DEVOTIONAL BIOLOGY

LEARNING TO WORSHIP THE CREATOR OF ORGANISMS

Kurt P. Wise, PhD
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A NOTE TO TEACHERS

This text can be used in two ways. It can be read as a stand-alone book, or it can be used as a textbook alongside the Devotional Biology video curriculum taught by Dr. Kurt Wise (available for purchase at CompassClassroom.com).

A UNIQUE COURSE

It is important for teachers familiar with traditional biology textbooks to realize this book is different.

It was written to look first at Christian theology as found in the Bible. It then applies that theology to what we see in living organisms. Finally, it examines what that means to how we live our lives. Each chapter will start with a section on God and His attributes, move into the scientific material, then end with a discussion about our responsibility to the creation.

The book also follows a different structure in terms of when certain topics are covered as well as which major topics are covered.

Finally, this book introduces many concepts that are simply not found in traditional biology textbooks. Many of these concepts are enlightening, but some can be a bit complex to understand on a first reading.

It is okay if a student does not comprehend everything: the goal of this class is to expand the way students think about God and His creation. Both are exceedingly complex. It is not a bad thing to struggle to understand; this is often where learning occurs.

USING DEVOTIONAL BIOLOGY VIDEO LECTURES

If you are going to use this book with the video series, there are two ways to approach the material. You are welcome to try both to see which works better with your particular student:

1. Some students do better by watching the video lesson first, then reading the associated text.

2. Others may want to read the text first, then watch the associated video.

Either way, it could be useful to repeat the video or the text if a concept is difficult to grasp. This will help long-term retention, as well.

As you look over the Table of Contents, you will notice a small “play” symbol with a number after different sections, such as: "Creation and Revelation [1.1].”

This means Devotional Biology Video 1.1 “God Desires to be Known” is associated with the textbook section starting at “Creation and Revelation” and continuing until the [1.2] appears. You would thus stop reading when you reach the next symbol and number in the text, such as "Origin of Modern Science [1.2].” This section is associated with Video 1.2 “Christian Foundation of Science and Biology.”
Please note that the video titles are not always the same as the chapter sections because some video segments cover multiple chapter sections. As you are taking the class, simply ensure you are matching the video numbers such as 1.1, 5.3, or 14.2 to the markers [ › 1.1], [ › 5.3], or [ › 14.2].

ADVANCED DISCUSSION AND POTENTIAL TEST QUESTIONS

If you purchased the Devotional Biology video curriculum, look for a Teacher’s Guide that provides a scope and sequence for scheduling the class as well as answers to Potential Test Questions. (The Teacher’s Guide is also available at CompassClassroom.com.)

You will find Advanced Discussion Topics at the end of most chapters, and Potential Test Questions at the end of every chapter. Both of these sections were originally written for teachers using the textbook in a classroom environment. If, however, you would like to work from these lists, they could be incorporated in part or in whole as a discussion between parent and child, or as student projects.

GLOSSARY AND INDEX

Effort has been taken to enable the student and teacher to quickly locate key terms throughout the text. Words in bold typeface indicate the presence of a full definition in the Glossary. In the Index, the definitional entry of a term is also indicated in bold.

LAB MANUAL AND LAB MATERIALS

Dr. Kurt Wise has written fourteen lab exercises to accompany Devotional Biology. These enhance the curriculum and provide one full credit for a high school lab science.

Purchase the available Devotional Biology Lab Materials and Lab Manual from CompassClassroom.com. Lab Materials include a microscope, DNA model kit, chromosome simulation kit, labware, microscopic slides, chemicals, and tools.

QUESTIONS?

Please email us at info@compassclassroom.com if you have specific questions about this class.
ACKNOWLEDGMENTS

Innumerable people and sources have contributed to the concepts, ideas, and even words of this text. Teachers and mentors, student peers and students of mine, textbooks and reference works, popular works and primary literature—I have borrowed from them all.

Perhaps nothing has taught me more about biology than the challenge of teaching college biology to hundreds of students over two decades before attempting this work. Then, as the first draft of this text was composed and subsequent editions were drafted, numerous students have functioned as guinea pigs in the development of the text. Their comments, tears, test answers, and groans have all made their mark on these pages. Then there are the near-whole-text reviewers in both theology and biology who devoted such a large chunk of their time and attention pouring over early versions of the text. They include (in the order of their review) Gregg Allison, Tom Hennigan, Brad Reynolds, Gordon Wilson, Joe Francis, Stephanie Hartz, and Leonard Brand. Many others reviewed smaller sections of the text.

As valuable as these many contributions have been, they should only be blamed for whatever might be good about the text. The shortcomings of the volume are, of course, entirely my fault.
INTRODUCTION

If you are a Christian and a student, this text has been designed for you. If you are typical of such students, you probably do not even like science, but must take a science class to fulfill the requirements of your academic program.

In fact, it is likely that you do not really know why a course like this is required. It may also be true that you chose Biology because it was the least undesirable of the science courses available. I pray that this text will convince you of the value of such a course. Even more, I hope that by the end of this course you even come to like science...at least a little!

CHRISTIAN THEISM VS. NATURALISM [►0.1]

Most college biology texts are written from the perspective of naturalism—the belief that only physical things exist. Since such a perspective or belief affects a person’s view or understanding of all things—including the world—it is a worldview.

Naturalism is more specifically the naturalistic worldview, or the worldview of naturalism. According to naturalism there is no God, there are no angels, and nothing non-physical exists, such as soul, spirit, good, evil, or even purpose. Naturalism accepts the existence of only that which can be detected directly by human senses.

The author of this text accepts the existence of God, so this text adopts a theistic perspective. Then, among the various theistic worldviews that exist, the author not only accepts the existence of God, but more specifically the existence of the God described in the Bible. Consequently, the worldview of this text is Christian theism (or the worldview of biblical theism as opposed to the worldview of naturalism).

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Physical things are temporary, destructible things that can be detected in some way by our senses (touch, sight, smell, taste, or hearing) or by an enhancement of our senses (through microscopes and telescopes, rockets and satellites, amplifiers, etc.). Physical things not only include things made of matter (that takes up space and weighs something in the presence of gravity), but also includes physical energy (such as light), space, and physical time.

b Technically, there are two different types of naturalism. The belief that the physical is all that exists is known as philosophical naturalism, whereas the practice of studying the physical world as if the physical was all that exists (even if one believes non-physical things are real) is known as 'methodological naturalism'. However, whether the physical world is studied from philosophical or methodological naturalism, the description and explanation that results (i.e. the science) is the same—a naturalistic description that excludes the non-physical. Consequently, this text will refer to both forms of naturalism by the simpler term 'naturalism' and apply to that term the definition of philosophical naturalism.

Although a person who believes in naturalism is called a naturalist, the word ‘naturalist’ can also refer to a person who merely focuses his or her study on the physical things in the environment, without regard to a particular belief about whether non-physical things also exist. Because of this ambiguity in meaning, we will avoid the use of the term ‘naturalist’ and refer instead to ‘naturalism’ or ‘naturalistic worldview’—both of which are unambiguously referring to the worldview of naturalism. Also, since philosophical naturalism accepts the existence of only physical or material things, it is sometimes referred to as physicalism or materialism. Unfortunately, ‘materialism’ more commonly refers to a desire to amass material things and ‘materialist’ to a person who hoards or strives to acquire material things. To avoid misunderstandings which might arise from the use of such terms this text will not refer to materialism, materialists, or the materialistic worldview.

Included among things that can be detected directly by human senses would be those things that cannot be detected with unaided senses but must be detected by means of one or more of thousands of different physical devices we have designed to amplify or extend our senses (such as microscopes, telescopes, magnetometers, seismometers, Geiger counters, infra-red cameras, x-ray machines, etc., etc.).

Note that although naturalism is the most common worldview found in biology textbooks, it is not the only worldview alternative to Christian or biblical theism. Many other alternative worldviews are advocated around the world, and each provides an alternative worldview of biology. As an example, many environmental activists almost deify organisms, seeming to believe that humans have done so much damage as to be considered an evil. Another category
Biblical theism believes in one triune God Who defines good and evil, provides purpose, and created both the spirit world (e.g. angels, souls, spirits) and the physical world (e.g. the universe, astronomical objects, the earth, organisms). I pray that this text will nurture your own biblical worldview and preserve you from any and all non-biblical worldviews you may encounter in the future.

**HOLISM VS. REDUCTIONISM**

Most college biology texts are also written from the perspective of reductionism—a logical consequence of naturalism. To understand something completely, a person who believes in naturalism does not believe he needs to consider purpose, or an unseen God, or in soul or spirit (because he does not believe any of these things exist).

Since naturalism believes nothing exists beyond the physical, it should be possible to understand something completely by taking it apart and understanding its physical parts and how they fit together (*i.e.* ‘the whole is the sum of its parts’). This belief is called **reductionism** and the perspective is **reductionistic**.

Most biology texts are written from the perspective of naturalism, and thus tend to adopt a reductionistic perspective. Consequently, it is common for most biology texts to arrange their chapters from small things (the **micro**) to large things (the **macro**)—in a stepwise fashion dealing with **atoms** then **molecules, cells, organs, organisms**, and finally ecosystems.

The author of this text not only explicitly rejects naturalism, he also explicitly rejects reductionism, believing instead that the creation contains **emergent properties** (those that cannot be explained by the parts that make it up). He also believes that **life** cannot be understood without considering divine intent, or the ‘big picture’. He believes that the biblical perspective is **holistic**, not reductionistic.

The Bible begins with God (“In the beginning God…”), then relates the creation of all things (Genesis chapter one), then relates God’s interaction with mankind in general (Genesis 2-11), then with a chosen people group, and finally to us individually. The author believes a holistic perspective of biology is the proper one. He also believes it is a better teaching strategy to begin the study of biology with things you as a student are already familiar with—like the critters and plants themselves.

Consequently, the chapters in this text begin with the macro and deal with the micro when it is most appropriate to do so—namely when it actually does help understand the whole. This text starts with organisms and deal with molecules along
the way. As a side benefit, the large-to-small approach is opposite that of the reductionist approach, so it implicitly reinforces a (holistic) biblical worldview⁴.

**YOUNG-AGE CREATION VS. EVOLUTION**

Since a person who believes in naturalism rejects a creator God, he or she believes everything came into being without help (i.e. spontaneously or ‘naturally’), changing—‘evolving’—from previously existing physical things³. With a naturalistic worldview perspective, a person has no choice but to believe that everything came to be by some sort of naturalistic evolution—the idea that all physical things originate by spontaneous or natural change from previously existing physical things⁵.

According to naturalistic evolution, life has been developing over billions of years, it has always been subject to natural evil (degenerative aging, animal death, suffering), and the diversity of human languages has been developed over thousands of years, and there never was a global flood on this planet.

However, since the God of the Bible is the Creator of all things (Ex. 20:11; Col. 1:16), the author accepts creationism⁶ rather than evolutionism (i.e. he is a creationist, rather than an evolutionist, and believes that ultimately, all physical things came to be supernaturally). More particularly, the author believes that the Bible speaks with truth on all matters that it addresses, including its claims about the physical world⁶.

As result, he affirms the creation of a complete, un-cursed universe in the course of six days (Gen. 1) only thousands of years ago⁶, a curse in response to Adam’s sin that

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⁴ Because there is no external organizer in naturalistic evolution, in many cases evolutionary theory also operates from the micro to the macro. Typically, sub-atomic particles are formed first, then atoms, and then molecules. Molecules are formed before cells, and single-celled organisms are formed before multi-celled organisms, organisms before species, and species before communities. Pursuing a macro-to-micro course also implicitly argues against naturalistic evolution.

⁵ In naturalism this was true up until recent times. Because of the naturalistic belief that everything arose from previously existing physical things, most naturalists from the time of Aristotle to the middle of the 20th Century believed that the physical universe has always existed—that it did not have a beginning. Naturalists consistently believed that everything physical came from something physical that preceded it. It is only with the extraordinary success of the big bang theory in the 1960’s that naturalists reluctantly accepted that the universe itself had to have had a beginning. Not only is this original belief of biblical theism a rather recent belief of science, but it stands as a substantial challenge to the naturalistic worldview.

⁶ Many variations on evolution have been proposed, including forms of theistic evolution that involve God helping or accelerating the physical transformations. Since biology is dominated by naturalism, the dominant form of evolution in biology is naturalistic evolution, where physical changes are unaided, and are thus spontaneous or ‘natural’. Consequently, the text will contrast creationism with naturalistic evolution. Unless otherwise indicated, when the text uses the word ‘evolution’ it is referring to naturalistic evolution, not any of the various forms of theistic evolution that have been proposed over the years.

⁷ For philosophical clarity, note that ‘creation’ and ‘evolution’, ‘creationism’ and ‘evolutionism’, and ‘creationist’ and ‘evolutionist’ refer to claims about the origin and modification of things, not the on-going existence of things. Although there is a now unpopular theological theory that claimed that things were being continually re-created, most people today—whether creationists or evolutionists—accept that things continue to exist for reasons other than creation or evolution. They commonly believe either that physical things have an inherent property of continued existence or that they are being held together by a process unrelated to their origin or modification.

⁸ An alternative perspective of Scripture that was first popularized by Galileo, suggests that the Bible speaks authoritatively on spiritual matters only. Various degrees of application of this concept to the Bible has generated a number of alternative perspectives of earth history, including a variety of old-age creationist views that accept the millions and billions of years of conventional science.

⁹ As per the chronogenealogies of Genesis 5 and 11, the time from the creation to Abraham was approximately 2000 years. Since Abraham lived approximately 2000 B.C. (derived both from Biblical chronology and from conventional archaeology), the creation was roughly 6000 years ago. Alternative numbers (e.g. those of the Septuagint) and
introduced natural evil into the world (Gen. 3), a global **Flood** in the days of Noah a millennium and a half later that destroyed all living things on the land with the exception of those in the ark (Gen. 6-9), and a couple centuries later, a judgment on humans at Babel that was the source of the diversity of human language (Gen. 11:1-10)\(^a\).

Thus, not only does this text present a creationist perspective of the world, it more specifically presents a **young-age creationist** perspective of the world\(^b\). Nearly every chapter relates the success of young-age creation and the failure of naturalistic evolution to explain some important aspect of biology\(^c\). The last chapter presents a summary of earth history from a young-age creationist perspective. Since the purpose of the text is to present a creationist perspective of the world, no systematic presentation or critique of evolution is presented in the chapters of the book, so it is offered instead in an appendix.

**GOD-CENTERED VS. BIOLOGY-CENTERED**

Biology is such an enormous field that authors of biology textbooks must select a few topics and ignore most of the others. Since most biology textbooks are written from the perspective of naturalism, it seems only natural that most biology textbooks include the things naturalistic biologists believe they understand about the biological world and avoid those things that continue to mystify them.

Consequently, most textbooks focus on the accomplishments of biologists, the nature of the biological world, and unify the topics with naturalistic evolution. As brilliant as scientists may be, as impressive as their accomplishments are, and as awesome as the biological world is, the author believes the focus of a textbook of biology should be on neither humans nor organisms, but rather upon the One Who created them. The chief end of man is to bring glory to God, so we ought to continually glorify and worship Him.

Scripture also tells us that God created the physical world to show us the invisible God and His invisible qualities or attributes (Rom. 1:20). It stands to reason that in some sense the obverse of this statement must also be true—that the attributes of God can help us better understand the creation. Consequently, this text focuses on how the major attributes of God illustrate the nature of God. Thirteen of the fifteen chapters

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\(^a\) See Chapter 15 for more detail on the young-age creationist perspective of history.

\(^b\) Note that the young-age creationist perspective of earth history is the position of a **very** small minority (<<1%) of scientists. It is even a small minority of college-educated evangelical Christians (perhaps <5%?). Of the hundreds of universities and colleges with accredited biology majors, less than ten accept a young-age creationist perspective of origins.

\(^c\) Young-age creationism and naturalistic evolution are explicitly referenced in the text because the former is the perspective of the author and the latter is the dominant perspective of textbooks of biology. Other versions of creation and evolution are not mentioned in the text only because of lack of space (not, for example, because they are unimportant). Also, cases in the text where young-age creationism has been successful at explaining the biological world may also be cases where other variations on creation and/or evolution have been successful at explanation. And, conversely, cases in the text where naturalistic evolution has been unsuccessful at explanation may also be cases where other variations on creation and/or evolution have been unsuccessful at explanation.
open with a description of a characteristic of God and introduce that particular aspect of the biological creation that God created in order to physically illustrate that characteristic.

**CHRISTIAN RESPONSIBILITY**

Another distinctive of this text is its emphasis on personal responsibility. Most biology texts engage in very little discussion of ethics and personal responsibility, probably because of the wide diversity of opinions that exist in our society, and the fact that in strict adherence to naturalism there is no such thing as right and wrong. Christians, however, cannot avoid personal responsibility. We have an obligation to learn about the biological creation so that we grow in our understanding of how to know God more intimately, how to share God more effectively, and how to obey God’s commands more completely. Then, once we have acquired that understanding we have a responsibility to use that knowledge wisely.

Thus, we have a responsibility to worship God, to share God with others, to guard and keep the creation He gave us, and to enhance the divinity-illustrating characteristics of the creation so as to bring God more glory. With this thought in mind the first chapter of the text focuses on what kinds of responsibility a believer has in regards to the biological creation. Nearly every chapter thereafter concludes with comments about specific responsibilities that the believer has with respect to the biological creation.

In summary, this text opens with a chapter on Christian responsibility in the biological creation and ends with a chapter reviewing young-age creation earth history. Between those bookends are thirteen chapters devoted to the characteristics of God. Each chapter opens with a brief discussion of an attribute of God, then discusses that part of the biological world that God created to illustrate that attribute. This is followed in each case by a short discussion on how the origin of that aspect of the biological world is better explained by young-age creation than by naturalistic evolution. The last part of each chapter deals with our responsibility to that biological creation—first our responsibility to God (to worship Him), then our responsibility to others (to share Him), and finally our responsibility to the creation (to care for it and enhance it to His glory).

It is my hope that this text will change you. After reading and studying this book previous students have claimed it has helped them grow in their relationship with God. Biology has helped them better understand things they have long known about God but struggled to understand. They have come to see God in those things He made, to be awed by God in ways they have never been before, and to know God more intimately. Students have also commented that studying this material has helped them in their Christian walk. They learned new ways to worship, to share their faith with others, to stand for what they believe, and to glorify God.

Finally, students claim that issues in this text have changed their perspective on who they are. They have come to understand their purpose, recognized their roles as
priests and rulers of the creation, and learned additional ways to do what is right. I pray all this for you. I pray that this course will initiate a life-long journey of worshipping and glorifying the One Who made all things and testifying of that truth to others.

Kurt P. Wise
July 2015
SUMMARY OF INTRODUCTION

- Whereas most biology texts are written from a naturalistic worldview perspective, Devotional Biology is written from a Christian theistic worldview perspective.
- Worldview is a belief or perspective that affects the way a person understands all things.
- Naturalism, or a naturalistic worldview, is the belief that physical things are the only things that exist (i.e. rejects non-physical things like God, souls, spirits, good, evil, purpose).
- The Christian theistic (or biblical) worldview believes in one triune God Who defines good and evil, provides purpose, and created both the spirit world (e.g. angels, souls, spirits) and the physical world (e.g. the universe, astronomical objects, the earth, organisms).
- Although there are many alternative world views, because biology is dominated by that of naturalism, Devotional Biology contrasts the Christian theistic worldview with naturalism.
- Whereas most biology texts are written from a reductionistic perspective (reductionism), Devotional Biology is written from a holistic perspective (holism).
- Reductionism is a logical consequence of naturalism; holism is a logical consequence of Christian theism.
- Reductionism is the belief that the whole can be fully understood by understanding the component parts and how they fit together (‘the whole is the sum of its parts’). Holism is the belief that there is more to the whole than can be understood from the component parts (i.e. the whole has emergent properties not found in the component parts).
- Reductionistic biology begins with molecules (chemistry) and moves from micro to macro (or from the components of organisms to the interactions among organisms). (Christian) holistic biology begins with God and moves from the macro to micro (or from the interactions among organisms to the parts of organisms).
- Whereas most biology texts are written from a naturalistic evolutionary perspective, Devotional Biology is written from a young-age creation perspective.
- Naturalistic evolution (all physical things come to be by spontaneous or natural change from previously existing physical things) is a logical consequence of naturalism; creation (the physical world was created supernaturally by God) is a logical consequence of Christian theism.
• Young-age creation is a biblically-based claim that the universe was created in six days 6-8000 years ago, in an un-cursed condition (no decay, death, suffering), the universe was cursed shortly thereafter in response to man’s sin, life on earth was judged about a millennium and a half later with a global Flood, and most of the diversity of human languages was created at Babel a couple centuries after that. In contrast, according to naturalistic evolution, life has been developing over billions of years, it has always been subject to decay, death, and suffering, there never was a global flood on this planet, and the diversity of human languages has been developed over thousands of years.

• Devotional Biology argues that biology is better explained by young-age creationism than naturalistic evolution.

• Whereas most biology texts focus on the achievements of biologists and the awesomeness of the biological world, Devotional Biology focuses on the attributes of God and how they are illustrated in the biological world.

• Whereas most biology texts are weak in human responsibility and ethics (a logical consequence of naturalism), Devotional Biology stresses human responsibility and ethical behavior.

ADVANCED DISCUSSION TOPICS

The author of this text met with considerable resistance in both the production of this textbook and in the implementation of the associated course, and the opposition came from believing science professors at Christian colleges. Discuss why this might be. Things to ponder:

• the impact of early education on philosophy of education
• what must be taken out of a science course in order to 'add' comments about God
• the comfort of thinking about the world the way someone in another discipline thinks
• the record of past success in the integration of science and theology
• the commonness of this text’s perspective in the church

POTENTIAL TEST QUESTIONS

1. Define worldview / naturalism / theism / Christian theism / reductionism / holism / naturalistic evolution / young-age creation / emergent properties.

2. Compare and contrast Christian theism and naturalism / holism and reductionism / young-age creationism and naturalistic evolution / 'micro to macro' and 'macro
to micro’ approaches to biology / ethics discussion in most textbooks and ethics discussion in this textbook.

3. Explain why, of all the worldviews that exist, the author chose the contrast the worldviews of naturalism and Christian theism.

4. Which of the following is logical consequence of naturalism / Christian theism, and explain why it is a logical consequence of that worldview: holism or reductionism / creation or evolution / ethics or lack of ethics

5. Which of the following is true of most biology textbooks / this textbook: naturalism or Christian theism / holism or reductionism / young-age creation or naturalistic evolution / God-centered or scientific achievement-centered / lack of ethics or ethics

6. Explain what ‘the whole is the sum of its parts’ / ’the whole is more than a sum of its parts’ means.
CHAPTER ONE: BIOLOGY FOR THE BELIEVER

“Praise God, O heaven and earth, seas and all creatures in them.”
(Psa. 69:34, Good News Translation)

CREATION AND REVELATION [ 1.1]

God identified Himself to Moses and Israel as ‘I am’ (Ex. 3:14) because it is part of His very nature to exist. It is impossible for God not to exist. Consequently, God is eternal (‘the King eternal’: I Tim. 1:17). He had no beginning. He always was, is, and always will be. God and only God is eternal and uncreated. “…by Him were all things created…” (Col. 1:16). He created both the physical world (everything detectable, or potentially detectable, with our senses of sight, smell, hearing, touch, and taste) and the non-physical world (everything that is not detectable with our senses).

“God is spirit” (John 4:24). Therefore, unless He chooses to reveal Himself, human eyes cannot see Him, ears cannot hear Him, tongues cannot taste Him, noses cannot smell Him, and skin cannot feel Him. Unless He wanted us to perceive Him, God would be undetectable and unknowable. He would not have to ‘hide’ to be unknown to us. He would not have to do anything at all.

In fact, considering the awesomeness of God and how far we fall short of His glory (Rom. 3:23), we do not deserve to know Him. It seems only ‘natural’ that such a God should be unknowable to us. However, astonishingly enough, this is not the God of the Bible. Instead, the God of Scripture desires to be known.

Before man’s rebellion, God apparently made it a habit to walk and talk with Adam and Eve in the cool of the day (the implication in Gen. 3:8a). Even after the Fall of man, Enoch ‘walked with God’ until God took him directly into heaven (Gen. 5:24), Abraham ‘was called the friend of God’ (James 2:23), Moses spoke with God face to face ‘as a man speaks to his friend’ (Exo. 33:11), David was chosen by God as a man ‘after His own heart’ (I Sam. 13:14), Israel was cherished as the ‘the apple of His eye’ (Deu. 32:10), New Testament believers are adopted children who can call Him ‘Abba’ (Rom. 8:15), and the church is cherished by God in the way a bride is cherished by her bridegroom (e.g. Song of Solomon).

From the very beginning God has sought out man so that we could know Him. To do so, God has condescended to reveal Himself to man. Although He could create the entire universe and its components in an instant and still not need rest, He condescended to create over the course of six days and rested on the seventh day as an example to man (Mark 2:27; Exo. 20:8-11).

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a Other references that God is eternal: Deu. 33:27 & Heb. 9:14.

b Thus, it is only reasonable that human reasoning would modify the Truth (as in modern Judaism), or create an alternative to the Truth (as in Islam), to envision God as distant and unapproachable. Such a god is too great to be known personally, and for a human to know such a god personally would be disrespectful, impious, or even sacrilegious. Although this might make sense to human reason, such is not the God of the Bible.
A couple thousand years ago “…the Word was made flesh, and dwelt among us…” (John 1:14). God went so far as to humble Himself and take on the form of a servant (Philippians 2:6-7)—all as an example to us. Jesus Christ even permitted a greater abasement than that. He allowed our sin to be placed upon Him, and He allowed Himself to take the full measure of punishment for our sin. He actually received on Himself His Father’s anger towards our sin and paid for an eternity of suffering for the sins we committed. And He made Himself ‘to be sin’ for us, so that we might enjoy an eternal relationship with the Almighty Holy God (II Cor. 5:21).

He did so much for us that all we have to do in return is believe in what Christ has already done (Acts 16:31)—to trust that He has done all that is necessary for us to be acceptable in God’s sight. As part of the revelation of Himself to man, God created the physical world so that humans could see His invisible qualities and attributes (Rom. 1:20a). This was true of ‘even His eternal power and Godhead’ (Rom. 1:20b). According to the larger passage (Rom. 1:18ff), God has so convincingly used His creation to show His attributes that every person has actually already come to ‘know God’ (Gen. 1:21a). Every person did not just come to know about God; every person has come to know God. God’s revelation through His creation is so effective that no person is left with an excuse. No one will be able to stand before God and say that he or she never knew God.

THE ORIGIN OF MODERN SCIENCE [► 1.2]

Because He intended the creation to illustrate His attributes, God designed the creation—and humans—in a very deliberate and special manner. A number of things had to be true about the universe and human beings for humans to recognize the illustrations and infer from them the nature of the invisible God. These might be called the ‘knowability traits’ of the creation, and they include the following:

The physical world actually exists. Although the existence of the physical world might seem quite ‘obvious’ to most of us in the Western world, many of the worldviews of the Eastern world believe the physical world to be an illusion. Consequently, if people believe consistently with their declared worldview, a majority of the world’s population rejects the claim that a physical world actually exists in some place other than the imagination of the human mind.

But, believers know the physical world exists because God created it to illustrate His attributes. An actual physical world not only allows inferences to be made from it, but also allows verification of those inferences.

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If before this moment you have never trusted in what Christ did for you, would you like to? The Bible says that if we understand that we are sinners (Rom. 3:23), deserving judgment for our sins (Rom. 6:23), but that Jesus died on the cross to pay the penalty for our sins (I Cor. 15:1-4), then to receive eternal life we need only believe in what He has already done (John 1:16; Acts 16:31). If you have so trusted in what Jesus has done for you, then the Bible says you HAVE eternal life that no one can take from you (John 10:27-29)—otherwise, in fact, it would not be eternal life!

Even in the western world, Plato (c426-c348 BC) pictured the physical world as shadows dancing on the wall of a cave—mere silhouettes of that which was truly real—the invisible world of perfect ideas, concepts, and forms.
Human senses are reliable. Even though we know of instances where our senses can lead us astray (e.g. with mirages) and we know that we can use the senses to lead others astray (e.g. as illusionists), human senses must be generally reliable so that humans can correctly perceive revelation from His creation. From this we can then conclude that the physical world that we perceive is the physical world that actually exists.

The creation is ordered. For the creation to illustrate something there must be some sort of structure or order to carry that illustration.

The order of creation is simple enough to be understood by humans and the human brain is complicated enough to understand creation’s order. Although a full understanding of God would certainly be outside the capability of any finite being, God still wants us to understand something about Him. This means He chose to illustrate understandable things, created the universe in such a way as to illustrate those concepts in understandable ways, and constructed our brains in such a way as to comprehend those concepts.

We can thus conclude that the order we perceive in the creation is the actual order that is there, and not un-naturally imposed upon the creation by our minds.

Regularities of the creation can be detected and understood in the course of individual human lifetimes. Humans have long recognized that there are consistent patterns in the creation. It is almost as if there were rules or laws that things in the universe must obey. This actually seems quite reasonable, for the God of Scripture is a personal God with reliable and consistent behavior, Who desires very consistent behavior of others.

If the creation mirrors God’s nature, the creation might be expected to have regular behaviors of its own. And, since God desires that each individual human know Him, it is reasonable to assume that He created at least some of that order and some of those regularities in such a way as to be detectable in the span of one individual’s lifetime.

Regularities of the creation are consistent across the entire universe for all time. Since God is an unchanging God, creation’s order and regularities should be consistent through time. And, since God desires to be known by all people, no matter where they are and no matter when they live, the law-like patterns of the creation ought to be true across all space for all of time.

The order of the creation, including all its regularities, is unified. Since God desires us to recognize the one true God in the creation, all its illustrations will point to the same God. Because there are many and various facets to God’s character, there are probably many and various illustrations of His character in the creation. As our understanding of these illustrations increases, we would expect that they will weave together as threads in a tapestry into a coherent, interlocking picture of the God of creation.

We can gain truth and understanding by studying the creation. Since God has created the physical world to teach us something about Him, it is reasonable to assume that studying the creation will lead to truth and understanding. At the very least we will gain truth and understanding about God.

There is intrinsic value in studying the physical world. There is perhaps no other endeavor as glorious and fulfilling as seeking God. The more we know of Him, the
more awesome we realize Him to be, the more awed we are in knowing Him, and more benefited we are in becoming like Him.

Since He created the physical world to teach us about Himself, better knowing the creation leads to better knowledge of God. There is great value in studying the physical world to better know its Creator.

*Truth is advanced by continual study of the creation.* Since God is so much greater than we can understand or imagine, it is likely that He put enough truth in the creation to keep all humans challenged for all time. God has authored His word in such a way as to provide simple truths for children, deeper truths for those older in the faith, deeper truths still for those who diligently study, and even deeper truths to challenge those who spend lifetimes in study.

Likewise, God has designed His creation with simple truths for all, deeper truths for those who seek, deeper truths still for those who diligently study, and even deeper truths to challenge those who spend lifetimes in study of His creation.

*Truth about the unseen can be inferred from the study of observable things.* God created observable things so that we could understand those attributes of God that we cannot see. We infer from this that there is probably much that exists that we cannot see, and we are justified in inferring the nature of those unseen things from the things we can see.

*For every event there is a cause.* God is a God of cause and effect. He wills and it occurs, He speaks and it is done, He promises and it is true, He redeems and we are His. The universe itself is an effect which resulted from His creation, and He has built the law of cause and effect into the creation as one of its regularities.

Just as we are supposed to infer the cause of the universe’s regularities (as illustrations of His character), so also we are justified in seeking cause for effects that we observe in the creation.

*Human language is capable of describing, understanding, and teaching truths about the creation.* The same God Who created the creation so we could recognize His character in it, gave us language. It is reasonable to assume that the language He gave us has been created in such a way as to make it possible to describe the creation and the attributes of God illustrated in that creation. It is reasonable to assume that that same language has been designed so that we can reliably pass on information about that creation to others.

Furthermore, the same God Who gave us language, spoke the universe into being by the word of His mouth. Not only should human language be capable of describing the universe, but human language itself should be similar to the structure of the creation. This would explain why mathematics—a language created by humans—has been so successful at approximating the very structure of the creation.

God’s desire to illustrate His nature in those things He made yields quite an astonishing creation. Such a world is not the expectation of naturalism. Although our survival might suggest that our senses must be somewhat reliable, naturalism gives us no good reason to believe that the physical world’s order just happens to be simple
enough for us to understand\textsuperscript{a} and our brains just happen to have evolved enough to be sufficiently complex to understand it.

Nor in naturalism is there reason to believe that the order of the universe should be comprehensible in the course of a single human lifetime, or that the order is unifiable. In naturalism there is no good reason to believe that the regularities of the physical world are unchanging—let alone consistent across all time and space. For naturalism it is even more incredible—or even presumptuous—to believe that language humans invented happens to correspond with the structure of the entire universe.

Yet, after centuries of studying the physical world, it does seem as if the universe is understandable. It does seem as if the regularities of the universe are consistent across time and space. And more and more of the regularities of the universe have been unified. And it does seem as if mathematics comes astonishingly close to mimicking the very structure of the universe. The universe seems to be designed just as the Bible intimates—in such a way as to illustrate the very nature of its Creator.

In fact, belief in such a universe led to the origin of science itself. When people acknowledged that the universe not only existed, but was understandable and worthy to be understood, and, additionally, that humans were capable of understanding it, humans began studying the universe in order to understand it. This was the birth of what is called ‘modern science’.

It is no accident that this occurred in the wake of the Reformation in Western Europe, among a people who were freshly re-acquainted with the truths of Scripture. No worldview aside from a Christian (or biblical) worldview generates such an understanding of the physical world as to spawn the birth of modern science. It is unlikely that modern science could have been birthed in any other worldview. In fact, the birth and subsequent success of modern science is implicit confirmation of the truth of the biblical worldview\textsuperscript{b}.

**WHAT IS SCIENCE? [➔ 1.3]**

**A CHALLENGE TO DEFINE**

Most people are under the impression that science is easy to define. After all, the word has some sort of a definition in the dictionary and even grade school textbooks offer definitions. Furthermore, since the word is used somewhat commonly, one might infer that it should be easy to determine whether something is science or not a science. Finally, since most of the definitions floating around in our society—especially those

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\textsuperscript{a} Einstein is said to have said “The most incomprehensible thing about the universe is its comprehensibility.”

\textsuperscript{b} The characteristics of the universe that permit it to illustrate the nature of God turn out to be what philosophers of science call the ‘presuppositions’ of science. Presuppositions of science are those things that are assumed so that science can be done and those things that must be true for the pursuit of science to be reasonable. The biblical worldview is the only worldview known to provide reason to believe the presuppositions of science.
which students are called upon to memorize—link science to ‘the scientific method’, there must be a procedure that all scientists use and no one outside of science uses.

In fact, none of these things are true. First of all, science is not easy to define. Even experts’ struggle to define it, and thus far no single definition has been agreed upon. Secondly, it is not always clear whether or not something is a science. There are certain things that everyone is satisfied labeling as science. There are many other things that everyone agrees should not be labeled as science. But there are still other things that some people label as science and other people label as non-science. Finally, there is, in fact, no single ‘scientific method’ that all scientists use, and most of the methods that are used by scientists are also commonly used by people outside of science.

The whole story on how our society came to confuse the definition of science is long and complicated. Some of the confusion comes from the rather typical changes that occur in language, where words change meanings and words assume additional—often figurative—meanings. Some of the confusion also comes from the nature of science itself. After all, such a large variety of things are studied by science, and such a huge variety of people are scientists, that a simple definition might not be possible.

I suspect that the single most important cause for the confusion, however, has to do with the fallen nature of man, rather than the nature of science itself. In our society, scientists are held in very high regard. Many people find the esteem that comes with science to be an irresistible temptation. Some outside of science want the esteem for themselves, so they stretch the definition of science so they can call themselves scientists. Some within science want to preserve or increase the esteem they already receive, so they modify the definition of science in such a way that science is even more respectable than it really is. Some even want to exclude others from the esteem of science, so they modify the definition of science so that those other people fall outside the definition and can then be called non-scientists.

All this has produced a variety of inaccurate definitions of science. Not only has this led to overall confusion about the nature of science, but our society has come to cultivate (and teach our young people) an inaccurate understanding of the true nature of science.

THE NATURE OF SCIENCE

Simple definitions of science are probably not possible. After all, scientists come from a wide variety of cultural backgrounds and they study many different things (e.g. from the structure of the universe to the makeup of electrons, from minerals of rocks to the workings of the human brain, from the behavior of extinct dinosaurs to the cause of polio, from the cause of gravity to the process of evolution). Furthermore, there might actually be human activities that lie on the edge of science, being (validly) defined as science by some and excluded from science by others.

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* Philosophers of science are those whose job would include creating a definition of science.
* In most educational materials (at all grade levels) science is defined improperly. Since students are often required to memorize these inaccurate definitions, most people have adopted inaccurate definitions of science.
On the other hand, though the fringes of science might be difficult to define precisely, the vast percentage of science is universally accepted as science. And, though science is a broad discipline, there are characteristics that seem to be found across its entire breadth. Let us now consider what seem to be the most important of the characteristics found across all of science.

Something Humans Do... Science is a human activity. One implication of this statement is that science is done by humans. Chimpanzees do not do science. But neither does God... nor angels. Chimpanzees do not do science because they are incapable of doing so. God does not do science because He does not have to. Angels do not do science because it is not what they are called to do. Humans invented science and humans do science.

A second implication of the statement is that science is an activity. Many students might think of science as a bunch of things a person has to memorize. In contrast, scientists themselves tend to understand science as a something scientists do—almost as if ‘science’ was a verb. A third implication is that since science is performed by humans, human nature plays an important role in science. For example, in our society, scientists are commonly portrayed as emotionless, unbiased seekers of truth. In fact, science is done by humans, and emotions are an essential element of being human.

Furthermore, bias has also been a part of every human who has ever lived. A person’s bias might be a correct one or an incorrect one, but there is no way that any human can have no bias at all. Scientists are not only emotional beings, they are also fallible and fallen. Scientists do make mistakes. And, although it would be nice if every scientist was seeking the truth, human nature being what it is, a fair bit of science is done for less than the best motives.

To Understand the Physical World... The purpose or goal of science is to understand the physical world. One implication of this is that pure science does not generate anything useful. Unlike many in our society may understand, science did not provide us with light bulbs, air conditioners, or cars. It is not used to build bridges or computers or cure disease. Pure science only attempts to understand how the physical world works. Inventions, engineering feats, and medical cures are examples of applied science. The applied sciences seek to modify the physical world for the benefit of humanity. The applied scientist may or may not base his or her inventions on knowledge derived from the pure sciences.

A second implication is that science focuses its attention on the physical world. Whereas another discipline, theology, seeks to understand God; science seeks to understand the physical world. This does not mean that science rejects the existence of anything else—even though naturalists (and many scientists) do believe that the physical world is all there is. It merely means that science focuses its attention on the objects of the physical world, many times ignoring everything else. Thus, whereas

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1 As shall be discussed later in the text, humans invented and do science in order to fulfill the task that God assigned humans in the creation.
2 Pure science is also known as ‘natural science’, or even ‘modern science’.
understanding is the purpose of science; the physical world is the object science—or said another way, the physical world is what science studies.

By Proposing Tentative Truths as Theories of Explanation... A common misconception of science is that it has something to do with proof and certainty. Rather, a better motto for science would be ‘you never know for sure’. In an effort to understand the physical world, a scientist makes an educated guess called a scientific theory. Any attempt to understand the physical world cannot be known for sure. We'll never be able to test theories in every possible situation and at all possible times.

Furthermore, you can never know for sure that something might be discovered which shows the idea to be wrong. As the late paleontologist Stephen Jay Gould (1941-2002) used to say, honest scientists must always fear the ‘mouse in Michigan’—that apocryphal mouse (that lived in the back yard of an elderly gentleman from Michigan) which falsified a highly celebrated theory about mouse behavior and humiliated the scientist who proposed it.

Reinforcing the idea of the tenuous nature of scientific theories is the turnover rate of scientific theories. New and better scientific theories are being suggested all the time, replacing older theories that are not as successful at explaining the world. Very few theories survive this process of modification for more than a few decades. None have survived for more than a few centuries. These short life spans for scientific theories suggest that every current theory of science may be wrong—in large or small part—and every scientist knows it. It may not be too far from the truth to say that every scientist prays that his or her theory is not shown wrong before he or she gets famous for proposing it... and if the theory is disproven that he or she be the one to show it wrong and become famous for its replacement theory! As a result of this, scientific theories of all types (e.g. hypotheses, historical scenarios, mechanisms, laws) must be accepted as only possible truths.

Theories remain theories for their entire existence—science itself cannot finally declare any scientific theory to be certainly true. Although a given theory might actually be true, there is nothing in science that alerts the scientist that that particular theory is actually true.

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1 The commonness of the phrase ‘proven by science’ illustrates the association of science and proof.
2 It is possible for a scientific theory to be shown to be false (if data of the physical world is contrary to the theory), but since a theory cannot be tested everywhere, at all times, under all circumstances, a scientific theory cannot be proven to be true.
3 Whereas it is commonly taught that a ‘scientific hypothesis’ is an untested theory, the term ‘scientific hypothesis’ is rarely used by scientists, and when it is used it is not restricted entirely to untested theories. Actually, hypothesis and theory are used interchangeably by most practicing scientists.
4 Whereas it is commonly taught that a scientific theory becomes a ‘scientific law’ with enough testing, scientific (or ‘natural’) laws are actually one very specific type of theory. A natural law is a regularity of the universe—something that is supposed to operate across all space and time. A theory that suggests no regularity for the entire universe can never become a law. Furthermore, a claim about a regularity of the universe is especially impossible to test over the entire universe for all of time. Natural laws cannot be proven and must always retain the status of tentative truths. Scientific or natural laws are thus nothing more than a particular type of scientific theory and must always remain a particular type of scientific theory.
5 It is even questionable whether scientific claims can be legitimately arranged in order of increasing likelihood of being true. It is often believed that theories that have successfully survived many tests are somehow more likely true. For example, it is commonly taught that a scientist first makes an educated guess known as a scientific hypothesis, which, upon successfully testing, becomes a scientific theory, which in turn, upon more successfully testing, becomes a scientific law. There is an implicit suggestion that hypotheses, theories, and laws have increasing
And Valuing Fit With the Physical World... Any process seeking to discover truth requires some standard to determine which ideas should be held onto and which ideas should be rejected. In conservative Christianity, for example, the Bible is considered absolute truth because the God of Truth authored it.

Consequently, anything which does not compare favorably with the Bible is considered untrue. In science, the physical world is the standard of evaluating scientific theories. Scientific theories are created in an effort to explain the physical world. So, if a particular scientific theory is correct, or nearly correct, then the physical world should 'behave' in the particular manner expected by that theory.

Other ways this might be described is that the theory should 'fit' the physical world, or align with the physical world, or 'explain' the physical world. If the physical world is not the way the theory expects (i.e. the theory does not fit the physical world), then the theory should be considered untrue. Some scientists may consult additional standards of truth (Christians, for example, may consult Scripture), but the physical world is the standard that scientists accept across all the disciplines of science.

Stringing these characteristics together, Science is something humans do to understand the physical world, by proposing tentative truths as theories of explanation and valuing fit with the physical world.

When multiple theories are available to explain something in the physical world, theories are preferred that match the physical world best. Theories that explain more of the physical world are preferred over theories that explain less. Theories that can be tested (in other words, compared with the physical world) are preferred over theories that cannot be tested. Theories that have ‘passed’ more tests or more severe tests are preferred over theories that have only a few or easier tests.

Theories that fit better with other accepted theories are preferred over those that do not relate to anything else or conflict with other theories. Theories that have fewer internal problems (e.g. logical problems) are preferred over those with more. Even theories that lead to further research into the physical world are preferred over those that do not lead to other investigations.

WHAT IS BIOLOGY?

In modern science there are many different natural sciences, distinguished by studying different aspects of the physical world. Biology, for example, is one of the natural sciences. Derived from the Greek words bios ('life') and logos ('word' or 'discussion'), 'bio-logy' was originally understood to be the discussion or study of life and is often defined as 'the study of life'. And, if you believe that the physical world is all that exists (the worldview of naturalism), this would be an accurate definition of likelihoods of being true. However, if one 'mouse in Michigan' can prove a theory wrong, then just before the mouse was discovered was the theory more likely to be true just because the theory had successfully survived many tests before that? No, testing does not make a theory more or less true. It is either true or false and testing will not change that.
biology. If, however, the biblical worldview is true, then there is more to the world (and more to organisms) than the physical.

God is called the living God (e.g. Jer. 10:10; Matt. 16:16), but He is also spirit—not physical. Since biology is a natural science and can only study the physical, God is at least one living being Who cannot be studied by biology. Consequently, biology does not study all of life—but only living beings with physical bodies. The Bible also refers to life itself as something different from the physical—or at the very least something more than physical. For example, God first formed man from the dust of the earth (Gen. 2:7a). It would seem that man’s complete physical being was formed at this time. But it was only after God breathed into man’s nostrils the ‘breath of life’ that ‘man became a living soul’ (Gen. 2:7b).

Our physical body is an essential part of being human (after all, God creates physical bodies even for believers in heaven). But the body alone is not alive. Adam’s body needed enlivening, so God gave it ‘life’, just as He did for all of us and even does for all animals (Psa. 104:29-30). Since it enlivens physical bodies (and is not itself the physical body), life involves something beyond the physical. And if life is non-physical, or something more than physical, then biology, as a natural science, may not be able to study life itself—at least not completely.a

Thus, although the nature of the word itself would suggest ‘biology’ is the ‘the study of life’, the science of biology may not actually be able to study life! At best, science can study only organisms—the bodies of those physical things that possess life. So, rather than say that biology is the study of life (a common definition and an acceptable one in naturalism), it would be more accurate to say that biology is the study of organisms (physical beings having life).

**WHY STUDY BIOLOGY? [ ▶ 1.4]**

Whereas the first half of this chapter focused on what biology is, the second half of this chapter focuses on why we should study biology. Why should a student majoring in music, English, history, or a host of other non-science fields take a course in biology? Since a pure science seeks to understand the physical world rather than produce something of value to humanity, what use is there then in studying science at all? And is not science dominated by unbelievers who attack Christianity? Did not biologists come up with evolution, and does not evolution contradict the Bible? Why should a Christian young person have to suffer through memorizing a bunch of useless facts, especially when he or she dislikes it, and it may even be an enemy to his or her faith?

I would suggest that there are a host of reasons why a Christian should study biology. A dozen of them are introduced below. It should be noted that because of the holistic nature of God and His truth, most of these reasons are strongly interrelated and often difficult to clearly distinguish.

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*a More discussion on the non-physical nature of life is found in Chapter 2.*
BIOLOGY AND OUR PRIESTHOOD

Theologians have pointed out that humans have an important priestly function. There are similarities between the Garden of Eden as described in Genesis 2 and Ezekiel 28:13 and the future abode of believers described in Revelation 21 and 22 (e.g. gems, gold, tree of life, God living with man, no curse, and no death). Both heaven and Eden are specially designed as places where man and God were to live together.

There are also similarities between the Garden of Eden and the tabernacle built by Moses and the temple built by Solomon (e.g. cherubim, a single entrance, God interacting directly with man). Between the dismissal of humans from Eden and admittance of humans to heaven, the tabernacle and temple were to provide a picture of both Eden and heaven.

In both the tabernacle and the temple, God descended to earth to sit between the cherubim of the ark, and there to dwell among priests. These priests in Numbers 3:7-8 were called upon to ‘keep’ and ‘serve’ (Hebrew words šâmar and ‘âbad respectively). First, of course, they were to ‘keep’ or look out for the physical care of the temple. At the same time, however, these priests were called upon to maintain a pure relationship with God which would compel them to worship God. In this manner they were also to ‘keep’ the temple a place of continual worship. Furthermore, this relationship with God was to compel them to share that relationship with others, thereby cultivating a similar love of God in others. In this way they were to ‘serve’, or meet the spiritual needs, of the remainder of the people by bringing them into temple worship. And all this was to bring glory to God.

When God charged Adam (and thus all humanity) in Gen. 2:15, He used the same Hebrew words, to ‘dress’ (‘âbad) and ‘keep’ (šâmar) that He would use later for the temple priests. Man has been called upon from the very beginning to be a creation priest, or a priest of God in the creation. He is to preserve or care for the creation as the abode of God (as the temple priest was to care for the temple). He is to make it a place of continual worship by deepening his own relationship with God and using the creation as a stimulus to worship (as the temple priest was to do for the temple).

Finally, he is to serve others by bringing them into that worship (as the temple priest was to do for the people of Israel). In fact, man should bring the entire creation into the worship of its Creator. Towards that end, the study of biology can help a Christian be a better creation priest in at least three different ways.

Through Biology We Can Better Understand God. The more familiar a person is with an artist’s work, the more intimate is his understanding of the artist. A careful study of God’s handiwork (such as a careful study of organisms) has the potential of providing an intimate understanding of God Himself. This would be the case even if God was not trying to teach us about Himself. However, Romans 1:18-20 indicates that God

* Noting here that, tragically, because of man’s rebellion, some can come to an intimate knowledge of the creation, but reject its Creator (‘…the invisible things of Him from the creation of the world are clearly seen… so that they are without excuse… [But]…when they knew God, they glorified Him not as God…’: Rom. 1:20-21)
does intend to teach us about Himself. He carefully designed the physical world to provide physical illustrations of His invisible qualities and He carefully designed humans to recognize those qualities. The passage indicates that God reveals these truths to all people, even to unbelievers.

The Bible, especially as the Holy Spirit reveals its truths to believers, provides much more specific information about God than is revealed in His Creation. However, physical illustrations from the creation can help us understand abstract truths. Witnessing a pattern throughout the entire creation can also confirm and deepen our understanding of biblical claims. The deeper our understanding of God the more effectively we can fulfill our responsibilities as priests of the creation. A study of biology can thus deepen our understanding of God and help us be better creation priests.

_Through Biology We Can Better Worship God._ Once you recognize how a biological feature teaches something about God, I believe you will be forever changed. I pray that for the rest of your life, every time you see that biological feature you will be reminded of God.

Sometimes seeing such things can even cause us to spontaneously erupt into worship. Psalm 19:1-6, which begins with “The heavens declare the glory of God…,” is an example of the worship that David experienced in response to viewing God’s creation. In fact, following David’s example, there is a long tradition among the Hebrews and in the church to produce psalms, and hymns and praises to God based upon the creation. A few of many examples would include _All Creatures of Our God and King_ (1225 A.D.), “Fairest Lord Jesus, Ruler of all nature… Fair are the meadows, Fairer still the woodlands…” (_Fairest Lord Jesus_, 1677), “…There’s not a plant or flower below But makes Thy glories known…” (_We Sing the Greatness of Our God_, 1715), “…Birds in song His glories show…” (_I Am His and He is Mine_, 1876), “…When through the woods and forest glades I wander… Then sings my soul…” (_How Great Thou Art_, 1885), “All nature sings… This is my Father’s world…” (_This is My Father’s World_, 1901), “…Join with all nature in manifold witness…” (_Great is Thy Faithfulness_, 1923).

Once we learn to recognize how God shows Himself through His creation, the biological creation can be used to stimulate us to worship. Sharing these experiences with others, such as David did in Psalm 19, can then stimulate others to worship. As this text introduces biological illustrations of God’s nature, the author will be reminding you of the responsibility we have to respond in worship*. I hope that you are compelled to worship in response to first learning these things. Even more, though, I pray this begins a life-long experience of priestly activity—using His creation to worship our God and bringing others into that same worship.

_Through Biology We Can Better Glorify God._ God created the physical world for his own pleasure (Rev. 4:11). The chief end of man is to glorify Him (“…whatsoever you

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*This reminder to worship is found in multiple chapters under the ‘Our Responsibility’ section of each chapter.
do, do all to the glory of God”: I Cor. 10:31). One way a person can glorify God is by recognizing that a specific aspect of the creation was placed there as an illustration of His nature. God is further glorified when we share those truths with others. In short, as we fulfill our priestly function, we bring glory to God. Every time this text reveals how the biological world illustrates a characteristic of God, you will learn a tool for glorifying God that you can use for the rest of your life.

**BIOLOGY AND OUR KINGSHIP [ ▶ 1.5]**

We are not only priests, we are kings. Only after God created the sky, land, and sea (creation days 1-3a), then filled them with plants, lights, and animals (creation days 3b-6), did God create man. God then gave man ‘dominion’ over all the things that He had created (Gen. 1:26-28)—over the ‘birds of the air, the fish of the sea, the animals of the land, and over the earth itself’. The Hebrew words used in this passage translated ‘dominion’ and ‘subdue’ are words commonly used for kings. Psalm 8:4-8, understood by theologians to be an inspired commentary or elaboration on this passage, uses the word ‘crown’ (Psa. 8:5) and clarifies that that rule is over ‘all things’.

The New Testament commentary on this same passage, I Cor. 15:24-28, uses the words ‘kingdom’, ‘rule’, ‘authority’, and ‘reign”. God is certainly the One Who deserves to rule over the creation. After all, He is the Creator of all those things and the only One Who has absolute power over those things. Nonetheless, God chose man to be a ruler over the creation in His place.

God did not look at everything He had made and then determine which being would be most suited to be ruler. The “Let us make man…” statement in Genesis 1:26 indicates instead that He planned for humans to be rulers before He created them. This distinction is important because we are rulers according to divine appointment, not because of our ability. He designated us to be rulers then gave us the tools we would need to accomplish this task. We have no reason to boast of our role as rulers, for both the role and the abilities were given to us by God so that we can obey and glorify Him.

This also means that we fill the role of ruler even if we lack the ability (analogous to the case of a very young boy who becomes king over a country). Unfortunately, this also means that we *must* rule (we were made rulers—Gen.1:26—and we were commanded to rule—Gen. 1:28) and we *must* bear the responsibility of reigning, even if we turn out to be very poor rulers. The study of biology can help a Christian be a better ruler over the creation in at least three different ways.

*Through Biology We Can be Better Shepherd Kings.* So many rulers have so abused the authority given to them by God that many people cannot see kingship as something good. However, God’s standard of the ideal ruler is the shepherd king. God is

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*Some people feel that the Psalm 8 and I Corinthians 15 passages are only making reference to Jesus Christ. In Psalm 8:4, the ‘son of man’ probably has reference to Jesus Christ, but the passage revolves about the question ‘What is man that Thou art mindful of him?’—referring to humanity. Because humans failed in many of their tasks that God took on the form of man to fulfill those purposes. I Corinthians 15 is Jesus Christ’s fulfillment of the role God gave to man.*
described as the shepherd of Israel (e.g. Psa. 23:1; 80:1; Isa. 40:11), and Jesus calls Himself ‘the good shepherd’ (John 10:11-16). God commanded the rulers of Israel to rule as good shepherds over the flock of God (Ezekiel 34). Just as the shepherd is willing to lay down his life for his sheep, so the shepherd king is to promote his subjects over his own pleasure and desires. He is sensitive to, and meets the needs of, his subjects and at the same time is subject to God. The shepherd king serves both God and subjects. The shepherd king is one example of the servant leadership advocated throughout Scripture.

Consider that when people choose rulers, they tend to choose men who have somehow proved their power. The first king mentioned in the Bible, for example, was Nimrod (Gen. 10:10). The Bible describes him as ‘a mighty one on the earth’ (Gen. 10:8) and ‘a great and mighty hunter before the Lord’ (Gen. 10:9). Although people choose such ‘mighty men’ so that such a person will protect them, many of the same mighty men abuse their power for their own gain. Likewise, when Samuel was seeking to anoint a king over Israel, he thought he had found such a person in Eliab, the strong, first-born son of Jesse (I Sam. 16:6). However, God did not choose Him. God passed over the older, stronger-looking sons of Jesse and chose Jesse’s youngest son, the shepherd David. David had proven himself faithful to the care of his sheep and he had proven himself to have a heart for God (I Sam. 16:7).

We should follow the example of David as we rule over the creation of God. Rather than exploit, plunder, and abuse the creation for our own end, we should seek God with all our heart and serve the creation He created. We should rule over the creation as God would rule\(^1\). One evidence of God’s concern for the creation is the Sabbath rest He required the Israelites to provide to their land (“For six years you shall sow your land and gather in its fruits, but the seventh year you shall let it rest and lie fallow, that the poor of the people may eat; and what they leave the beasts of the field may eat. You shall do likewise with your vineyard, and with your olive orchard.”: Exo. 23:10-11, and similarly in Lev. 25:2-7).

It is instructive to note that God did not assign us to be rulers without giving us the ability to rule. As God created humans, He gave humans the authority and power to rule. That we have the power can be seen in the incredible ways in which humans have directly altered the creation. That we have the authority can be seen in the massive impact our sin has had on the creation. When Satan fell, there was apparently no change on the physical creation. The fall of man was another matter entirely. According to Romans 8:18-20, the pain, suffering, bondage, and corruption to which the entire universe is subject is a consequence of man’s sin. God cursed His own creation because of man’s fall. Then the sin of man in the days of Noah brought about a global flood that destroyed all living things found on the land. Even when we think

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\(^1\) It is common to say that we should not ‘play God’, and we should certainly not take a role God reserves for Himself or attempt to take such a role. However, God has called us—He has commanded us—to rule in His place, to act in His interest, and to rule as He would rule. If we do not do as God would have us to, then we are sinning against the Almighty God. There is a sense in which we must play God (i.e. rule as He has called us to, to act as He would act).
we are abdicating our responsibility to rule, we are still rulers. Our decisions—good or bad—substantially impact the creation.

In order to serve the creation most effectively we need to better understand it. If we do not know what plants need to thrive, or what critters need to stay healthy, or what the earth requires to best support the life on it, then we will do a poor job of caring for the creation. We will rule poorly even if we desperately wish to rule well. The more we understand the creation, the better we can serve it. The study of biology allows us to better understand the biological creation, and thus better rule over it. I pray that his text will encourage you to whole-heartedly serve God and rule over the biological creation more effectively.

*Through Biology We Can be Better Stewards.* As rulers over the creation, we are also called to be stewards. A steward in Scripture is placed in charge of someone else’s belongings (*e.g.* Gen. 44:2; I Chr. 28:1). Though he is not the owner, the steward is made ‘ruler’ over those things (Luke 12:42, 44). Since we do not own the creation that we rule over, we are stewards of that creation.

The steward over a household serves that household, paying employees (*e.g.* Mat. 20:8), providing for the needs of the people in the house (*e.g.* Luke 12:42), and taking care of visitors (*e.g.* Gen. 43:19, 24). The steward is given his responsibility for the purpose of serving others (I Pet. 4:10). A steward who abuses others or serves himself rather than others is specifically condemned (Luke 12:45). In both our roles—as shepherd kings and as stewards—we are expected to provide for the needs of the creation, serving the creation and not abusing it.

At the choice of the actual owner of the goods, stewards even enjoy the same kind of authority that the owner possesses. Biblical examples of stewards had the authority to buy and sell needed provisions (*e.g.* Gen. 44:1), the authority to capture thieves (Gen. 44:4-5) or release prisoners (*e.g.* Gen. 43:23), and the authority to renegotiate the debts of the owners (Luke 16:5-7). Likewise, God has granted us the authority over the creation to do with it as we like. At the same time, the steward was not to perform his own will, but the will of his master (Luke 12:45, 47). So likewise, we are to perform the will of God in the creation and not our own will. As in the case of our role as ruler, as stewards we are to oversee the creation *as God would.*

Finally, because the owner might ask for an accounting at any time, the biblical steward is to be ready at all times (Luke 12:43) to give an account of how well he has taken care of the owner’s possessions (I Cor. 4:1; *e.g.* Luke 16:1-2). Since Christ could return at any time, as stewards of His creation, we must be ready always to give an account of how well we have taken care of those things He made. Applying the *stewardship* principle to our role as rulers of the creation, we must realize that the authority we have over the creation is not something earned or even deserved but granted by God. So, it is something to be thankful for. We should care for the creation...
because it is not ours, but God’s. It was made for His pleasure and is His handiwork and we must treat it as important to God\(^a\).

We should realize that someday we will have to give an account of everything that we did, including our role as rulers over His creation. Did we rule over it as we were supposed to? Did we care for it as if it were important to God? We are rulers whether we like it or not, and if we do not rule well, or if we refuse to rule at all, we are subject to judgment. The more we learn about God and the biological creation the more we learn about how to be a good steward of the biological creation.

I pray this course will better prepare you for the Lord’s return by helping you care for His creation more effectively. As this text introduces biological illustrations of God’s nature, the author will be reminding you of the stewardship responsibility we have towards the biological creation\(^b\). I hope that through this, you will unite with others in the church in creating a more constructive perspective of creation stewardship than has been common in the past.

*Through Biology We Can Enhance Creation’s Glorification of God.* The parable of the talents in Matthew 25 introduces a concept too infrequently heeded by the church. In that parable (Mat. 25:14-30) the lord gave talents to three servants—or stewards. When the lord returned after a time he rewarded those who invested and increased their talents but condemned the servant who did not take a risk and merely preserved the talent he was given. It seems that the lord expected each servant not just to keep what he had, but also to take some risk and work hard to use the talent and multiply it. The lesson we get from this is that God desires for us to take those things which we have been given and *increase or enhance* them.

As rulers and stewards, we have been given charge of the creation. Applying the principle of increase or enhancement to our role as stewards and rulers, we are not just to preserve the creation, we are to take some risk and work hard to increase or enhance the creation. How do we do that? God created to bring glory to Himself, and it is the purpose of man to glorify God (I Cor. 10:31). Consequently, the creation is increased or enhanced when it brings God more glory. We glorify God as we fulfill our priestly responsibilities (*i.e.* as we recognize the illustrations of God’s nature in His creation, worship God as a result, and bring others into that worship). But we can *increase* the creation’s glorification of God if we can increase how much glory the creation actually brings to God.

The good ruler *enhances* the creation. He brings out more evidence of the nature of God so as to reveal more and more of the glory of God. At first thought this would seem impossible. God created the world to bring glory to Himself. Can man even think to make the world better than God created it? Actually, we can, *if* God created it in such a way that we could. And He did. God revealed many illustrations of His nature in the creation, but it seems that he hid even more. God glorified Himself in

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\(^a\) God is not said to ‘love’ His creation (His love seems to be reserved for fellow members of the Godhead and His children, *i.e.* humans), but as His creation and possession, He certainly values it.

\(^b\) This reminder of creation stewardship is found in the ‘Our Responsibility’ section of multiple chapters.
the creation but included in that same creation the potential for even more glory. And He gave humans the ability to reveal that hidden potential and thus increase or enhance the glory that creation brings to God.

This may be analogous to parents who wrap gifts for their children, enjoy their children’s excitement as they unwrap the presents, and revel in the thanks their children give them with the receipt of the gifts. It is as if God wrapped gifts of His glory for us to reveal, and God enjoys our excitement as we unwrap the gifts and He revels in the thanks we give Him for those gifts. Through biology we can discover the potential—the gifts of glory—God hid in the biological creation and find ways to reveal it. In our role as rulers, we can enhance the biological creation to the increased glory of God. As the text introduces more ways to enhance the attributes of God in the biological creation, I pray that you will learn how to glorify God more effectively.

**BIOLOGY AND OUR IMAGE** [1.6]

Humans were created as the image of God (Gen. 1:26). We are not to make images of God (Ex. 20:4) because God has already made images of Himself, and they are us! From before the creation of the world, God planned a physical representation of Himself in the world. This representation was not to look like God, for God is spirit and not physical. In a certain sense this representation was not even to have God’s attributes, because God is infinite and any created being could at most only have a tiny, limited measure of any of His attributes.

Rather, humans were to be His representation because God declared them His representation. As in the case of our rulership status, our image status is not because we deserve it, but because He decided to make us His image. He did in fact grant us some tiny measure of His attributes, but only so that we could better image Him—so that we could bring more glory to Him. Just as a king of Egypt might design a ring to represent his power or have a statue or a building constructed to represent his person or kingdom, God designed and fashioned humans to be a representation of His person, kingship, and kingdom. We have the status of image whether we’re a good image or a bad one, and whether we want to be an image or not. Nonetheless, it would be better if we imaged Him well. The study of biology can help a Christian be a better image of God in at least three different ways.

Through Biology We Can Better Care for Our Bodies. Because God is spirit we cannot ‘look’ like God, but our bodies are visual representations of God, nonetheless. The way in which we appear to others is the representation of God we offer to them. For as long as we are alive and in whatever we do, we are a visible representation of God. This is reason enough for humans to care for their bodies, so as to illustrate God well. For believers, however, there is an additional reason. The body of a believer is also

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1 Specific suggestions on how to enhance the creation for the glory of God are provided under the ‘Our Responsibility’ section of multiple chapters.
home to the Holy Spirit—thus the very temple of God (I Cor. 3:16-17; 6:19-20; II Cor. 6:16).

If God lived in a particular building we would take great care to see that that building was well cared for. In fact, God does live in a building—not one built by human hands—but a building God created: the body of the believer. Christians should take great care to see that their bodies are well cared for. Biology gives us insight into the workings of our bodies. The more we know about our bodies, the better we can maintain our bodies and care for the temple of God. Although the structure of the human body is not the focus of this text, I pray that what is said about the human body will help you better maintain the temple He has given you. In this way you can better image God.

*Through Biology We Can Make Better Ethical Decisions.* As the image of God, Our bodies are a physical representation of God. At the same time our decisions are a moral representation of God. We are to do right—to make the decisions that God would make. To be the best possible image of God, we should be perfect as He is perfect. So we are commanded (e.g. “Be holy, for I am holy”: Lev. 11:45 & I Pe. 1:15-16; “…let us …perfect holiness…”: II Cor. 7:1).

Part of that command to be perfect is fulfilled as we stop wrongdoing and do the right things instead. Yet, to do right in a given situation we need to understand enough about the situation to understand what is right and wrong. For example, if a person does not know that most IVF (in-vitro fertilization) procedures involve abortion, he or she may think that all IVF procedures serve only to promote life. Do the different birth control methods differ in ethics, or risk of abortion, or danger to the body? What about genetic engineering, or cloning? Are some methods displeasing to God? Are some honoring to God? Human technology permits us to do things we never dreamed of before, and human technology of the future will allow us to do even more. Which of these things are right and which are wrong? What about the changes in global climate, pollution, extinction, and human population? Which should be stopped and which should be allowed to continue? And what is the best way of doing what is right?

Learning biology and the language of biology can help us to know what is right and wrong in a host of bioethical situations. Biology can help us obey God’s command to do what is right, and thus be better images of God. I pray that the ethics comments scattered through the text will help you to be holy as He is holy.

*Through Biology We Can Learn to Respect God’s Word Over Man’s.* We have been commanded to worship God and only God (e.g. Exo. 20:3-6), and we are to fear God and only God (Deu. 13:4). We are not to worship or fear the creation, we are not to worship or fear the idols that we make, and we are not to worship or fear other humans. In part this is because we are the image of God. It would not be appropriate for God to worship or fear anything He had created, so it is not appropriate that His image should be seen worshiping or fearing anything God created. Our awe and worship should be directed only towards God.

Down through the centuries, a number of challenges to Christianity and the Bible have come from the field of biology. Even many Christians have listened to the critics
rather than God. As a result, they have questioned Christianity, they have doubted God, and they have questioned God’s word. And this is within the ranks of Christianity! Such things should never happen. The conclusions of science are tentative truths, and this can be demonstrated by a study of science. God’s Word carries more weight than biological challenges to it, and this can be demonstrated by a study of biology. For example, because biological evolution is a substantial challenge to Scripture in our day, critiques of evolutionary theory are found throughout the text. I pray these critiques will encourage you to embrace the claims of God over the claims of man, and thus better image God. I also pray that the overall effect of this course would lead to the strengthening of your faith, and that you would wholeheartedly embrace the claims of Scripture, becoming thereby immune to any efforts to undermine the authority of the Bible.

**BIOLOGY AND OUR SERVICE TO OTHERS**

To a large extent, the reasons for studying biology that we have considered so far are a fulfillment of the first great commandment (Mat. 22:37-8). As we function as priests and kings of the creation and images of God, we love the Lord our God with all our heart, soul, and mind. The second commandment is to love others (Mat. 22:39). The study of biology can help a Christian better minister to the needs of others in at least three different ways.

*Through Biology We Can Better Meet the Physical Needs of Others.* One of the ways we love others is by serving them (Gal. 5:13-14). Studying the biological world has the potential of providing knowledge which we can use to meet the needs of others (e.g. to treat disease, provide food crops, and advise in bioethical dilemmas). An accurate understanding of the human body can allow a better understanding of the physical responses and needs of others. Even an understanding of the theories of science which oppose Scripture can permit us to more effectively minister to those who accept those theories. I pray this course will improve your overall ministry to others, and thus allow you to better obey the second great commandment.

*Through Biology We Can Better Meet the Spiritual Needs of Others.* Rom. 1:19-20 tells us that God uses His creation to introduce Himself to humans. If God can use His creation to illustrate Himself to humans, we should be able to use His creation to lead unbelivers to Him and believers closer to Him. As we learn more about the creation, we should be able to discover more ways to share God with others. At the very least, an understanding of science will broaden and round a person’s general knowledge, which in turn will allow discussion of a wider range of topics with others.

Learning biology should provide more opportunities for common ground in discussions and should make the Christian a more interesting person to others. And, as we become familiar with more biological illustrations of God’s attributes we also learn more ways to introduce God to others. In this fashion, a study of biology can help us better love others by ministering more effectively to their spiritual needs. I pray that this text increases the effectiveness of your own evangelistic efforts.
Through Biology Christian Biologists Can Be Salt and Light to Other Professionals. Unbelievers everywhere need a Christian example. Christians are called upon to be salt and light in our world (Mat. 5:13-16) and to evangelize the world (Matt. 28:18-20). In whatever profession, in whatever position (e.g. friendship), with whatever authority (e.g. advising or voting) that believers possess, believers should introduce the world to the Gospel, a Christ-like lifestyle, and to Biblical morality and ethics. Unbelieving scientists, for example, need the testimony of believers. God has called some of his children to pursue the science of biology and be the salt and light that that discipline needs. I would be thankful indeed if this text were to stimulate someone to follow God’s calling into professional biology.
SUMMARY OF CHAPTER

- By His very nature, God is undetectable and unknowable. However, God wishes for us to know Him, so He condescended and created the physical world full of physical illustrations of His nature.

- For the creation to illustrate the invisible attributes of God, the universe and man had to be created with certain 'knowability traits'.

- The 'knowability traits' of the creation include:
  - The physical world
    - exists;
    - is ordered;
    - has an order simple enough for us to understand;
    - For every physical world event there is a cause;
  - The regularities of the creation
    - can be detected and understood in a single human lifetime;
    - are consistent across the entire universe for all time;
    - are ultimately unifiable;
  - Human
    - senses are reliable;
    - brains are complex enough to understand the order of the creation;
    - language (including mathematics) is capable of describing, understanding and teaching about the creation;
  - Truth and understanding can be gained by studying the creation;
  - There is intrinsic value in studying the physical world; and
  - Truth can be advanced by a continual study of the creation.

- These 'knowability traits' of the universe not only seem to be true, but they are readily explained by the Christian worldview (and no other worldview).

- Since modern science assumes all the 'knowability traits' of the creation to be true, modern science was birthed in—and probably could only have been birthed in—a Christian worldview of the creation. The success of science is implicit confirmation of the truth of the biblical worldview.

- Modern/Natural/Pure science
  - is difficult to define and impossible to define precisely because 1) the word 'science' refers to several very different things; 2) so many different kinds of
people do science and so many different things are studied by science, and 3) scientists are held in high regard, so people have distorted the meaning of science to make themselves look better or to make others look worse.

- is not defined by a ‘scientific method’ (because there is no single method used throughout all of science) and is not associated with proof (because theories of science cannot be known with certainty).
- is something humans do (a ‘verb’; a distinctively human activity, done by fallen, biased humans) to understand the physical world (science’s purpose is non-pragmatic; science’s object is the physical world) by proposing tentative truths as theories of explanation (scientific theories are suggestions of understanding that can never be proven) and valuing fit with the physical world (science’s standard of truth is the physical world).
- prefers theories that 1) explain more of the physical world, and/or 2) have more often been successfully compared with the physical world, and/or 3) fit better with other accepted theories, and/or 4) have fewer mismatches with the physical world, and/or 5) stimulate more science.

- Biology is a science that studies organisms.
- Humans are to serve as priests of the creation by (1) caring for the creation and using the creation to (2) better know God, (3) worship God and (4) bring others into the worship of God. It is good that all Christians study biology so that the believer can be a better priest of the creation by (1) learning enough about the creation to take better care of it, and (2) becoming familiar with more illustrations of God’s nature so to (2a) deepen the believer’s understanding of God’s nature, (3) stimulate the believer into worship of God, and (4) give us opportunity to glorify God before others and include them in the believer’s worship of God.
- Humans are to rule as kings over the creation, (1) looking out for the best for the creation, all the while (2) ruling as God would rule, accountable (as stewards) to God for our actions, and (3) searching for ways (as stewards) to further enhance the glory of God in the creation. It is good that Christians study biology so that the believer can be a better ruler over the creation by (1) better understanding the creation so that the believer can better care for it and protect it (as a shepherd king), (2) learning more about God through the creation so that the believer can better rule over it as God would (as a steward), and (3) discover and reveal illustrations of God’s nature that God hid within it, and thereby enhance the glory of God in the creation (as a good steward).
- Humans are the image of God because God declared us His image. It is good that Christians study biology so that the believer can image God better by learning (1) how to take better care of the believer’s body (as the temple of the
Holy Spirit), (2) how to make better ethical decisions, and (3) how to respect God’s word over man’s.

- Christians are to serve others. It is good that Christians study biology so that the believer can better serve others (1) by learning things about the human body and organisms that interact with it to allow the believer to better meet the physical needs of others, (2) by learning illustrations of the nature of God that allow the believer to better meet the spiritual needs of others. The believer can even (3) pursue biology professionally and thereby introduce other professional biologists to God.

**ADVANCED DISCUSSION TOPICS**

A. There was a period of time when it was popular to derive spiritual truths from the creation (described by some as ‘spiritualizing’). Most historians of both science and the church look uncharitably on this period, considering the entire endeavor not only a failure but also wrong-headed. What was wrong with this approach? How is spiritualizing different from the approach of this text (in finding illustrations of divine attributes in the creation)? What safeguards should be followed to avoid the same mistakes? Things to consider: compare and contrast the direction of inference (theology to creation vs. creation to theology); compare with proper and improper methods in the analogous project of biblical typology; and observe where Scripture is explicit vs. non-explicit.

B. Modern science was apparently not invented for the first 6000 years of human history. Why was modern science not invented until then? Things to consider: the socio-economic conditions that would support full-time jobs for people who do nothing useful, but merely study the creation; the importance of widespread literacy/higher education; and the relationship between the presuppositions of science and cultural/religious worldviews.

**POTENTIAL TEST QUESTIONS**

1. Define the physical world / non-physical world / scientific theory / science / knowability traits / biology.

2. Compare and contrast physical and non-physical / natural science and applied science / popular and biblical understandings of kingship / stewardship and dominion.

3. According to Romans 1:20, what is one of the ways that God reveals Himself?

4. Short Essay: Explain how Romans 1:20 / God’s creation of illustrations logically leads to [any one of the ‘knowability traits’ of the creation]

5. Short Essay: Explain how [the understandability of the universe / the knowability of universe regularities in one human lifetime / the consistency of universe
regularities in space and time / the unification of universe regularities / the adequacy of human language to describe, understand, and teach about the universe / the close approximation of the universe by mathematics] is not expected in naturalism.

6. Essay: Explain how a Christian worldview [leads to the 'knowability traits' of the creation / provides philosophical foundation for the presuppositions of science].

7. Short Essay: Explain why science is so hard to define.

8. Who does science? / What is the purpose of science? / What does science study? / What does science use as a standard of truth?

9. Short Essay: What does it mean to say that scientists often understand science to be a verb?

10. Short Essay: Can science be used to study God / angels / the soul / the human spirit? Why or why not?

11. Short Essay: Comment on the statement ‘Science gave us the light bulb and computers and automobiles and planes’.

12. Short Essay: What does it mean to say that a scientific theory is tentative truth / possible truth? / What does the statement 'In science you can never know for sure” mean?

13. Short Essay: Comment on the statement ‘Science has proven [insert any claim here]’.

14. List two different ways in which one scientific theory may be preferred over another.

15. What is the popular definition of biology and what is wrong with that definition?

16. The popular definition of biology is acceptable in what worldview? / Short Essay: In what worldview is the popular definition of biology unacceptable, and why is it unacceptable in that worldview?

17. List two evidences that suggest that life might not be physical.

18. Short Essay: Why is it that biology may not be able to study life? / Why is it ironic that biology may not be able to study life?

19. Essay: How would you explain to a Christian who is not majoring in science and dislikes science why he or she should take a course in biology?

20. Essay: If science merely seeks to understand the physical world, rather than produce something of value to humanity, what use is there in studying the physical world?

21. Essay: What does it mean to say that we are priests / kings, and what does that have to do with biology?
22. Short Essay: How can we use biology to know God / to glorify God / to worship God?

23. Short Essay: How can we use biology to be better kings / to be better stewards / to better execute dominion?

24. List two different ways that we can glorify God.

25. Short Essay: If God created the creation to glorify Himself, how do we increase God’s glory in the creation?

26. Short Essay: How can we use biology to better care for the temple / to do right / to not fear man?

27. Short Essay: Why should we take care of our bodies?

28. Short Essay: What does it mean to say that many Christians fear science, and why should we not fear science?

29. Essay: How can we use biology to obey the second greatest commandment? / Short Essay: How can we use biology to be salt and light / to witness to others / to minister to others?
CHAPTER EIGHT: THE SUSTAINING GOD

"Consider the lilies of the field... even Solomon in all his glory was not arrayed like one of these... if God so clothes the grass of the field... will He not much more clothe you...?" (Matt. 6:28-30, NKJV)

GOD IS SUSTAINER [ 8.1]

After God provided a ram so that Abraham would not have to sacrifice his son, Abraham called that place Jebusab-jireb, which is Hebrew for ‘God is provider’ (Gen. 22:14). A God of love is a God Who provides, not only the requirements needed for life in the first place, but also those things needed for life every day. To assure us that God takes care of our physical needs, Jesus pointed out that God provides for the ongoing physical needs of plants and animals (Matt. 6:25-33).

God upholds all things (Heb. 1:3), preserves all things (Neh. 9:6; Psa. 36:6), and by Him all things consist and hold together (Col. 1:17). God is responsible for weather\(^a\) and the rising and setting of the sun (Psa. 104:19-20; Matt. 5:45). He creates the life of each individual sea animal (Psa. 104:29-30), He is responsible for animal instincts (Job 39:26-30), He makes plants to grow (Psa. 104:14-17; 147:7-8; Matt. 6:28-30), and He provides food for animals of the sea (Psa. 104:25-28), the air (Job 38:41; Psa. 147:7-9; Matt. 6:26), and the land (Job 38:39-40; Psa. 104:21; 147:7-9).

PROVISION AND THE BIOMATRIX

In the last chapter we examined features of the non-biological world that make it possible for organisms to exist. In this chapter we will examine ways in which God designed the biological world to provide for the ongoing, daily needs of plants and animals. Animals require food and other nutrients that are not found in the right form in the non-biological world. In the case of the land animals, most of that food and many of the nutrients are provided by plants (Gen. 1:29-30).

However, even the plants need nutrients that are not supplied in usable form by the non-biological world. So, even with all the AP characteristics of the universe in place, plants and animals still could not exist on the earth by themselves. To make life possible for plants and animals, and to further illustrate His attribute of love, God created a complex network of unnoticed organisms (called a biomatrix or organo-substrate\(^b\)) that provide what animals and plants need to exist.

\(^a\) God is responsible for springs (Psa. 104:10) as well as the evaporation of water (Psa. 135:5-7), the formation of clouds (Job 37:10-11; Psa. 147:7-8), thunder & lightning (Job 37:5; Psa. 135:5-7), wind (Psa. 135:5-7), and the dropping of frost (Job 37:10), snow (Job 37:5-6) and rain (Job 5:10; 37:5-6; 38:36; Psa. 147:7-8; Matt. 5:45).

\(^b\) The word ‘biomatrix’, suggested by Joseph Francis, is derived from the Greek word bios meaning life (both because it is necessary for animal (and plant) life and because it is made up of biologically living organisms) and ‘matrix’ (both because it is a rather complex system of organisms and because it is an unnoticed basis of the reality—as the ‘matrix’ was, as in the 1999 American-Australian science fiction action film ‘the Matrix’). ‘Organo-substrate’ is derived from ‘organic’ (both because it is part of carbon-based or organic life and because it is necessary for the existence of
Many of the biomatrix organisms are unnoticed because they can only be seen with a microscope: the bacteria (sing. bacterium), most of the algae (sing. alga), and most of the protozoa (sing. protozoan). Other biomatrix organisms (the fungi and the remainder of the protozoa and algae) are large enough to be seen (including the largest organisms on this planet), but are rarely seen because they live in places we do not frequent, or appear at times we normally do not observe, or stay inside other things for most or all of their life.

At this point, we know relatively little about the biomatrix. We have only begun to study this long unnoticed part of biology. Let us spend a little bit of time considering this critically important part of the biological world.

**FOOD PROVIDERS**

All biological organisms need energy to do what they do. Many organisms—including all animals, fungi, protozoa, and some bacteria—get that energy from food (energy-containing molecules formed by other organisms). The energy is first put into organic molecules by producers, organisms specially designed for that purpose. These molecules then become food for all other organisms (the consumers). Organisms of the biomatrix play a very important role in providing food to many of the animals of the world, especially those in water environments.

*Producers in Water Environments.* The main producers on the land are plants. All other producers (the algae and some of the bacteria) are part of the earth’s biomatrix. Some algae and photosynthetic bacteria produce on the land what the plants do not. The remainder of the algae and photosynthetic bacteria are the main producers for the streams, lakes, and oceans of the world. There are thousands of species of algae and thousands of species of photosynthetic bacteria in an amazing variety of forms—a vast percentage of which are microscopic.

As in the case of plants, algae and photosynthetic bacteria construct organic molecules by the process of photosynthesis (Greek words phōs, ‘light’, + synthesis, ‘putting together’). One group of algae, the green algae, are green because they collect energy from the same colors of sunlight that plants do. Other algae and photosynthetic bacteria use different pigments to absorb different colors of sunlight. Consequently, they display different colors and are often named accordingly (e.g. ‘red algae’, ‘brown algae’, ‘golden algae’, ‘yellow-green algae’, ‘cyanobacteria’, ‘purple bacteria’).

*Producers in Extreme Environments.* Plants, algae, and photosynthetic bacteria produce almost all the food needed by the consumers of the world, but not quite all.

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carbon-based plant and animal organisms) and ‘substrate’ (because it is the substrate or ground or foundation for animal and plant life).

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* Some fungi in the soil and some algae in the sea are spread over square miles of earth surface, and are in the running for the largest individual organisms on the planet.

* Although nearly all plants are producers, there are a very few plants that are not (such as the Indian pipe, *Monotropa uniflora*).

* As in the case of plants, although nearly all algae are producers, a few species are not.

* All bacteria, and all but a few species of algae (e.g. the kelp and seaweeds) are microscopic.
There are some environments where plants, algae and photosynthetic bacteria cannot live, and where their energy-containing organic molecules cannot reach.

Algae and photosynthetic bacteria, for example, cannot perform photosynthesis without light, so cannot live their entire life in the soil or in rocks, inside organisms, or in deep water where light cannot penetrate. They also cannot live in ‘extreme’ environments—namely wherever there is too little water or where there are too few nutrients, or wherever temperatures are too hot or too cold, or wherever the pH is too high or too low, or wherever the salinity is too high, or wherever the pressure is too high.

All the producers of these extreme environments are members of the biomatrix. Lichens, for example, are the main producers in land environments where nutrients are hard to find or water is in short supply. The fungi that make up lichens are capable of absorbing nutrients when there are not enough of them to support plants, and capable of pulling water out of the air—even the dry air of deserts. The algae or photosynthetic bacteria that cooperate with the fungi to make up the lichens produce the energy-containing organic molecules needed by both organisms. The producers in most other extreme environments are bacteria—each specially designed to live in a particular kind of extreme environment.

In extreme environments where light is absent, producers construct their molecules by the process of chemosynthesis. Rather than using light energy, chemosynthesis uses ‘chemo’, or chemical energy, to synthesize energy-containing organic molecules. Around hot springs on the bottom of the ocean, for example, chemosynthesizing bacteria are producers for a fairly diverse group of animals, including tube worms, shrimp, crabs, fish, and octopuses. Chemosynthesizing bacteria often inhabit environments where no other organism can survive.

In Yellowstone National Park, for example, the waters flowing out of hot springs support a fairly diverse community of biomatrix organisms, creating, in turn, the beautiful colors seen in Yellowstone hot springs. In the extremely hot water at the source of the springs, the producers are chemosynthesizing bacteria that thrive in hot, near-boiling water. In the progressively cooler waters found at progressively greater distances from the springs, the producers are photosynthesizing bacteria and algae.

Other chemosynthesizing bacteria are designed to thrive in very acidic (low pH) environments. Others still live in very alkaline (high pH) environments. Others live in very salty environments—some planted directly on crystals of salt! Still others live miles beneath the surface under the extreme pressures that are caused by miles of overlying rock.

First consumers. Plants come in such a wide variety of sizes that nearly every size of land animal has a suite of plants that they can consume directly. Most of the biomatrix producers, on the other hand, are too small to directly provide food for animals. For example, most of the animals of the water environments of the world are fed actually fed by protozoa. Protozoa are biomatrix consumers that eat the tiny food particles produced by smaller bacterial producers, and in turn, become the food for progressively larger animals.
BREAK DOWN MOLECULES

Producers use energy from their environment to build energy-containing organic molecules. The energy stored in these molecules can be extracted by breaking them back down again. In fact, the breaking down of energy-containing organic molecules is how consumers get their energy, including many of the organisms of the biomatrix.

**Digestion.** Animals must consume food (energy-containing molecules) to survive. Animals digest the food by breaking down molecules into simpler molecules. However, not all the food that animals consume can actually be digested by those animals. To help animals with digestion, an entire community of bacteria and fungi inhabit the digestive systems of animals—perhaps all animals. It is this gut flora† that is largely responsible for the digestion of grass in ruminants like cattle and for the digestion of wood in termites. The gut flora in humans may involve hundreds of species and include 100 trillion individuals—more than ten times the total number of human cells in the human body. Without biomatrix organisms that help in digestion, most animals would not be able to survive.

** Decomposers.** When an organism dies, it is important that the body of that organism be broken down (decomposed) into the simple molecules from which it was constructed. There are a couple reasons for this. First, if bodies were not decomposed, we would quickly find ourselves walking on a very deep pile of dead bodies. Second, if organic molecules were not returned to the molecules from which they were made, the earth would run out of these molecules.

Decomposition cleans the earth of dead bodies and dangerous wastes and replenishes the supply of nutrients needed by the earth’s organisms. Almost all decomposition is done by bacteria and fungi of the earth’s biomatrix. Without biomatrix decomposers the earth would be polluted with dead bodies and waste, and organisms would run out of nutrients.

CONVERT MOLECULES

**Fixation.** A number of elements are needed by organisms (e.g. oxygen, carbon, hydrogen, nitrogen, calcium, phosphorus, potassium, sulfur, sodium, chlorine, magnesium, boron, cobalt, copper, fluorine, iodine, iron, manganese, molybdenum, selenium, silicon, zinc). Outside of organisms, each of these elements is available in one or more inorganic forms.

The most common elements of life are found in the atmosphere: oxygen in the form of oxygen gas (O₂), water in the form of water vapor (H₂O), carbon in the form of carbon dioxide (CO₂), methane (CH₄), hydrogen in the form of hydrogen gas (H₂), and nitrogen in the form of nitrogen gas (N₂). Most of the remaining elements are found in minerals in rocks. In the case of most of these elements, the natural, inorganic

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† When first discovered, microscopic organisms were classified among the ‘plants’. The plants living in a particular area were known as the ‘flora’ of that area, so the microorganisms of the stomach and intestines of animals were referred to as the ‘flora’ of the gut, or ‘gut flora’. 
form is not in a form that can be easily used by organisms. Most of the molecules have to be broken apart to release the needed elements, and some of the bonds are extremely difficult to break. In the case of several of the elements, even the atoms have to be altered by taking away or adding electrons.

If the inorganic form of an element has to be substantially changed for it to be usable by organisms, it is said that the element must be fixed. The process that accomplishes the ‘fixing’ of that element is called fixation. The element carbon, for example, must be fixed to take it out of carbon dioxide and construct organic molecules from it. Almost every organic molecule is storing more energy in its bonds than carbon dioxide, so building organic molecules from carbon dioxide is a rather difficult process that requires considerable energy. Certain organisms had to be provided with rather complex designs in order to fix carbon. In plants, algae, and photosynthetic bacteria, for example, carbon fixation has been designed as part of the process of photosynthesis. In fact, carbon fixation is a process God designed into all producers, whether they build their organic compounds by photosynthesis or chemosynthesis. Consequently, much of the carbon fixation that occurs on the earth is performed by algae and bacteria of the biomatrix.

Another life-essential element that requires fixation is nitrogen. With 81% of the earth’s atmosphere made up of nitrogen gas, nearly every organism on earth has easy access to inorganic nitrogen. Very few organisms, however, can use this form of nitrogen. Each particle (molecule) of nitrogen gas is made up of two atoms of nitrogen bound together by one of the strongest chemical bonds known. Because it is very difficult to break that bond, nitrogen gas does not enter into very many chemical reactions.

On the one hand, this makes nitrogen gas a great choice for making up most of the atmosphere. On the other hand, it is difficult to separate the nitrogen atoms so that they can be used by organisms. Extremely hot fires and billion-volt lightning bolts are some of the very few things outside organisms that can break these bonds. To make nitrogen available to organisms, nitrogen must be fixed. The only organisms capable of nitrogen fixation are some bacteria in the biomatrix known as nitrogen-fixing bacteria.

The inorganic form of a majority of the life-essential elements is available only in rocks. In several cases (such as for molybdenum) the element is found in very low concentrations, even in rocks where it is most abundant. In rocks, the element is often available in parts per thousand or parts per million. For any of these elements to be used by organisms, it must somehow be mined from the rocks.

In the case of a couple of the elements, bacteria have been discovered that mine that element from the rock. In each case a special type of bacterium living in water releases a molecule into the water that ‘lands’ on the rock surface and bores into the rock until it encounters an atom of that element. It then jettisons a portion of the molecule attached to the element into the water to be picked up by the mining bacterium. It is likely that for each of the elements necessary for life that is found in
minerals, there is at least one bacterium species of the biomatrix that is designed to
mine that element from rock and fix it for use by organisms.

Remediators. Bacteria of the earth’s biomatrix also work at keeping the earth safe for
life. There are times when organisms release waste that is unhealthy for other
organisms. There are other times when non-biological processes like volcanoes, hot
springs, and storms expose organisms to dangerous substances that have been buried
in the rocks of the earth. Our experience is that if we wait long enough these dangerous
substances disappear. Closer examination usually reveals that there is a particular
bacterium that transforms that dangerous substance into something that is not
hazardous to other organisms.

It would appear that for each dangerous substance that might appear in the world,
God designed a bacterium to remediate—to take the toxicity out of dangerous
molecules. Thus, some of the biomatrix bacteria have been created for the purpose of
bioremediation. As in the case with other aspects of the biomatrix, we are only just
beginning to learn about bioremediation. New bacteria are being discovered all the
time that make toxins non-toxic, place radioactive elements in safer molecules, etc.

PROVIDE NUTRIENTS

Develop Soil. “Every spoonful of garden soil contains some $10^{10}$ bacteria...”—that
is 10 billion bacteria! What many of those bacteria are doing—in a non-stop fashion,
24 hours a day, 7 days a week, 365 days a year—is generating nutrients that plants need
to survive. Fixers are putting needed elements into forms the plants can use, decomposers are breaking down dead plant and animal material for re-use by the
plants, and bioremediators are making dangerous molecules safe.

Most plants require soil to thrive and biomatrix bacteria are mostly responsible for
making soil ‘fertile’. That is why when a sterile landscape is formed—such as after a
very hot fire or after lava flows across the earth’s surface—bacteria are the very first
organisms to inhabit that landscape. They immediately begin the process of building
soil so that plants can eventually thrive in that area.

Feed and Water Plants. The role of the biomatrix organisms does not end with
creating the nutrients. Some organisms of the biomatrix also deliver the nutrients. In
the case of trees, for example, studies indicate that tree roots alone are not capable of
absorbing water fast enough to supply the needs of the tree. Closer examination reveals
that the roots of the tree are not alone. Fungi have been discovered to be associated
with the roots to help in absorbing the needed water and nutrients. These fungi are
called mycorrhizal fungi (Gk. mykōs, ‘fungus’ + riza, ‘roots’). Fungi have been
specially designed by God to be more effective at pulling substances into their bodies
than any other kind of organism.

Combined with the absorbing ability of the plant roots, mycorrhizal fungi can, in
fact, absorb enough water and nutrients to supply the needs of even the very largest
trees. Research suggests that these fungi may be used by all woody species of plants,
and perhaps by a vast majority of all plants.
Vitamin Source. Biomatrix bacteria also produce vitamins that are necessary for the health of plants and animals. Vitamin B₁₂, for example, cannot be produced by any animal or plant—it can only be produced by biomatrix bacteria. In humans, bacteria in the large intestine produce Vitamin K and Vitamin B₇ (also known as biotin or vitamin H).

PROTECTION

To keep them healthy after the Fall, God designed organisms with rather complex systems of protection from pathogens. Part of this involves keeping the pathogens from getting into an organism’s body. This includes surrounding organisms with tough coverings that are hard for pathogens to get through. But it also includes planting friendly microorganisms on the outside of those tough coverings so that pathogens are prevented from living on those coverings. Being microscopic, these friendly microorganisms are part of the biomatrix, and created to protect larger organisms. Humans, for example, have a skin flora designed to provide our first line of defense against disease.

BIOGEOCHEMICAL CYCLES [ ▶ 8.2]

As mentioned already, a whole suite of elements is necessary for biological life to survive on earth. 98% of the bodies of organisms are made up of oxygen, carbon, hydrogen, and nitrogen. Despite the rarity of the remaining elements, biological life cannot exist without a number of them, including (in alphabetical order) boron, calcium, chlorine, cobalt, copper, fluorine, iodine, iron, magnesium, manganese, molybdenum, phosphorus, potassium, selenium, silicon, sodium, sulfur, and zinc. Many of these elements have to be provided to organisms on a continuous basis, to build growing bodies, to repair damage, and to replace worn out parts.

Furthermore, God originally intended His creation to persist indefinitely. It would seem that God created processes to supply His organisms with a continual supply of these life-necessary elements. Similar to the water cycle that was created by God to make water continually available, God also created a biogeochemical cycle for each element needed by organisms. Each biogeochemical cycle is a cyclical process so that the element is always ‘in stock’. Most of the biogeochemical cycles include a reservoir or sink for storing the element so that there is enough to provide all the organisms with the element.

As noted above, the common form of many of the elements needed by organisms are not usable by organisms. So, for many of the biogeochemical cycles God has designed biomatrix organisms to fix the desired element so that organisms can use it. Once the element is fixed, it is usually picked up first by producers and then passed on through consumers to all the remaining organisms. And, for many of the biogeochemical cycles, there is another set of biomatrix organisms designed to return the element to the reservoir.
Consequently, biomatrix organisms play critical roles in most of the biogeochemical cycles. Without those tiny organisms, life would run out of the elements they need to survive—either because the reservoirs would empty or because we would be unable to get the element out of the reservoir... or both. And, once again, as with other aspects of the biomatrix, our understanding of the biogeochemical cycles is incomplete. We are learning more about them every day. A few of the better-known cycles are summarized below.

The Carbon Cycle. Carbon is the backbone of every organic molecule, so organisms cannot exist without it. Of all the places where inorganic carbon is found, only a very small percentage is in the form of carbon dioxide (CO$_2$) gas in the earth’s atmosphere.

In fact, even there, carbon dioxide only makes up about 0.04% of the atmosphere. Yet, it is atmospheric carbon dioxide that is the inorganic source of almost all the carbon found in organisms. So, CO$_2$ in the atmosphere is the reservoir for the carbon cycle. And, as noted above, carbon cannot be used by many organisms in the form of CO$_2$. Carbon is one of the elements that has to be fixed so that it can be used.

God created producers to use carbon fixation to develop organic molecules—either as part of photosynthesis in plants, algae, and photosynthesizing bacteria, or as part of chemosynthesis in chemosynthesizing bacteria. Consumers then distribute the carbon to the remaining organisms of the planet. Some of the organic carbon is returned to CO$_2$ in the atmosphere as organisms respire (break down organic molecules to get energy from them). Most of the remaining carbon is returned as decomposers break down organic molecules.
The Nitrogen Cycle. Nitrogen is used in DNA (the genetic molecule of nearly all organisms) and most proteins (used by all organisms to make chemical reactions go fast enough to benefit organisms). The reservoir for inorganic nitrogen is nitrogen gas in the earth’s atmosphere. About 81% of the earth’s atmosphere is nitrogen gas ($N_2$). So that the atmosphere is safe, the nitrogen atoms of nitrogen gas are so strongly bonded that they are extremely difficult to separate. God created special nitrogen-fixing bacteria to break those bonds and produce ammonia ($NH_3$). He also created ammonia-oxidizing bacteria to transform ammonia into nitrates and nitrite-oxidizing bacteria to transform nitrites into nitrates (the ion $NO_3^-$).

In places where oxygen is abundant—such as on land and in shallow water—producers can readily take up nitrates to get their nitrogen. In places where oxygen is lacking, producers can get their nitrogen from ammonia. Consumers then distribute the nitrogen to the remaining organisms of the planet. Decomposers convert most of the nitrogen in dead bodies and wastes back to ammonia, and denitrifying bacteria convert nitrates back to nitrogen gas.

The Sulfur Cycle. All organisms use proteins, and a couple of the common amino acids from which proteins are built utilize sulfur. Consequently, sulfur is an essential element for biological life. Minerals in the rocks of the earth function as the reservoir for inorganic sulfur. That sulfur is in the form of sulfides and elemental sulfur ($S$). God created sulfur-oxidizing bacteria to transform mineral sulfur to sulfate (ions of $SO_4^{2-}$). Producers can take in sulfate to get the sulfur they need. Consumers then distribute the sulfur to the remaining organisms of the planet.
If plenty of oxygen is available to decomposers, then the sulfur in dead bodies is returned to sulfate for used again by organisms. If oxygen is not so readily available, sulfur-reducing bacteria transform the sulfur in organic molecules into sulfur and sulfides.

We do not have as complete an understanding of how the other life-essential elements are provided to organisms. However, it is most probable that for each element, biomatrix organisms have been designed to form a biogeochemical cycle that continually provides that element to organisms. When all the cycles are considered together, the biomatrix is always active in altering the earth in major ways. Biomatrix organisms seem to control what gases are found in the earth’s atmosphere and in what concentrations. The biomatrix also affects—and perhaps determines—the chemistry of the world’s oceans.

Finally, the biomatrix may be responsible for many of the earth’s rocks, concentrating elements into minable ore deposits, creating huge accumulations of oil and natural gas, and probably forming most of the carbonates (limestones and dolomites) of the world.

It is apparent that God created a complex network of organisms to make life possible on this planet. None of these organisms are specifically mentioned in Scripture, but they were clearly created by God to make it possible for plants and animals to thrive. All of these organisms—the producers and consumers, the digesters and decomposers, the fixers and remediators, the developers of soil, the mycorrhizal fungi, and the protectors—have been created to make biological life possible. The biomatrix bridges the gap between the living and the non-living. When the biomatrix
is healthy, it is designed to provide everything needed for life and to eliminate everything harmful to life. If levels of any substance are too high the biomatrix works to bring them down. If levels are too low, the biomatrix works to bring them up.

Because plants and animals are dependent upon the biomatrix for their survival, the biomatrix organisms in soil and water were probably created before the plants on Day Three of Creation Week. The biomatrix organisms more closely associated with organisms (gut flora, mycorrhizal fungi, etc.) were probably created at the same time as the organisms with which they are associated.

THE ORIGIN OF BIOLOGICAL SUSTENANCE

In 1972, the radical environmental organization ‘The Club of Rome’ published a book entitled *Limits to Growth*. They warned that we were running out of non-renewable resources. Some resources were considered *renewable*, either because they were continually available (like sunlight) or because they could be replaced (such as trees). Other resources, however, such as iron, copper, silver, gold, oil, and natural gas, were considered *non-renewable*, because they were being used but not replaced. *Limits to Growth* predicted that the costs of non-renewable resources would skyrocket as these things became scarce and we would run out of them by the early 2000’s.

In the 40 years since the book was published, their predictions were shown to be quite inaccurate. Not only have most of these resources increased, despite increasing use and huge increases in human population, most of them are cheaper today than they were in 1972. In part this is because the earth contained more of these resources than was believed at the time, and in part this is because we have become better at finding these resources. But it is also due to the fact that very few things are actually truly non-renewable, because God created the earth capable of sustaining life.

Biogeochemical cycles seem to be cleverly designed. The combined characteristics of a reservoir large enough to supply the needs of organisms, specially designed organisms that fix the element, and still other organisms specially designed to return the element to the reservoir, makes each cycle simple and yet effective at supplying the everyday needs of billions of organisms.

It is hard to imagine a simpler system, and it is hard to comprehend how a system could do more. In human experience, this type of *elegance*—simultaneous simplicity and efficiency—is not generated without intelligence. Elegance is due to careful design. Naturalism would expect something like what The Club of Rome expected—that we should be running out of our resources.

Even the existence of a single biogeochemical cycle would suggest careful design. But there is not just one such cycle, there are many—probably as many as there are different elements in organisms. Then there are the thousands of different kinds of molecules that the biomatrix is able to bioremediate, and hundreds of thousands of different kinds of plants to which mycorrhizal fungi are able to provide water and nutrients. How such a complex and elegant biomatrix came to be is difficult to explain with the purposeless process of naturalistic evolution. It makes much more sense that
the God of love specially designed the biogeochemical cycles and the other features of the biomatrix to provide for the ongoing needs of His biological creation.

After Adam sinned, he and Eve were kicked out of the Garden of Eden and denied reentry so that they would not eat of the tree of life and live forever. This suggests that before the Fall—and if the Fall had never occurred—Adam and Eve would have lived forever.

For this to happen, the original creation must have been fashioned with cycles of provision for everything in the universe. The cyclical nature of these processes would permit existence without end. Part of God’s curse on the creation in response to man’s sin probably involved the ending and/or inefficiency of one or more of these cycles.

**BIOLOGICAL SUSTENANCE: OUR RESPONSIBILITY**

**OUR RESPONSIBILITY TO GOD**

When we observe a living thing, we should remember the extraordinary designs necessary to make that life possible. Hundreds of organisms had to be created in special ways to supply the elements that that organism needs every day to survive. The design necessary to supply all the needs of billions of organisms across this planet should remind us of the extraordinary wisdom of God.

The elegance of the cycles of provision should impress us even more with the wisdom and efficiency of God. The fact that the cycles of provision are too elegant to have come about by naturalistic evolution should direct our thoughts to God as Creator. But the cycles of provision were not just designed in the mind of God. They were actually created, and created in such a way as to successfully provide for every organism on this planet. This argues for the remarkable power of God to make His designs happen.

Furthermore, the fact that so many organisms are provided for ought to remind us that our God is *Jéhovah-jireh*, the providing God. And, if God can provide for the biological world, should He not also be capable of providing for our needs? "If God so clothe the grass of the field, which today is, and tomorrow is cast into the oven, shall He not much more clothe you, O you of little faith?" (Mat. 6:30). Even, more, God’s provision should provide insight into what it means for God to have the attribute of love.

Finally, the fact that cycles of provision were created to be physical illustrations of that love should impress us that such an awesome God desires that we know Him. It follows then, that contemplation of the biomatrix cannot help but prompt us into worship of the One Who created it. On-going contemplation of the biomatrix should

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*As we shall see in Chapter 10, not all of the changes that came with the curse are bad in an absolute sense. They would all be bad in a perfect creation, but some of the changes that came with the curse were designed to minimize the evil in a cursed creation (e.g. so that the creation would not last forever, always degenerating, but never able to be restored).
prompt a life of worship. And, in the midst of such worship, how can we help but bring others into that worship? In so doing, we fulfill our calling as priests of the creation.

**OUR RESPONSIBILITY TO THE CREATION [► 8.3]**

*Preserve Our Body’s Biomatrix.* When God created the human body, He created it covered with and containing hundreds of species of biomatrix organisms. Some live on our skin and protect our bodies from disease. Others live in our intestines helping us digest our food and providing us with vitamins we cannot get from any other source. Others probably help us in a host of other ways we do not yet understand. As kings of the creation, we have a responsibility to preserve our body and the biomatrix He created as part of it.

Towards that end, although it is good idea to keep our bodies clean, completely sterilizing our skin or cleaning ourselves excessively will destroy the organisms of the biomatrix created on our skin to protect us from pathogens. And, although taking an antibiotic may help our immune system destroy a pathogen that is infecting our bodies, taking an antibiotic when we are not sick is *not* a good idea. Antibiotics kill more than just pathogens; antibiotics also kill organisms of the biomatrix that are beneficial to us.

Taking antibiotics when we are not sick kills organisms that are of benefit to us—organisms that are protecting us, helping us digest food, providing vitamins, and otherwise helping in a host of other ways. Rather than making us healthier, taking excessive antibiotics weakens us. Furthermore, it destroys, rather than preserves, the biomatrix over which God made us rulers.

*Restoring Provisionary Cycles.* Humans have not only failed to preserve the biomatrix, time and time again they have upset its balance. Humans have introduced harmful chemicals (*pollutants*) into the environment at a more rapid rate than the biomatrix has been designed to remediate. Because the biomatrix is designed to make life possible, pollution can kill organisms or even extinguish entire species.

Lacking a way to rid themselves of pollutants, some organisms accumulate the pollutants from the environment, a process called *bioaccumulation*. Because longer-lived species collect the pollutants for longer, bioaccumulation is a greater problem for longer-lived species. It can even be worse for species that consume other species. If a bioaccumulating consumer eats bioaccumulating species, the levels of that pollutant can increase faster in the consumer than in the species it eats.

This process, where organisms higher in the food chain accumulate toxins more rapidly, is called *biological magnification*. This process puts the highest predators in a given community at the greatest risk of being negatively affected by pollutants. A few examples of different types of *pollution* include the following:

- Because of carbon dioxide picked up from the atmosphere, precipitation (*e.g.* rain, snow, dew) is naturally slightly acidic from the carbonic acid formed when carbon dioxide dissolves in water ($CO_2 + H_2O \rightarrow H_2CO_3$).
However, precipitation can be made much more acidic by various types of pollution. Coal-burning power plants, for example, release sulfur dioxide particles into the atmosphere. Gas-burning vehicles, gas-burning and oil-burning power plants, and nitrogen-rich fertilizers release nitrogen oxide particles into the atmosphere. In the atmosphere, sulfur and nitrogen oxide particles affix onto dust grains and form dust grains themselves. When water condenses onto the dust grains, the oxides produce sulfuric and nitric acids, creating precipitation much more acidic than normal—something called ‘acid rain’.

Sometimes the acid rain is too acidic to be controlled by the earth’s biomatrix in a given area. When lakes and rivers become too acidic, many creatures are harmed or die. For example, young fish may not develop correctly and adult fish can be killed. In fact, acid rain is thought to be responsible for over 200 lakes in the Adirondack Mountains having no fish at all. On land, acid rain burns tree leaves and acidic ground water depletes the soil of needed positive ions (like Ca\(^{++}\)) and releases positive ions that are toxic (like Al\(^{+++}\)).

These things weaken trees and make them susceptible to stress and disease. As a consequence, acid rain is thought to be responsible for widespread tree death in the Great Smoky Mountains. In an attempt to control acid rain, low-sulfur fuels have been sought and filters have been required for power plant stacks and automobile exhausts. There is even reason to believe that since pollution controls have been put in place, some of the damaged ecosystems in the Adirondacks and the Great Smokies are recovering.

- Humans have created a variety of substances never before known in the natural world, such as nylon, teflon, and plastic. At the time when many of these substances were created, there were no decomposers available to break the substances down and allow the components to be recycled. Substances like this are non-biodegradable and are ‘disposed of’ as trash. Being undigestible, some of this trash can accumulate in an animal’s stomach until it kills the animal.

In landfills some of this trash can release non-biodegradable chemicals that pollute ground water. Such problems can be minimized by reusing (recycling) non-biodegradable substances. Or, biodegradable substances can be invented to replace the non-biodegradable substances.

For example, biodegradable plastics have been created from trees to replace some non-biodegradable plastics made from petroleum. Alternatively, organisms can be sought that decompose the new substances, such as a fungus discovered in South America that can break down polyurethane plastic.

- Whereas many non-biodegradable substances were not produced for the express purpose of adding them to the environment, humans have created some substances with the express purpose of applying them to the environment about
them. But some of these substances, added to the environment for one purpose, have unintended side effects.

For example, humans have created many herbicides, insecticides, and fungicides to control diseases and promote agriculture. Many of these substances were unknown in the natural world until humans created them, so many of them were not decomposed or otherwise controlled by organisms of the biomatrix. For example, beginning in the 1940s, dichlorodiphenyltrichloroethane (DDT) was widely used as an insecticide, and saved millions of people from malaria, especially during World War II.

Over the following decades, DDT, and later a DDT break down product called dichlorodiphenyl dichloroethylene (DDE), were found to biomagnify in the tissues of ospreys, eagles, and other birds of prey at the top of the food chain, causing them to get sick and their egg shells to thin. These thin egg shells caused chick death which threatened raptor populations.

• Several kinds of mining activities release toxins in the environment at a faster rate than the biomatrix cleans up the toxins. Heavy metal mining in the region of Ducktown, Tennessee, for example, destroyed most of the organisms in the area. Storage of nuclear wastes presents another challenge, as nuclear wastes can remain radioactive (and thus dangerous) for thousands of years, or even longer.

It is our responsibility to carefully study the earth and do everything we can to understand it, make sure its balance is not upset, and promote technology that will benefit both man and the creation. This should be done because the biomatrix is necessary for life on this planet. But it should also be done because God gave us the responsibility to preserve the creation, and because a healthy creation better illustrates the character of God.

Enhancing Bioprovision. Besides preserving the earth’s biomatrix, it should also be our responsibility to enhance it, to ‘return it’ better able to support life than when it was given to humans in the first place. In 1975 a variety of Flavobacterium bacteria was discovered that could consume some previously non-biodegradable molecules associated with the production of nylon. This suggests that in the original creation God may have created organisms in such a way that they were ready to decompose nylon when humans finally created nylon.

This, in turn, suggests that God may have done this for every molecule that humans would ever create. If so, then God may have also given us the ability to express that information and thus enhance the earth’s biomatrix. And, since doing this would only

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1 Although DDT is capable of harming some organisms, it got an undeserved reputation in the 1960’s when its harm was exaggerated by activists. For example, in 1962 Rachel Carson published Silent Spring, a wildly popular propaganda piece. The premise of the book was a fictional community waking up to a silent spring, where the sounds of birds are no longer heard because they had been wiped out by pesticides. Carson actually distorted the scientific research and claimed that DDT caused human cancer, endangered birds with extinction, and threatened life in the oceans. Each of these statements was refuted in years to come, but the damage was done. In 1972 the United States banned DDT, and countries around the world followed suit. Since malaria spread as DDT was outlawed, it is likely that millions of people have suffered and died from malaria as a result of DDT’s premature ban.
reveal what was already there, we would have no right to brag about our ability. Instead, our proper response would be to glorify God because He was not only the One Who hid the information, but He was also responsible for our ability to reveal it.

A similar example of these hidden abilities has been shown in bacteria that can remediate DDT and DDE. At this point, however, we know so little about the biomatrix, that it will take much more research to understand its hidden qualities and use them to clean polluted environments. Yet, such research would fulfill our responsibility to enhance the biomatrix and glorify God.
SUMMARY OF CHAPTER

• As a physical illustration of His love, God created the biomatrix and associated biogeochemical cycles to provide the daily, ongoing needs of the earth’s plants, animals, and humans.

• The biomatrix is made up of the bacteria, algae, protozoa, and fungi of the earth. The biomatrix makes it possible for plants, animals, and humans to exist on earth by
  o algae and photosynthesizing bacteria being the main producers (the organisms constructing the energy-containing molecules that all organisms must have to survive) in water environments;
  o being the main producers in extreme environments (e.g. lichens in dry and nutrient-poor land environments, chemosynthesizing bacteria in deep oceans, soils and rocks, and very hot, very acid, very alkaline, and very salty environments);
  o protozoa being the first consumers in water environments so animals can eat the energy-containing molecules that are otherwise in too-small bacteria
  o gut flora (various bacteria and fungi) helping animals digest food;
  o fungi and bacteria decomposing dead plant and animal material to clean the earth and return nutrients to the environment for its organisms;
  o bacteria fixing elements that organisms need (e.g. carbon, nitrogen, molybdenum, nickel) into a form that organisms can use;
  o bacteria returning elements to the reservoirs where those elements are stored;
  o bacteria remediating (making dangerous molecules safe);
  o soil flora building, maintaining, and fertilizing the soils of the world;
  o mycorrhizal fungi absorbing water and nutrients to provide for the needs of plants;
  o some bacteria producing vitamins (e.g. Vitamin B12) needed by plants and animals; and
  o skin flora protecting us from pathogens that might land on our bodies.

• Each of the elements necessary for biological life (especially oxygen, carbon, hydrogen, and nitrogen, but also boron, calcium, chlorine, cobalt, copper, fluorine, iodine, iron, magnesium, manganese, molybdenum, phosphorus, potassium, selenium, silicon, sodium, sulfur, zinc) is part of a biogeochemical cycle that continually (and because it is a cycle, without end) provides that element to organisms. Many biogeochemical cycles include 1) a reservoir where that element is stored, 2) biomatrix organisms that take the element out of the
reservoir and provide it to producers, 3) consumers that spread the element to the remaining organisms, and 4) biomatrix organisms that return the element to the reservoir. Examples include:

- The carbon cycle, where producers (plants, algae, photosynthesizing and chemosynthesizing bacteria) fix CO\textsubscript{2} from the atmosphere, consumers spread the carbon to remaining organisms, and biomatrix decomposers (bacteria, fungi) return the carbon to the atmosphere;

- The nitrogen cycle, where nitrogen-fixing bacteria fix N\textsubscript{2} from the atmosphere into ammonia, ammonia- and nitrite-oxidizing bacteria create nitrates, producers take up the nitrates and consumers spread the nitrogen to remaining organisms, decomposers return the nitrogen to ammonia, and denitrifying bacteria return nitrate to N\textsubscript{2}.

- The sulfur cycle, where sulfur-oxidizing bacteria transform sulfur and sulfides in rocks into sulfates that producers can take up, consumers spread the sulfur to remaining organisms, decomposers return the sulfur to sulfates, and sulfur-reducing bacteria return sulfates to the sulfur and sulfides of rocks.

- The elegance (complex tasks performed with simplicity and efficiency) of biogeochemical cycles suggests that they were designed by a wise creator and are inadequately explained in the naturalistic worldview.

- So as to preserve the biomatrix God created for our bodies we should not sterilize or overwash our skin, and we should take antibiotics only to help our bodies kill a pathogen that is making us sick.

- Humans pollute when they introduce harmful chemicals into the environment faster than the biomatrix can remediate them. Pollutants are more harmful to those organisms that bioaccumulate (accumulate a given pollutant), and, by biological magnification, are most harmful to the bioaccumulators at the top of the food chain. We have a responsibility as rulers of God’s creation to control our behavior to minimize or eliminate pollution. Examples of pollution:

  - Acid rain is rain water that is made acidic enough to harm water animals and trees. Humans can cause acid rain by burning coal, oil, and gas. Such burning produces nitrogen and sulfur oxides that become nitric and sulfuric acid when dissolved in rain water. The problem can be minimized by reducing energy consumption, finding alternative energy sources, and filtering acid-causing particles out of exhaust smoke.

  - When humans create artificial substances that cannot be broken down by biomatrix organisms, those non-biodegradable substances accumulate in landfills, and can potentially pollute the soil and harm organisms near those landfills. The problem can be minimized by recycling, replacing non-biodegradable substances with biodegradable substances, or finding, creating, or promoting organisms that can break down those substances.
• Mining can bring substances from beneath the earth’s surface that are dangerous to organisms living on the surface. The problem can be minimized by preventing mining refuse from entering the environment around the mine.
• Humans can enhance the biomatrix by revealing the organism designs that God placed in the creation for the purpose of cleaning up man’s messes.

**POTENTIAL TEST QUESTIONS**

1. How does God demonstrate His love?
2. What is the purpose of a biogeochemical cycle?
3. What are the components of a biogeochemical cycle?
4. Why is a biogeochemical cycle cyclical?
5. What does it mean for an element to be ‘fixed’?
6. Explain what a reservoir is in a biogeochemical cycle.
7. Describe the major components of the carbon / phosphorus / nitrogen / water cycle and explain what the cycle is designed to do.
8. Define bioremediation.
9. Define the biomatrix.
10. List three / four / five different components of the biomatrix.
11. What is the function of the biomatrix?
12. The observation of biological sustenance should cause what sort of worship?
13. Short Essay: Why should we restore provisionary cycles?
15. Define bioaccumulation / biological magnification. / Why does pollution affect some species more than others?
16. List three / four different types of pollution.
17. Explain what acid rain is / what causes acid rain / how acid rain negatively affects life / how to reduce acid rain.
18. Explain why artificial substances disrupt the biomatrix / how artificial substances can negatively affect life / how to reduce the negative effects of artificial substances.
19. Explain what it means for something to be biodegradable / why biodegradable substances should be preferred.