present state because small random changes that cannot be excluded lead to large and unpredictable changes in the system.¹⁹ Weather prediction is a well-known example. The exquisite sensitivity of the macroscopic world to the details of the environment and the inherent probabilistic character of the microscopic world have revolutionized our understanding of the physical world. The future is now much more open than some philosophers and scientists in the past claimed it would be. The development of quantum mechanics and chaotic dynamics helps us to appreciate much more fully the wonderful world that God has created.²⁰ Christians should welcome every new insight gained from physics!

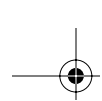
The Bible was written before the advent of modern or even medieval science, but the prevailing views and understanding of ancient Middle Eastern culture are reflected in the text. The scientific statements found in the Bible can be verified by any person who chooses to observe the world with the five senses in the geographical region described in the text. The sun is observed to rise in the east and to set in the west. The horizon forms a circle around the observer. The heavens are above and the earth is below. This very human frame of reference makes complete sense for all people because the phenomenological language is meaningful to men and women of the past, present and future. The notion that the stars are billions of miles away makes no sense to the unaided eye in the context of everyday life. Distances on the earth referred to in the Bible were measured relative to the range of typical experience of people of that day. The advent of sea travel extended the range quite a bit, but the whole world was still viewed on the scale of the ancient Middle East and the immediately surrounding countries. Jerusalem was seen to be the center of the universe, and all distances were reckoned relative to the temple!

Time in the Bible is reckoned relative to Adam. The history of the universe is not measured with a cosmic clock but with reference to the life

¹⁹James Gleick, *Chaos* (New York: Heinemann, 1988).

²⁰J. C. Polkinghorne, *Quarks, Chaos and Christianity* (New York: Crossroad, 1997).





span of humankind. No real history existed before God made humans “in his image.” Time for humankind is often regulated by events in the heavens: the day depends on the rising and setting of the sun, the month on the phases of the moon and the year on the celestial seasons. But where did the week come from? God created time as a gift to humankind and the sabbath as a special reminder of who created time. Attempts to modify the length of the week have not succeeded, and the seven-day cycle of life is one more evidence of the influence of God in our lives.

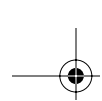
C. Chemistry and the Bible. Chemistry is the study of matter and its changes, and it all started when the elements were formed during the period of creation. The fabrication of atoms with higher atomic numbers from hydrogen and helium is a delicately balanced process. Even atheists marvel at the enormous number of quantities that must have extremely precise values to lead to nucleosynthesis.²¹ The current model identifies exploding stars as the celestial chemical factories for heavy atoms.

The existence of atoms is not sufficient to yield life because life requires molecules. Current research has identified many molecules in interstellar space and as constituents of meteorites, and interestingly there is an especially large amount of water associated with the Oort cloud beyond Pluto. Under the right conditions, including those in space, atoms combine to form molecules. Cosmochemistry has become a recognized field of research.

Large molecules (macromolecules) are required for life as we understand it, but the interstellar universe is not the right kind of place for the formation of large molecules. Although the earth’s magnetic field protects us from the high energy ions emitted by the sun, molecules in space are subject to the full force of the solar wind. A special environment is required for the formation and stabilization of macromolecules. High temperatures favor small molecules; so the earth needed to be at the appropriate temperature before life could be sustained. Life requires highly concentrated solutions of molecules, but at the present time no one has been able to demonstrate how this could have occurred spontaneously. The current popular notion that chemistry leads inevitably to life is based on nothing more than unsupported conjecture. Life requires molecules that are cata-

²¹David Arnett, *Supernovae and Nucleosynthesis* (Princeton, N.J.: Princeton, 1996).





lytic (which promote more rapid chemical reactions). Although it has been speculated that RNA molecules were the ubiquitous primeval catalysts,²² no actual mechanism has been identified by which RNA molecules could have been formed on the earth. Given the difficulty modern chemists have in reproducing the molecules of life, it requires remarkable faith to believe that they arose spontaneously under the hostile conditions that are believed to have existed on earth during the suggested time period!

The core of the earth is still partially molten. If the earth were actually more than four-billion-years old and if cooling occurred primarily by thermal radiation, then the earth should have fully solidified long ago. It currently is believed that the liquid condition is maintained by radioactivity within the core where there are energetic neutrons, electrons, alpha particles (helium nuclei) and gamma rays (photons) constantly being produced. The detailed physics that leads to radioactivity is now well-understood, and the basic phenomenology has been described in detail. The rate at which nuclear chemical reactions occur has been measured for virtually all the known elements.²³ Radioactive clocks have been used to help gain insight into the scale of the history of the earth, and geochemistry also has become an important field of science. While there are many factors that are not known with great precision, and there are many assumptions that are used in the reconstruction of the geological history of the earth, sound exegesis requires that the evidence of geology be considered in the interpretation of biblical texts. The stones do cry out, but what do they say?

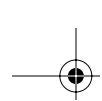
The Bible contains interesting information about certain technological uses of chemistry in ancient Middle Eastern cultures. The direct descendants of Cain were metalworkers (Gen 4:22). The practice of chemistry was well-developed in Egypt, and the children of Israel practiced the art of the apothecary (Ex 30:25). Appeal to theory is absent, as would be expected in a work written in the centuries before Christ, but the chemical details can be verified by anyone (Prov 25:20).

The process of winemaking was understood completely at a practical level. Thus the first miracle of Jesus was understood to be outside the nor-

²²Christian deDuve, *Vital Dust* (New York: BasicBooks, 1995).

²³Gerhart Friedlander et al., *Nuclear and Radiochemistry* (New York: Wiley-Interscience, 1981).





mal practice (Jn 2:9). No chemist of the first century could instantly make wine out of pure water, but the Creator of water and alcohol could accomplish this feat by divine command. We worship the maker of matter, not the matter itself. Pure materialism is the basest of beliefs.

D. Biology and the Bible. Modern biologists have discovered remarkable things about the world of living creatures (*nephesh chai*). The basis of all life is the cell. While it is simple to conceive how a molecule of water could be formed in the outer reaches of a star, it is much more difficult to imagine how a cell could be formed by spontaneous processes. The popular notion that cells just arose at a certain stage in the earth's history is based on a number of highly speculative scenarios, none of which have been supported by experimental evidence. In the following we will consider the factors necessary to form a cell.

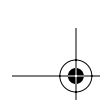
A cell is defined by a mechanically and chemically stable boundary called a cell membrane. It is a simple matter to assemble homogeneous vesicles if water and phospholipids are shaken together in a test tube. But the membrane of an actual cell does much more than just define the boundary. The cell membrane actively transports ions and molecules from the inside to the outside and from the outside to the inside. Without the active transport of the cell membrane, the object would not be alive. The chemical concentrations inside the cell are very different from the composition of the surrounding solution. Merely establishing an equilibrium between the primeval soup and the inside of the cell will not produce life.

Active transport requires a source of energy. In fact all the active processes of life require a source of energy. The proposed process by which the first cells obtained and utilized energy is completely unknown. Plants today can capture the energy of light in a process called photosynthesis. Current scientific models of the earth during the time when the first cells are believed to have appeared are characterized by a very low solar energy flux and a largely translucent atmosphere.²⁴ What source of energy is available under these conditions? It has been proposed that the chemistry of sulfur and iron could have provided the necessary energy.²⁵ But in order to utilize this energy, sophisticated systems of enzymes are required. The

²⁴Preston Cloud, *Oasis in Space* (New York: W. W. Norton, 1988).

²⁵deDuve, *Vital Dust*.





large number of extremely rare and highly concentrated compounds necessary to initiate metabolism spontaneously transcends normal levels of credulity. Honesty requires substantial humility on the part of any spontaneous model for the origin of metabolism.

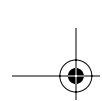
A cell needs to be sensitive to its environment. This sensitivity must reside in the cell membrane since it is the surface that is in contact with the outside world. Food must be transported from the outside to the inside and waste products must be transported from the inside to the outside. Ions must be specifically identified and transported in the correct direction. The enormous amount of detection and control information necessary for the life of the simplest single celled organism strongly suggests that it did not arise by purely random processes.

A living cell is not just a solution contained in a membrane boundary. The interior architecture of the simplest living cell is a marvel of complexity. The surface area of the interior membranes of the cell is very much larger than the surface area of the exterior cell membrane. There are many interior organelles with specific functions and even with their own DNA. A common analogy that fully applies to the present subject is that it would be just as likely for a tornado ripping through a junkyard to produce a fully functioning 747 jet as it would be for random processes to produce all the interior structures of a cell!

Many cells are capable of active motility. Some cells move by a type of swimming motion involving flagella or cilia. Other cells move by deforming their shape in nonrandom ways. The chemistry and biology of actin (the active protein involved in cell motility) is truly a wonder. Actin filaments can be assembled and degraded with remarkable speed inside a cell. While random processes do yield many types of self-assembly, specific self-assembly to produce motion in the direction determined by the cell membrane is far too complicated a process to be random. There are many interlocking processes that are necessary to achieve the desired movement: energy transport, raw material synthesis, raw material transport, enzyme synthesis, enzyme transport, and so on. A truly random process would slow down and stop as the system approached equilibrium. What random process keeps the cell on task as it continuously carries out the actin ballet?

Cells are capable of reproduction. The biology of mitosis is now well-known. The choreography of DNA duplication, organelle segregation and





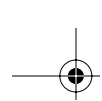
cell division is far too finely tuned to have been the result of unconnected random mutations. How does the cell know that both DNA strands must be duplicated instead of merely making an RNA template suitable for protein synthesis? The precision of the control mechanisms in a cell suggests strongly that they were designed. In spite of rationalist rantings, the macroscopic design arguments of Paley (1802) have never been refuted. Design in nature does not prove that there is a God, but it certainly does establish that the biology we do know is not characterized entirely by random processes! For those who believe the Bible's clear assertion that God is the designer as well as the fabricator of life, the wonders of biology are no surprise. Brave defenses of nineteenth century Darwinism cannot cover the basic fact that the world of life exhibits such exquisite complexity that the inference of a designer is most compelling.

In contrast to the scientific viewpoint, the Bible presents God as the creator and sustainer of life (Ps 104). The earth is claimed to be the planned home of plants and animals. The marvelous relationships between flora and fauna that we now call ecology were ordained by God. The study of other creatures is encouraged as an example of God's current active concern for their welfare, as noted in Matthew 6:26-30.

While humankind shares dust (*aphar*) with the earth and breath (*ruach*) with the animals, we are more than matter and metabolism. The Bible tells Christians that "the Spirit himself testifies with our spirit that we are God's children" (Rom 8:16). Any view that restricts us to nothing but molecules in motion is less than Christian. The deepest understanding of humankind does not come from physics, chemistry or biology.

E. History and the Bible. Although some contemporary views of history question the concept of objectivity, we believe that events actually happened in the past. We even believe that it is possible to gain a measure of certainty as to what they were and so are convinced that there is a field of scholarly endeavor known as historiography. Modern academic history has suffered from two devastating but quite different trends. Atheistic rationalism views the data of history through such a strong ideological filter that many well-attested events are rejected because they violate the presuppositions of the historian. For example, since miracles *cannot* occur, miracles *do not* occur. While a healthy skepticism is essential in all historical work, there are times when the historical evidence must be at least considered,



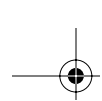


even though the event is difficult to understand or believe under a particular set of presuppositions. Pure skepticism is neither good science nor good philosophy. The other current, counterproductive trend is the assertion that all written history is necessarily myth, which means that it was produced to convince the reader, but the objective veracity of the details is lacking. Valid insights from the sociology of knowledge have been fallaciously extended to deny the objectivity of all written texts. It follows that since all previously written histories are mythical, the job of the contemporary scholar is to reimagine history. We categorically reject this postmodern perversion of the honorable science of history. Good historical research is hard work, and the raw data must be analyzed carefully to reach valid conclusions. But we assert that valid histories can be written, and we assert that the facile work of many current postmodern historians is an insult to all previous generations of historians!

When the science of history is applied to the Bible, many secular historians immediately give up and move on. If they are interested in subjects that are covered in the Bible, they tend to ignore completely the biblical evidence and instead choose to reimagine their own version of the past. *The History of Israel* by Martin Noth (1930) is a typical example. However, for those who believe that the Bible is inerrant, in order to properly interpret the Scripture it is necessary to consider all the external historical evidence as well as internal biblical evidence. The passage of time in the late twentieth century has been very kind to the biblical data regarding its reciting of the history of the nation of Israel. Fanciful histories concocted by unbelieving scholars have been largely discredited by recent archaeological and philological research, while the biblical record has been confirmed.

Biblical history starts with a man and woman who can communicate verbally and conceptually with God. Adam and Eve were not primitive people. The subsequent history is measured chronologically relative to the first "adam," and secular evidence of human culture during the time frame inferred from the genealogies of the Bible (4000-3000 B.C.) confirms the existence of language, farming, metallurgy and domesticated animals (Gen 4:2, 22). Our spiritual parents were not savages. In particular, they were not pagans; they worshiped God. The Bible is basically silent regarding the extent and nature of other beings with similarities to humans. The focus is





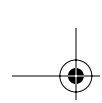
on the race of creatures that were chosen by God to communicate with him and to worship him.

While the setting and the scenario of Genesis 3 may be difficult for some scholars to believe, for there is no direct external evidence to support the events recorded there, the rest of the Bible treats the Fall of humankind as a historical event. We choose to accept the witness of the Bible for this key happening. Failure to accept the historicity of the Fall has disastrous consequences for all theology. The sad history of humankind is certainly consistent with a fallen race. There have been more atrocities committed in the twentieth century than in any preceding one-hundred-year period. The levels of morality common today parallel those reported for the world just prior to the flood of Noah. While the problem of evil helps to keep philosophers employed, the assertion that moral evil has no historical roots is completely inconsistent with Scripture.

Another central event in the early chapters of Genesis is the Noachian flood. A helpful treatment of this subject is *The Biblical Flood* by Davis Young (1995). The understanding that the biblical text is focused on the direct descendants of Adam and the local geographical area could help to make sense of the external evidence. Both epistles of Peter clearly present Noah as a historical character and the Flood as an important part of the history of humankind. Sound interpretation of the relevant texts requires consideration of both the internal textual evidence and the external geological and historical evidence.

Abraham was revered throughout the ancient Middle East, not just by the Jews, and there is compelling external evidence for a historical Abraham. In addition to his wealth and political power, which were acknowledged by the surrounding tribes, God chose to reveal himself to Abraham in a special way. However, theophanies (direct appearances of God to men) are out of the question for atheistic scholars. God also chose Abraham to receive prophecies about the future of his descendants and the world as a whole (Gen 12:2). Prophecy is even more repulsive to rationalists. If there is a God, and if he has communicated with humankind, then prophecy must be accepted as a possibility. The Bible is filled with prophecies, but if apparent prophecies are only dishonest redactions, then our faith is in vain. If solid textual evidence exists that the written word preceded the historical events by many years, then skeptical disparagement of prophecy must yield





to the evidence, however distasteful this might be for some. The prediction of the coming of the Messiah in Daniel 9 is a strong example of fulfilled prophecy.

The Bible asserts that Jesus was literally the Son of God. The historicity of the incarnation is an oxymoron for a number of scholars, including some who claim to be Christians! It has even become fashionable to deny that Jesus ever existed,²⁶ but the external evidence fully supports the Bible's record of a historical Jesus. However, the Jesus presented in the Bible is often unacceptable to people in the modern world. He was always in communion with his Father in heaven (except for the brief period on the cross); he knew the thoughts of all people; he knew the future; he calmed storms and raised the dead. The internal biblical evidence has not convinced some scholars that such a person ever actually existed. One scholarly approach is to attempt to demythologize the text and to try to discover the authentic historical data behind the supposedly corrupt text. Many scholars give up in disgust! Jesus really was the person presented in the text of the Bible, and there is no point in trying to reimagine a Jesus made in our latest politically correct image. Anyone who would worship a God made in their own image is deluded. But if Jesus really did do and say the things attributed to him, what will become of the nonnegotiable presuppositions of the rationalists?

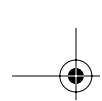
While the incarnation is offensive to atheists, the resurrection is an outrage. It even enrages certain Protestant theologians. But the historical evidence makes the resurrection of Jesus Christ one of the best attested events in antiquity. The Bible is unequivocal in its presentation of the historicity of this event. The apostle Paul concludes, "and if Christ has not been raised, our preaching is useless and so is your faith" (1 Cor 15:14). The key criterion for a miracle is not its explanation, but its attestation.

According to the Bible, history not only has a beginning, but also it has an end. Peter summed up many themes in the following passage.

First of all, you must understand that in the last days scoffers will come, scoffing and following their own evil desires. They will say, "Where is this 'coming' he promised? Ever since our fathers died, everything goes

²⁶James D. G. Dunn, *The Evidence for Jesus* (Louisville, Ky.: Westminster Press, 1985).





on as it has since the beginning of creation.” But they deliberately forget that long ago by God’s word the heavens existed and the earth was formed out of water and by water. By these waters also the world of that time was deluged and destroyed. By the same word the present heavens and earth are reserved for fire, being kept for the day of judgment and destruction of ungodly men.

But do not forget this one thing, dear friends: With the Lord a day is like a thousand years, and a thousand years are like a day. The Lord is not slow in keeping his promise, as some understand slowness. He is patient with you, not wanting anyone to perish, but everyone to come to repentance.

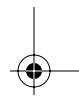
But the day of the Lord will come like a thief. The heavens will disappear with a roar; the elements will be destroyed by fire, and the earth and everything in it will be laid bare. (2 Pet 3:3-10)

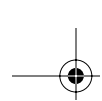
The prediction of future judgment is followed by the announcement of “a new heaven and a new earth” (2 Pet 3:13). Science will become obsolete; theology will not be needed in the presence of God himself; but the Word of the Lord will endure forever!

Part 5: Concluding Remarks—A Case for Creation

The fundamental Christian position that God is Creator of all things is based on the unanimous testimony of the Bible. Many specific verses have been cited in support of this view, and it has been our intention to keep the Bible in clear view throughout this chapter. We believe that a Christian does not need to abandon a biblical perspective in order to carry out effective science. Accurate exegesis and reliable interpretation of the Bible along with valid scientific conclusions are the goal of all scientists who are Christians.

It is clear that not all interpretations of the Bible are consistent with all conclusions asserted by scientists. It is our hope that the rejection of invalid biblical exegesis and interpretation along with unsubstantiated scientific assertions will continue in the arena of science and religion. Many controversies have resulted from the conflict between unsound interpretations of the Bible and unsupported or even incorrect conclusions presented in the name of science. The resulting polarization has never been resolved by choosing one bad position over another. A genu-

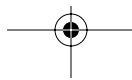


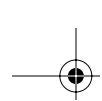


ine search for solutions requires a willingness to consider possibilities outside the narrow positions that sometimes emerge in such debates. There is much work to be done in both biblical exegesis and some fields of science, but it is our conviction that a proper understanding of the Bible will be consistent with all valid scientific observations of the world in which we live.

Astronomy remains one of the most dynamic and exciting fields in current science. New observations of the most distant celestial objects continue to challenge current concepts. Christians should humbly consider whether the latest proposed scientific conclusions are invalid results that come about because some scientists use atheistic presuppositions in doing their science, or whether these conclusions are based on sound scientific methodology that includes reproducible observations of the heavens. Christians are under no obligation to acquiesce to the assumption that there is no God, but when the scientific conclusions do not depend on such presuppositions, we should carefully consider the evidence and the arguments that lead to a given scientific position. We also should carefully examine our approach to biblical exegesis and interpretation. We are convinced that a productive Christian approach is to consider the work of skillful and faithful biblical exegetes such as Henri Blocher who provide detailed evidence and careful discussions of the nature and meaning of the biblical text. We find Blocher's treatment of the early chapters of Genesis to be helpful in sorting out some of the relevant issues of creation and science. Our conclusion and conviction is that astronomy and the study of the cosmos is not a threat to Christian faith. The more we discover about the heavens, the more we appreciate the Creator of the heavens.

Another area of intense current activity is the earth sciences. Our planet is now understood to be a very dynamic system with multiple coupled subsystems. The degree of complexity revealed by the precise observations now being carried out is an eloquent witness to the Creator of the earth. The reconstructed history of the earth reveals the degree to which our planet was prepared systematically for the appearance of life as we know it. Christians should be wary of attempts to use the current scientific consensus on some issues as an argument in favor of atheism, but the misuse of science should not be employed as an excuse to reject the sound scientific



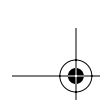


observations and carefully reasoned conclusions that dominate the actual work in this field. Most of the naive and simplistic notions that characterized the great controversies of eighteenth- and nineteenth-century geology have been discarded in favor of models that have a clear basis in observation. Christian earth scientists can provide a continuing encouragement to focus on what can be observed and to be skeptical of arguments that are based on “what must have happened.” The more we learn about the earth, the more we appreciate the Creator of the earth. Our own faith has been increased by our study of our planet.

The life sciences are now growing rapidly as new technologies enable new observations and investigations. Many old conclusions or theories that were based on speculation have been replaced by more accurate pictures based on actual observations. The more we learn about earth life forms—all plant life and living creatures—the more we appreciate the Creator of life. While the Christian belief in God as the Creator of life is established on clear exegesis of the Bible, the external evidence only strengthens this position. Christian life scientists should welcome all new observations of the structure and function of living organisms. Yet, they serve as ballasts in the scientific community by displaying a healthy skepticism when scientific arguments are based primarily on assumptions and not on actual observations. As the life sciences emerge from the period when consensus was based primarily on the opinions of experts to the phase where key experiments are cited in support of new ideas, Christians can follow the latest developments with increasing admiration. It is our conviction that a compelling case can be made for the creation of life—the very complex structure and highly regulated functions of biological organisms have all the appearances of being created.

While we have presented a positive case that the observed biological world is consistent with the concept of creation, it is also important for us to address the prevailing view in the life sciences that life arose by chance and that natural selection provides a filter that leads necessarily to the appearance of more complex life forms over time. Christian life scientists can play an important role in distinguishing the valid observations and organizing principles that guide current research from atheistic presuppositions that hinder or even preclude progress in some areas. This will promote a more effective search for new concepts to help understand the





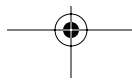
structure and function of biological organisms.

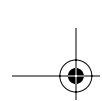
When the philosophical presupposition of a world governed entirely by chance is applied to specific proposed histories of the formation of life on earth, the probabilities calculated are so low that they cease to have meaning in the context of ordinary life. Attempts to appeal to situations like a state lottery—producing a winner using a clear protocol even though the *a priori* probability of a particular person winning is low—illustrate the vast difference between human attempts to understand the biological world in terms that are familiar to us and the unimaginably small probabilities that emerge from detailed calculations. The statistical approach to the formation of life has been a dismal scientific failure.

The current biological consensus on dating the appearance of the first cells creates another major problem for the view that life formed over a very long time period due to purely random events. It appears that living cells were formed as soon as the earth cooled enough to form significant amounts of liquid water. Attempts to explain this phenomenon illustrate a parallel strategy in the current practice of biology—the appeal to necessity. It is argued that since cells are observed, it is highly likely that there are mechanisms that lead to the formation of living organisms from nonliving matter. This proposition has also been expressed by proposing that the principles of chemistry lead inevitably to biology.

Research at the interface of chemistry and biology need not be wedded to atheistic presuppositions, but when concrete results are rare, there is a temptation to cover gaps in understanding with appeals to necessity. Attempts to understand what constitutes the essential elements of biological life at the cellular level do not conflict with the view that God is the author of life, and success in this scientific program will only increase our appreciation of God's activity in creation.

A consideration of the differences between single cell and multicell organisms requires new concepts to explain the mechanisms of biological development. Currently, this is an especially active field of research, and further progress is eagerly anticipated. It is often assumed that the capacity for multicellular development was acquired by chance, but such a complicated biological system would require a highly unlikely or even impossible history of formation if only random events were postulated. The beautifully orchestrated development of the simplest multicell organisms looks more



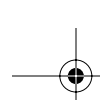


like a ballet than like a mob scene. It is our conviction that the Christian desire for a detailed understanding of the structure and function of these creatures provides the best context in which to study them, but the actual observations and the induced relationships between them constitute the scientific enterprise. An appeal to atheism does not lead to any actual observations, nor does a prejudice against well crafted biological sub-systems aid in the identification of the interacting parts.

The abrupt appearance of large numbers of apparently new life forms at the Cambrian explosion presents a challenge to a model of biological history characterized by minute changes occurring over long periods of time. The Darwinian approach to this problem is rooted in the nineteenth-century emphasis on uniformitarian processes. The notion that only small, slow changes are possible has been rejected in astronomy and the earth sciences. It is time for the introduction of highly nonlinear processes into biology. This research field is still in its infancy, but the explanation of large changes in biology requires a willingness to consider new possibilities. The Christian assertion that God had a direct role in the creation of new life forms (kinds) is based on an interpretation of the Bible which emphasizes the continuing activity of the Creator in the history of earth. This perspective does not address how one particular kind of animal could be changed into a very different type, but an appeal to atheism also offers no guidance on this question. Such a complex problem will require a truly multidisciplinary approach if any progress is to be made. New understanding must be data driven as new observations enabled by new technologies are reported. It is our conviction that every new discovery in the life sciences will only increase our appreciation of the Creator of life.

The rapid increase in sophistication in the earth and life sciences has created an ethical crisis. Science itself provides no basis for deciding what ought to be done. Christian scientists can provide a clear voice that identifies the actual source of ethical pronouncements made in the name of science. As humankind's ability to do great good as well as great harm has increased, the need for clear ethical principles is even greater. The biblical perspective has two crucial components. First, the earth and all living things have been created by God. Second, the Bible clearly states in Genesis 1—2 that humanity has been ordained by God to care for creation in a nurturing and preserving sense. These components provide the basis for





the central ethical principle for all issues involving our environment and our fellow creatures. If Christians are to be heard on these issues, they must be able to speak intelligently at the cutting edge of current science. Christian scientists should exercise the utmost diligence as representatives of the Creator of the physical and biological worlds to know and understand the best scientific observations and models.

The final area to be considered is the human sciences. The Christian position asserts that language was created by God for the benefit of humankind and that in addition to communicating with one another this ability allows communion with God himself. Christian human scientists can serve to resist the persistent efforts to dehumanize our race by reducing humankind to nothing more than a naked ape. God has created humans in his image and no attempt to formulate a human science entirely apart from this perspective will be fully adequate. However, considerable progress has been made in fields like cognitive psychology, where reproducible observations have been organized into general principles. Christian scientists can help to distinguish those aspects of human behavior and civilization that are based on sound observations from mere speculations based on political prejudices. In a field where the scientist as observer is also part of the group being observed, Christians can take the lead in identifying the influence of the observer on the nature of the reported observations. While difficulties associated with carrying out research in the human sciences must be clearly faced, this is an area where Christians have the most to offer. The more we learn about how God has formed us, the more we marvel. What makes us human is that we are created by God in his image.

Creation by God is the unifying concept that pervades all work by Christian scientists. It is the basis for our life and work. By observing the created world we answer the question, What has God wrought?

