

Studying Science & Theology Together

An Adult Small-Group Lesson Guide for Leaders

Using Gregory S. Cootsona's *Creation and Last Things:
At the Intersection of Theology & Science*

by Michael Fitzpatrick

1. Overview

The Christian testimony through the ages has been of God as both Creator and Redeemer. God creates and sustains the world through His power, but God also saves the world through Jesus Christ, a saving work that looks ahead to its fulfillment in Christ becoming Lord of all. These twin doctrines, the doctrine of *creation* and the doctrine of last things or *eschatology*, are profound truths that have been revealed by the pages of scripture. But they are more than truths about God; indeed, they are truths about what God has done and is doing and will do. They are about God's actions and involvement in all of creation. Thus, the works of God's hands are worth studying for themselves, to see what God has done and to join Him in the work.

Theology is the more formalized aspect of the church which systematically develops the revealed truths of who God is and the nature of his relationship to us and the world. Growing in theological knowledge is a great way for Christians to deepen their faith and practice as believers. But theology is not all God has for us to learn. We are to go out into God's good creation and see the work of our Creator. Over the past few centuries, various *sciences* have developed which study different aspects of creation and report their findings. As Christians, we believe in both God's special revelation of scripture, and in God's general revelation of nature. Therefore, we can say that theology brings to light our best understanding of special revelation, and the sciences produce our best understanding of general revelation. Growing deeper in our faith means growing deeper into both.

This study is an invitation to join in the growing church conversation which brings science and theology together under one roof. The goal is to not just study both, but to draw out the resonant and mutually-informing relationship between them. As people of faith, we seek a fully integrated worldview that is at once Christian and scientific. Therefore, this course has been designed to put participants into direct contact with theological insights and scientific discoveries, and to follow Gregory Cootsona's guidance in recognizing the tensions and harmonies between them while moving toward a more satisfying and foundational vision of our universe and our God. Although Cootsona chooses the themes of creation and last things as his unifying topic, the hope is for this study to provide a basis for further personal and small-group growth in the rich relationship between these two disciplines. May God bless you and your small group as you explore God's good creation!

2. Suggestions To Leaders Using this Study

The study has two components, which can be used separately or in tandem. The first component is a short series of *discussion points* relating various scientific discoveries to key doctrines of faith. These are designed to get participants talking directly about what the sciences tell us about creation, and how these discoveries fit into our theological understanding of creation. The discussion points are a resource to you that fill out the details of a topic and present it in language accessible for ordinary persons. You can either read through the various discussion points, or you can adapt the ones you want to cover in your session into your own approach. Suggestions for supplemental videos are included for further research.

The second component is a series of *discussion questions* which are designed to encourage people to share what they know and work together to develop possible approaches to the questions. Both theology and the sciences provoke a diversity of perspectives, and getting those perspectives heard is a great way to see different strategies for integrating science and theology. It is important that at the outset the tenor of the group is established. Instruct your group that the goal of the study is to grow in our knowledge of scientific discoveries and theological insights, and to find various possibilities for their integration. The goal is not to be right or to insist on one particular answer. Doing so only alienates participants who are more uncertain about how to approach these topics. Instead, encourage the group to work together to help each other grasp difficult ideas and develop useful metaphors or images for integrating the various aspects together.

The material in both components is designed to complement and expand the rich comments and discussion in Cootsona's text. In addition to working through the study components, consider asking participants at the beginning of each discussion what questions they have from the reading, and what topics they are struggling with. Organic discussion is often the most fruitful. Finally, there are recommendations at the end of each lesson for books which further develop the ideas Cootsona introduces. They can be used as supplements to the present study or directions for future inquiry.

3. Lesson One: Getting Started (pp. 1-7, 28)

The goal of this lesson is to prepare the ground for discussing Cootsona's four chapters on various connections between science and theology. Therefore, the reading load is light, but the discussion involved is not. The following discussion points and questions are designed to get a sense of the territory before diving into the specific ideas in the subsequent chapters.

Discussion Points

- Get the group oriented with the major areas of exploration: science, theology, creation, eschatology.

- A science is a body of knowledge developed by a community of researchers coordinating their efforts and adhering to certain standards of practice in order to investigate specific, well-defined areas of the world.. Scientists are normal people who work together in a community governed by various practices, epistemic norms and social norms.
- The practice of science works by testing *hypotheses* (well-defined suggestions) through experiments. For example, if a scientist suggests that smoking causes lung cancer, they might test that hypothesis by interviewing all the people with lung cancer and seeing how many are smokers. When the predictions a hypothesis makes do not play out, the hypothesis is either revised or rejected. When predictions do play out, the hypothesis is tested further and further, and as long as it continues to give successful predictions, it becomes integrated into an overall theory. A *theory* is a large body of well-tested hypotheses that scientists then apply to new situations. Scientists use the theory to interpret data in experiments, but they also revise the theory as experiments challenge the theory's predictions.
- The epistemic norms are the criterion by which scientist's judge their theories. The first norm is *consistency*, which means that a bad theory is one where one part of the theory contradicts another part. The second norm is *coherency*, where each part of the theory needs the other parts of the theory—they all fit together as a whole. The third norm is *comprehensiveness*, which says that the best theory is the one which applies to the most situations. The more that is explained by a theory, the better. Finally, the last norm is *simplicity*, which strives for making a theory only as complex as necessary to successfully describe and predict what is being studied. Together, these norms guide scientists to decide which amongst competing hypotheses and theories are the *best explanation*.
- The social norms hold for the way the scientists work together in their research programs. One social norm is that scientists should *repeat* each other's experiments to make sure that one person's findings were not a fluke. As more scientists get the same experimental result each time, hypotheses grow in their support. Another social norm is that scientists should be rigorously *honest* about their work. They should not try to fudge data or bias experiments. Their goal is not to confirm what they believe but discover what is true. Additional social norms include *universalism*, the idea that anyone can be a scientist and do science; *openness*, the shared ownership of scientific ideas and discoveries; and *skepticism*, the imperative to test ideas rigorously and consistently rather than just accepting what others say. By working together according to these shared norms, scientists hold each other accountable in the work they do.

- A theology is a body of knowledge that has been developed by a community of scholars working within a particular faith tradition to exposit scripture and tradition in a way that is systematic, faithful to doctrine, practically applicable and spiritually inspired. The ultimate goal of a theologian is to deepen our understanding of God and his relationship to us as revealed by scripture and Christian tradition.
- Theologians start from the perspective of a faith tradition, which holds to various doctrines and hermeneutics (ways of reading scripture). They then combine this tradition with scripture to develop a body of beliefs which are *systematically* organized. This just means that the beliefs are organized in a logical ordering, where one discovery leads to the next and the beliefs are all connected together. In developing these beliefs, theologians follow the same epistemic norms as scientists. They seek a consistent theology, lacking contradictions; they strive for coherency, trying to avoid obscure or arbitrary doctrines that don't seem to fit in with the rest of Christian faith or scripture; and they desire comprehensiveness, to develop a theology which makes sense of all the various areas of Christian life, community and practice. Additionally, they strive to be *faithful to doctrine*. This does not mean they will not question beliefs held by the church, but that they will not depart from those beliefs unless they are compelled to do so by the wider Christian tradition and scripture.
- Theologians not only develop theologies to bring understanding to tradition and scripture, but also develop insights which are *practically applicable*. This means that the truths of theology are meant to be lived out in the lives of ordinary people. Theology aims to provide guidance to Christians for ordinary practice and life. The insights of theology can illuminate our relationship with God and our role in the world as his image-bearers. Additionally, theologians also seek to be *spiritually inspired*, allowing God to guide their labors and set their work in the larger context of his actions in the world. This means that they are governed not merely by social norms, but spiritual norms which compel them to follow the moral expectations of the Christian community in their work.
- Both scientists and theologians are seeking *well-motivated beliefs*. These are beliefs that have good reasons supporting them according to the norms described above. Thus, Christians and scientists have a common ground in seeking truth together.
- Discuss Ian Barbour's four ways that science and theology can interact as described on p. 28 of Cootsona's text. Talk about how people feel about each interaction model, and discuss as a group the kinds of interactions you hope for in the study and as a church. Keep in mind that there may be multiple approaches desired, and they are not all mutually exclusive.

Consider having the group watch Cootsona's introduction to Barbour's four ways online:
<Cootsona Video #1 19:02-23:15>

- If time permits, discuss with the group your faith tradition's doctrines of creation and eschatology so that people are familiar with these themes as they work to relate these doctrines to the discoveries of the sciences.

Discussion Questions

- What experiences have you had with science? How much scientific background do you have? Have you learned about any scientific ideas or experiments that stand out to you as particularly exciting or memorable? Which scientific area of research most interests you?
- Do you trust the theories and discoveries of the sciences? Name one or two scientific ideas you're familiar with that make you uncomfortable or uncertain. What about these ideas are you concerned with, and what would you like to learn about them? In contrast, what scientific ideas have you heard about that you think have contributed to your life positively and helped you better understand the world?
- Cootsona writes that God made creation good. Where do you find beauty in creation? Do you connect with God through what He has made? Do you consider human society and your family and job part of God's creation, or only the natural world? Do you think it is okay for the sciences to study both human society and the natural world?
- What gives your life meaning from a Christian perspective? What does theology have to contribute to this meaning? What do the sciences have to contribute? How does our cosmic story end, according to Coostona, and what does this do for your perspective on not only life, but the exploration of the sciences?
- Which model of Ian Barbour's four ways do you most identify with in your relationship with science? Do you think one is better than the other ways, or do they all have a context where they are appropriate? Which approaches should the group adopt for the remainder of the study?
- Describe the doctrine of creation according to Genesis 1-2. What important ideas do you think it teaches that are worth bringing to the science and theology conversation? Why does it matter that we believe God is Creator?
- Describe the doctrine of eschatology. Potential scripture passages include 1 Corinthians 15, Revelation 21-22, and Isaiah 65:17-25. How does knowing God's ultimate plan guide our living for today? How is it a source of hope for you?

Additional Reading Suggestions:

One World: The Interaction of Science and Theology - John Polkinghorne

Surprised by Meaning: Science, Faith, and How We Make Sense of Things - Alister McGrath

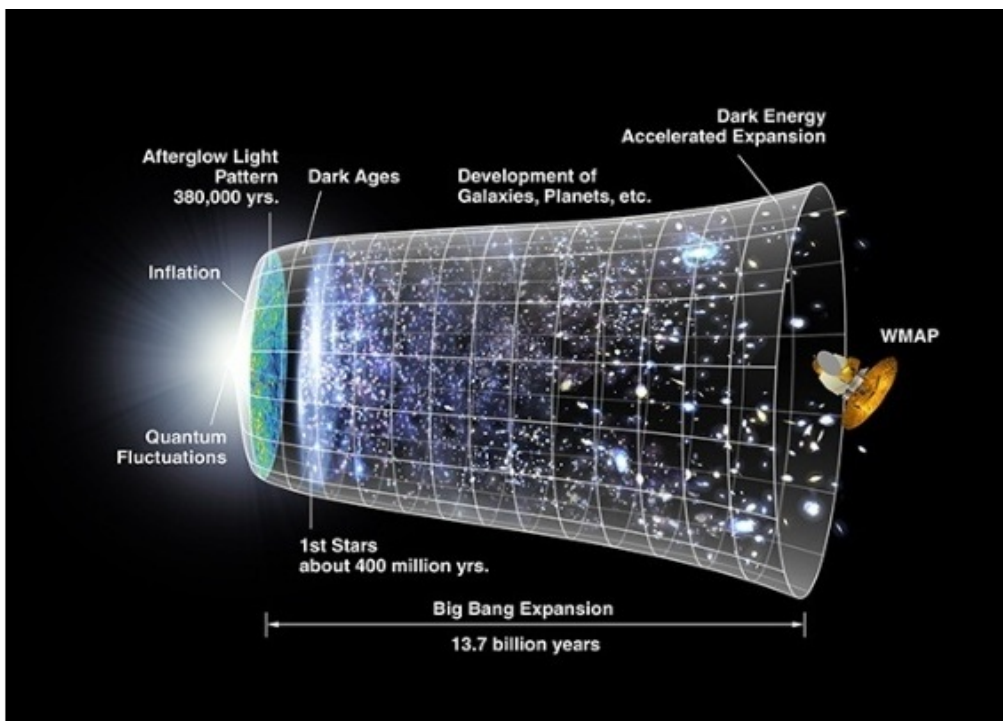
4. Lesson Two: Cosmology, Time and the Trinity (pp. 8-33)

Discussion Points

- “The Big Bang” is the name for a particularly surprising scientific discovery in the mid-20th century, the history of which Cootsona describes. The most effective model we have for describing the history of our universe is one in which the universe is expanding, growing outwards the way a balloon expands when filled with air. Running the story backwards means that as we go further and further back in time, the universe gets smaller and smaller, until it reaches a single point of space and time, known as the initial singularity. Astrophysicists can only speculate about this point, or what happened to cause it to “explode” into a universe as we know it. But, astrophysicists can describe the cosmological history almost immediately after that initial point, a vanishingly small 10^{-43} seconds after the Big Bang. At that time, the elementary particles of our universe began to form—the creation of matter. The universe was initially very hot, but as it expanded its temperatures cooled. Protons, neutrons and electrons formed out of the elementary particles, and light particles, or photons, spread through the universe. After about 400,000 years, the first atoms began to form, primarily hydrogen. But it was only after 400,000,000 years that more complex elements formed, creating gas clouds and stars and galaxies, and eventually, our galaxy and our solar system.

Consider watching as a group the History Channel’s history of the universe (3:47min):

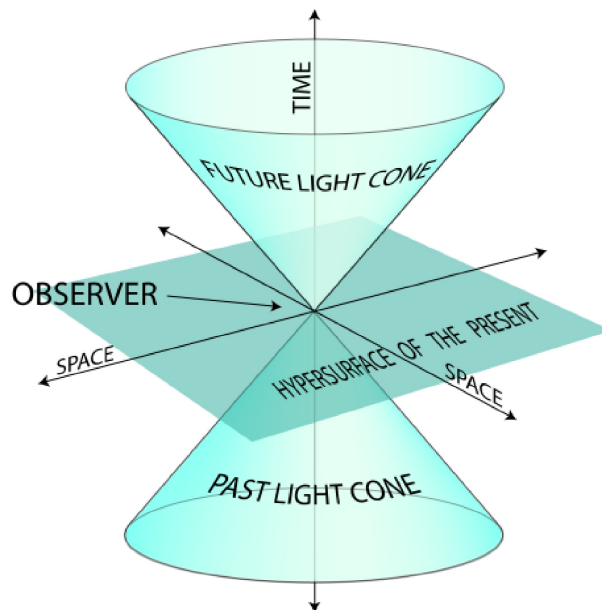
< www.youtube.com/watch?v=zDQzKTedGNE >



- In Genesis 1:1, we are told, “In the beginning, God created the heavens and the earth.” This has traditionally been the foundation for the Christian doctrine of *creation ex nihilo*, creation out of nothing. Christian doctrine has held that at some finite location in the past, space and time and matter, indeed the whole universe as we know it, had its origination in the spoken word of God. The universe is not eternal; rather, God is eternal, and it is through His Word (John 1) that all things have been made that are made. There is profound resonance between the Big Bang model of the universe, and our belief in God as having made all things.
- But the sciences help us understand that God did not make everything “at once.” Believing in God as Creator actually affirms a God who continuously creates. The universe as we know it is a product of billions of years of shaping and molding activity. This leads to a profound importance of *time* in thinking about God as Creator.
- In 1905, Albert Einstein provided a model of Special Relativity, a theory which surprisingly revealed that while the laws of physics and the speed of light are constant no matter where you are in the universe, space and time are not. *Spacetime* is a relational idea that space and time are not absolutely separate, but rather deeply connected, such that changing the one changes the other. These ideas entail that what you see around you and what affects you at a given time will only be things that can travel fast enough to reach you at that moment in time. Consult the following spacetime diagram.

At the center of the diagram is the location of some observer, perhaps yourself. The cone on the bottom is a limit—it is the scope of everything that can move fast enough to reach that observer from some original location. Since nothing can move faster than the speed of light, the edges of the cone are the boundaries beyond which nothing can move fast enough to reach the observer. Notice that the vertical line is time. It takes time to travel from one place to

another—traveling is not merely a matter of distance. All the things inside the observer’s past *light-cone* are the things which can reach them; everything outside of the light-cone are things which are too far away to reach them, because it would take too much time. The future light-cone on top is a description of everything the observer can influence. It



marks the limits for the future possibilities of the observer to affect their future world. The observer cannot travel faster than the speed of light, but anything that they can travel to they can affect.

Consider this example for your group. Go outside at night and look up at the stars overhead. It seems like we see the stars “right now,” doesn’t it? But in fact, the stars we see overhead are not the stars as they themselves currently exist, but rather as they appeared many years ago when the light we are seeing was emitted from them. It has taken many light-years for the light to reach us, and so we are only just now seeing it. That means the stars in our distant past are inside of our light-cone, and can affect us, but the stars themselves cannot affect us yet until we move further in the future. Alpha Centauri, the closest star to us, requires over 4 years for its light to reach us, so what we see is the star as it was 4 years ago our time!

What all this means is that reality is deeply relational and interconnected. Everything inside of the observer’s past light-cone affects them, and everything in their future light-cone will be affected by them. It is true that anything outside of the two light-cones will not be directly affected, but such things have their own light-cones which will overlap with the light-cones pictured above at some point in time. Given enough time, every light-cone overlaps.

For a great guide to graphically drawing light-cones as a group, and for more details on light-cones and spacetime, consider consulting John Norton’s page at the University of Pittsburgh, located at:

< http://www.pitt.edu/~jdnorton/teaching/HPS_0410/chapters/spacetime/ >

- The interconnectedness of spacetime results in a remarkable affirmation of Christian living. Everything has significance in God’s creation, because each element of our past affects us in some way. This means that our choices, which emanate out into our future light-cone, will be significant for everything within our light-cone. We have a responsibility to make good choices for the future, because our choices will affect everything else, just as others’ choices will affect us. A profound picture of the responsibility God has blessed us with as stewards of his creation unfolds from our discovery of spacetime relations.
- The relationality of space and time also connects closely with the Christian doctrine of the Trinity. As Cootsona writes on p. 16, “God is a God of relationships among the three persons of the Father, the Son, and the Spirit.” The intrinsic relationality of the universe deeply reflects the intrinsic relationality of God. And part of what this relationality means, in both respects, is that the relations are unified together. God is a unity of three relations between divine persons, and the universe is a unity of spacetime relations which come together to form each moment of time.

Furthermore, God creates through the Son and sustains through the Spirit. This captures the multiple ways God and the world are related. Not only are God and world intrinsically relational, they are also extrinsically related to each other. Through continuously creating the universe, God is always intimately active in the world. Thus God is not only intrinsically personal, but is personally related to the universe, taking an interest in all that unfolds.

- The 16th century Reformed theologian John Calvin has given a name to the awareness we often have of God's personal involvement in creation. For Calvin, this awareness was a *sensus divinitatis*, or "sense of the divine." People get this from nature, from human relationships, or from contemplating their own insignificance relative to a vast cosmos. But this awareness does not reveal the concrete, relational character of God. Rather, it witnesses vaguely to God and prompts our further exploration, our theological adventure to know God more.
- These early discussions help us frame the interaction between science and theology. Cootsona suggests the following principles for developing a healthy relationship between them (pp. 29-30). First, we need humility, on both sides. The world is far more complex than we can imagine, and both the church and the sciences make mistakes and develop wrong ideas. A willingness to admit error must be present in both communities. Second, a strong consonance arises out of the historical Christian perspective of a rationally-ordered universe guided by God's natural laws. Christianity in some ways provides the right framework for science to work towards illuminating these laws. Third, science and theology use different methodologies for their own research programs. The sciences need to respect that God is not a scientific hypothesis, subject to scientific verification. But neither is theology an alternative to good science. Positing God to explain things we do not yet understand, known as creating a "God-of-the-gaps," is both bad science and poor theology. God is not at work in the gaps of our knowledge, but in all of creation. Such gaps are just places where the sciences are still working to understand what God has done.

Discussion Questions

- Even great scientists like Robert Jastrow acknowledge the surprising consonance between the Big Bang and Christian doctrine. What does the picture of a universe created from nothing and evolving through time suggest to you about God as Creator? What possible reasons might lead God to create galaxies and our solar system progressively, rather than all at once?
- Cootsona describes seeking the *fullness of time* in each moment. How does thinking about God's relation to time, and our relation to spacetime in our past and future light-cones, challenge you to live more fully in each moment? What does this do for traditional Christian virtues like patience and thanksgiving? How can you more consciously fill your moments of time?

- Spacetime is relational, God-as-Trinity is relational, and God and the world are relational. These ideas imply that nothing exists independently, that all things are deeply interrelated. How do you see this interrelation in your life? What are some of the relationships you depend on most? How can sciences such as sociology or ecology reveal these relationships and affect our decisions?
- Have you considered the ideas of general and special revelation before? Why should we expect their harmony? How much does each contribute to your understanding of God? What can you do to deepen your engagement with each?
- Cootsona retells the famous interaction between Galileo and the Roman Catholic Church, often taken as a paradigm of the incompatibility between science and theology. After reading Cootsona's diagnosis, what do you think? Discuss some of the particular elements which contributed to the division between Galileo and the Church (p. 26). What lessons can we draw from this historical narrative for the present, so that such mistakes are not repeated?
- What is the "God-of-the-gaps"? Where in contemporary culture have you seen this strategy used? Why is this strategy not a good representation of God? What better ways are there to think of God's relationship to creation?
- Cootsona has given some great suggestions for moving the science and theology conversation forward (see last Discussion Points bullet). How do you see your church being able to put these suggestions into practice? What would you add to or change about these suggestions? What implications might these have for the church's witness to the world?

Additional reading suggestions:

God and the Astronomers - Robert Jastrow

Seven Glorious Days - Karl Giberson

Galileo Goes to Jail and Other Myths about Science and Religion - Ed. Ronald Numbers

God, Creation, and Contemporary Physics - Mark William Worthing

5. Lesson Three: Biological Evolution and the Image of God (pp. 34-55)

Discussion Points

- The goal of this section is to bring together the theological ideas surrounding the image of God in humankind, and the scientific ideas surrounding the theory of evolutionary biology.
- Read together Genesis 1:26-31 and Genesis 6:7. The two pictures of human creation we are given are first, being made in the image of God, and second, being made from dust. These two images together form our grandeur and humbleness as creatures. We bear the image of God, which Cootsona develops as connoting the capacity for relationships. These relationships are with God, other humans, with ourselves, and finally with all of creation. These relationships provide not only the meaning and shape of our lives, but also the great responsibility we have in our stewardship of the world. Yet we are made of dust. “Dust” here can be read as the elements of the earth, and indeed we are carbon and water based life-forms. We are made of the same elements as everything else on earth, because like them, we were made from the elements of the earth. Thus we can make a distinction between what we “bear” or carry (the image of God), and what we are made of and how we were made. These two aspects of our nature are clearly united in the Bible, and so we should expect a compatibility between what theology can tell us about the image we bear and what science can tell us about how we were made from “dust.”

Consider watching Greg Cootsona’s introduction to the image of God, [Cootsona Video #2 6:10-11:47]

- The Christian witness is that the image of God has been further clarified as the image of Christ. Paul famously distinguishes in the letter to the Romans between “the first man,” or Adam, and “the second man,” or Christ. Adam was given the image of God, but now we have the image of Christ. These two images also represent two poles, the poles between Genesis and the Gospels. What happens between these two poles is an evolutionary story, a historical account in which a particular people, the nation of Israel, go through a series of trials that deepen their understanding of the image of God. This evolutionary story reaches its fulfillment in the coming of Christ. Paul tells us that the light of the Gospel “displays the glory of Christ, who is the image of God” (2 Corinthians 4:4). It isn’t that the old has been discarded, but rather that the image given to Adam to bear has become fully visible in Christ. Thus we see that God uses historical processes to realize His purposes.

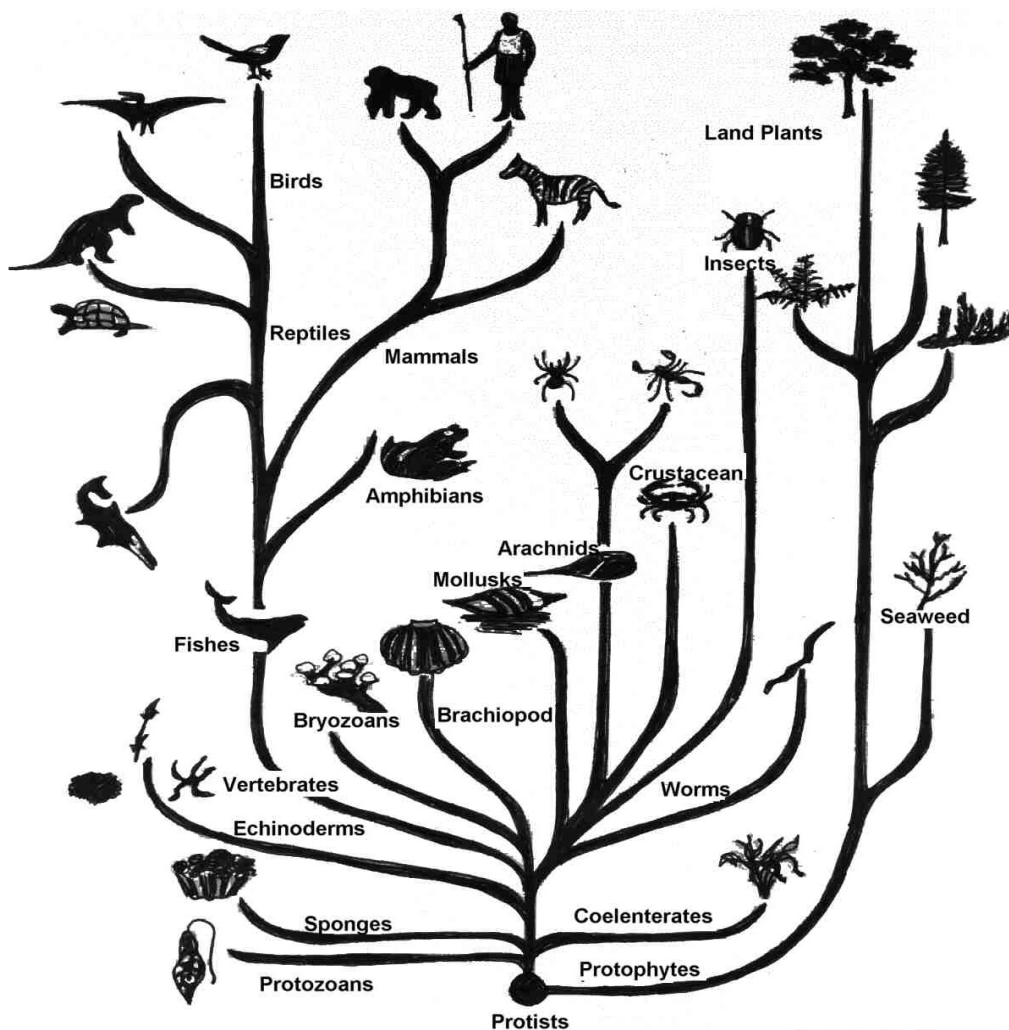
- William Paley attempted to offer another place God becomes visible. He said that we know a watch found in the desert has an intelligent maker due to its intricate organization. Likewise, he felt we can conclude the same about created organisms as evidence for a Creator who directly created us just as a watchmaker makes a watch. However, the history of philosophy has given us good reasons to think Paley was mistaken. Two concerns stand out.

First, Paley likened creation to the dominant metaphor of his day: a man-made machine. But creatures are not like machines at all. Machines only work if their parts work, and once they break they cannot function further unless repaired by a human. In contrast, creatures can survive even if parts of them are sick, and they can adapt to new circumstances and contexts, requiring no outside intervention. They are unpredictable and surprising.

Second, Paley's argument makes God just one more object in the world. A watchmaker and a watch share the same reality (both are made of the dust of the earth), even though they are very different. But God is not one more object in the world. God is the Creator of the world. This means that God does not create in the same way that a watchmaker creates. God creates *through* the processes in the world, but God is not just one more process in the world the way a watchmaker is. Paley's argument is another example of the "God-of-the-gaps" error we saw in our last lesson.

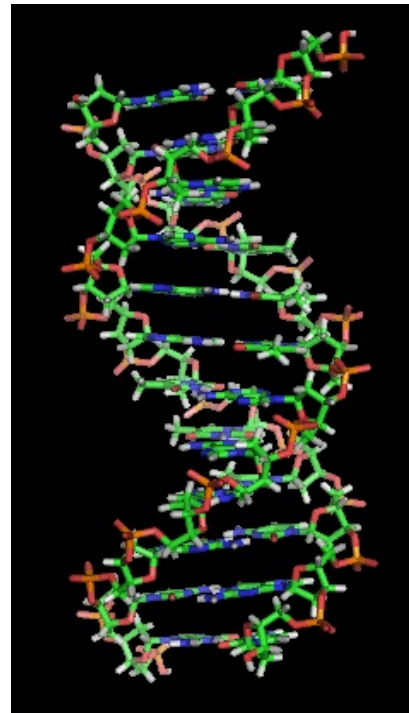


- The modern theory of biological evolution is the principle theory by which biologists today understand living organisms. The theory says that as species reproduce over time, the inherited characteristics of their offspring can change. As changes accumulate, descendants might look very different from their more distant ancestors, to the point of not even being able to reproduce together. Since the inability to interbreed is the standard by which biologists differentiate species, they conclude that descendants which change sufficiently to be unable to breed with their ancestral species are a different species. The theory describes all living creatures on this earth, from bacteria to humans, as the evolutionary offspring of a primordial organism that emerged on the earth 3.8 billion years ago. All life has resulted through a series of inherited changes from that initial ancestor, a relationship that is often described as the “evolutionary tree.”



- Evolutionary biology seeks to explain the processes by which organisms evolve. It is not a question of *why* they evolve, which might include God's involvement, but *how* organisms evolve, which is a question about causal relationships. Biologists have identified five major factors in biological evolution: mutation, meiosis and sexual reproduction, natural selection, gene flow and genetic drift.

- *Mutation* is the appearance of new characteristics in an organism and species. Every organism is made of millions of proteins folded together in complex ways. The “blueprint” for these proteins is the DNA, or genetic code, of each organism. DNA is a long molecule string made up of smaller molecular “letters”—G, A, T, and C—which together form triplets that are recipes for different proteins. Out of these few letters and the triplets they form are created all the larger organic structures we see in the world. In fact, the genetic code constitutes the strongest evidence for an evolutionary story of species evolving out of earlier species. Francis Collins, the supervisor for the Human Genome Project which mapped the genome, describes how a comparison of human DNA to other primates or mammals reveals a high degree of similarity (*The Language of God*, Free Press pp. 126-130). The further one goes away on the evolutionary tree, the less the similarity. So our genome is 98% similar to chimpanzees, 52% similar to dogs, but only 4% similar to chickens. The genetic code bears in itself the evolutionary history which created it.



A mutation is the source of new genes in an organism's DNA. Mutations occur when the order of the letters in the DNA helix change due to some environmental interference, such as radiation from the sun or chemicals in the food an organism eats. Mutations take on an evolutionary importance when they happen in sex cells, because then the mutation can get transmitted to the offspring. Mutations are of three kinds: harmful, in which they hurt the organism; neutral, in which they have no effect at all on the organism, or beneficial, in which they provide a new trait that is more helpful to the organism. Whether mutations fall into one of these three categories is entirely dependent on the type of environment the organism lives in. For example, eyes seem like a good trait to have. But some salamanders who live in caves have lost their eyes over time, because an eye is not a useful mutation in an environment with no light.

- Without sexual reproduction, mutations would just disappear when the organism dies. The only way a mutation can have an evolutionary effect is to be spread to many other organisms. *Meiosis* is the cell-division process that produces the sperm in males and the

eggs in females. Each of these sex cells have half of the chromosomes from the parent. Thus an offspring does not inherit all of an individual parent's genetic traits, but only half of them. That half combines with the half from the other parent to form a new genetic code during *sexual reproduction*. During sexual reproduction, the chromosome pairs in each sex cell combine, and their combination determines which genetic traits are dominant and which are recessive. Chromosomes carry all the possible traits that can be expressed in an organism.

- *Natural selection* is probably the most famous, and most misunderstood, aspect of evolutionary change. Natural selection is a description of how the environment impacts an organism's likelihood to survive long enough to reproduce and pass on its genes. It is a description of the relationship between an organism and its environment. If an organism has traits that allow it to survive in its environment, then its traits will be "selected for," which just means it has a greater likelihood of surviving long enough to pass on its traits to future offspring. Organisms which have traits that make them less suited to surviving in their environment will have a smaller likelihood of passing on their traits. The genes that get selected for are those that promote survival until reproductive age. However, this does not mean that organisms produce mutations that help them adapt to their environment. Mutations are themselves random, which simply means they are unpredictable and unrelated to organism need or intention. An organism simply has to make due with whatever gene traits it has. But whether it survives is not random (though not entirely predictable either), but is a function of the relationship between those traits and the demands the environment makes on the organism.

For example, Darwin's finches on the Galapagos islands have a variety of mutations that create different beak sizes. These beaks are more or less useful depending on the size of the nuts or the type of cacti they are feeding from. The nature of the nuts and cacti fruit differ from season to season depending on the water tables. Which finches survive long enough to reproduce depends on which have the best beaks for handling the nuts and fruit for that particular season. If your beak isn't big enough to crack the big nuts in a rainy season, you won't survive.

- *Gene flow* and *genetic drift* describe the last two known major evolutionary forces. Along with natural selection and sexual reproduction, these forces are responsible for transmitting genes throughout a species, or removing genes from a species. These forces can make mutations and existing genes either more or less common. By changing the frequency of the genes, evolutionary forces can dramatically alter organisms to create the vast variety we see on the earth today.

Gene flow is the simple idea that when portions of one species migrate and mix with portions of another population in the same species that lives elsewhere, genes from the one population flow into the genetic pool of the other population. Likewise, as populations become more isolated from each other, the more they diverge as a species,

each evolving in their own separate directions. Genetic drift, on the other hand, is the probability distribution for how genes will be increased or decreased from one generation to the next within a given population. It describes the odds of a particular gene spreading throughout a given population.

- To help your group grapple with these ideas, consider using the following analogy to language. Languages evolve in a very similar way to organisms. Just as mutation introduces new genes into a species, so metaphors and coined words (neologisms) introduce new words or word uses into a language. Like sexual reproduction, parents and human communities pass their language on to their offspring, but the vocabulary and way of speaking is never exactly the same from one generation to the next. Where natural selection describes the value of a particular genetic trait for surviving in its environment, so the words we keep and use, or forget and lose, are relative to how useful they are for speaking about and doing things in our human contexts. Gene flow describes two different populations of the same species either mingling or being isolated from each other. In language, when different societies come together, they almost always borrow words from each other, bringing new words into the languages. Or, if a single language community splits and lives in different areas, over time they will begin to develop their own words and speaking practices that differ between the two groups. Finally, where genetic drift describes the probabilistic distribution of a genetic trait, so we can describe the distribution of words and grammatical patterns based on how much they're used by the parent generations of a community. Just as language evolves, so do organisms.

To look together as a group at the evidence for evolutionary biology, consider discussing the summary of the scientific evidence given on the BioLogos website, found here:

[<http://biologos.org/questions/category/scientific-evidence>](http://biologos.org/questions/category/scientific-evidence)

- One big concern for Christians is whether the forgoing description of evolutionary theory means that we were made by chance, and not by the hand of God. While certainly there are biologists who have taken this view, there is nothing intrinsic to the theory which suggests this is the only view. Evolutionary change is overall random simply because it is not possible to predict when mutations will happen, or which traits will be favored by an environment. But this does not mean that evolution happened completely apart from God's providence. Rather, it signals that God, who is the primary cause of all that is, acts through the secondary causes of creation. As we said in the beginning, the Bible affirms that we were created from dust, the inorganic elements of the earth. But how we were created from dust is another matter. The evolutionary story, from primordial origins to technological hominids, is a story of how God created. So although evolution is an unpredictable process from our perspective, it is perfectly consistent with the grandeur of a God who works historically to shape all things.

- Indeed, there are several areas of deep consonance with theological doctrine. Recall the relational thesis Cootsona describes of both the Trinity and the image we bear of God. This relationality is reflected in the cosmological nature of reality, and here again evolutionary history bespeaks of a profound relationality—the relationality of all creatures to each other. All living things are made from dust (compare to Genesis 1:11 and 1:24, where the “land produces” living things), all living things come from a common origin, and all living things are deeply connected together, both ecologically and developmentally. Also, the story of evolution is one of twists and turns, of surprises and reversals. We see life originate in the oceans, develop on dry land, and create large reptiles and small mammals, some of which return to the ocean and become whales and other marine life. This side-winding, unpredictable story is the same kind of weaving and twisting we see to the story of the Israelites from Genesis to the Gospels. If we believe that God was working through the history of the nation of Israel, which is such a strange and surprising narrative, so we can be confident that the same God can work through the history of life on this earth from prokaryote to the first in this long evolutionary history to bear the image of their Creator, Adam and Eve.

Consider watching together the following selection from the documentary “From the Dust,” featured on the BioLogos website, about evolution revealing our Creator:
<http://biologos.org/resources/multimedia/evolutionary-creation-video>

- Adopting an evolutionary perspective on human beings challenges our folk conceptions of the human as body and soul. This folk view is known as *dualism*, which says that the body and soul are two different things and can potentially be separated. But this view can lead us to think that we are really “nothing but” our soul, that our body is just a temporary house that can be later shed. However, an evolutionary history forces us to appreciate that although we do have a spiritual aspect to our nature, God has formed us through millions of years of physical evolution. The result is not a soul with a body for a shell, but a deep unity between soul and body. Hence, the image of God which is our spirit and our dust are both the materials God made us out of, and neither can be forfeited. See Joel Green’s book in the “Additional Reading Suggestions” for more information on the biblical foundations for body/soul unity.
- The Anthropic Principle is a highly-studied aspect of cosmology which states that the universe bears precise features that together make life and intelligence like ours possible, and that even a minute alteration to any of these variables would have made our appearance in history impossible. It is as if the universe knew we were coming. Discuss Cootsona pp. 51-53.
- The doctrine of dominion, taken from God’s command to Adam and Eve in Genesis 1:26, is not a license to do whatever we please with creation, as many such as John Locke thought during the Enlightenment. Rather, it is a call to stewardship, to represent our Creator as image-bearers, and to care for creation as God would have us care. This means

appreciating how deeply interconnected all living things and their ecosystems are to one another. The tiniest variation in one, from a littered plastic bottle to a large oil spill, can spell destruction for millions of living things. Instead, as Cootsona writes, we are called to communion with all things, first with God, but then with each other and the rest of creation. This communion relationship is one of service and self-sacrifice, not imperialism and plunder.

Discussion Questions

- What is the image of God? Where is it manifest in your life as a human being?
- Is there any conflict between our image and our dust? How is our image fully expressed in Christ? Where do you struggle to see the image of Christ in yourself?
- Why do we not serve a Divine Watchmaker? Can you think of a better metaphor for our God?
- What are some of the main features of evolutionary theory? How does evolutionary theory link together all living things? Does this linkage between organisms bear any resemblance to the relational, interdependent nature of the universe we saw in the previous lesson?
- Just as God creates the universe progressively, so we discover that God creates life on the Earth progressively. How does this progressive account compare to the progressive account of creation in Genesis 1? Does the picture of God as primary cause creating through evolutionary secondary causes diminish His role as Creator?
- Could the Bible be read as an evolutionary story, an evolution from creation to the cross, filled with all the surprised and wrong turns that biologists find in biology?
- What is the relationship between body and soul? In thinking about your life in your daily regime, how do you notice the deep kinship between body and soul? How does one affect the other (e.g., being tired or injured affecting your spirit, or being angry in spirit affecting how your body handles situations)? Why do both your body and your soul matter to God?
- What do you make of the Anthropic Principle and the precise conditions of the universe for our existence? Is it a further disclosure of our Creator, or another watchmaker in disguise?
- How do these scientific and theological perspectives affect your perspective on ecology and taking care of the environments God has given us responsibility for?

Additional Reading Suggestions:
The Language of God - Francis Collins
Origins: Christian Perspectives on Creation, Evolution and Intelligent Design
- Deborah & Loren Haarsma
Body, Soul, and Human Life: The Nature of Humanity in the Bible - Joel B. Green

6. Lesson Four: Evil and God's Providence (pp. 56-77)

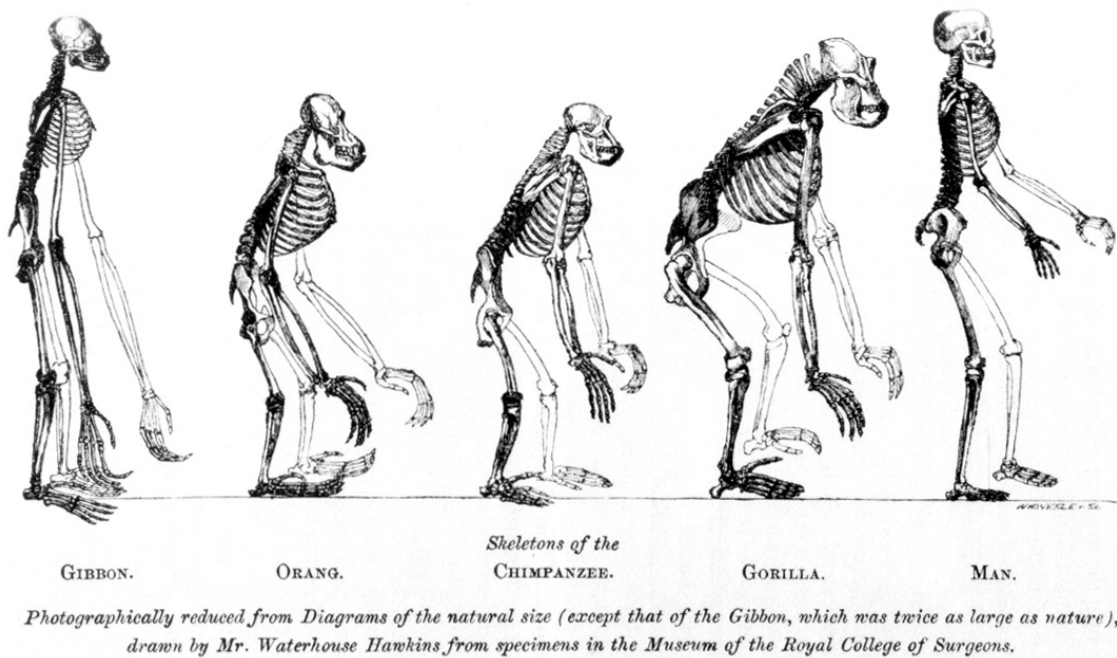
Discussion Points

- The reality of evil in human life is one of the greatest sources of not only pain and distress, but theological confusion. This lesson aims to explore ways we can be sensitive to the presence of such evil and God's redemption of it, while still being faithful to science. Prepare for people being personally invested in this topic, and leave much room for open and honest discussion.
- The major inference made from science about evil is that it seems as if good and evil happen for no reason at all. Galaxies are created and destroyed, species evolve and go extinct, wildebeest give birth to offspring only to have them eaten by crocodiles, and newly expectant human mothers are often found among the wreckage of car accidents and plane crashes. Some of these observations are new insights from science, but many are common sense observations from everyday life. This is important. While the sciences have definitely expanded our horizon, it's far less clear whether they have added anything particularly important insofar as our awareness and suffering of evil.
- Evil appears biblically as the destruction or perversion of what God has originally made good. When humans commit evil, this is uniquely called "sin," which comes from the Hebrew *hamartia*, an archery term meaning "to miss the mark." Sin is when we fail to adhere to God's will. Since God always wills what is best, our deviation from that will leads us to destructive ends. More importantly, it shows we do not trust God's choice for what is best.
- List together as a group examples of evil and sin in the world. Then discuss ways in which these could be seen as challenges to God's goodness.
- In many ways, Cootsona's discussion does not represent a *theodicy*, an attempt to rationally justify why there is evil in the world. Rather, his discussion shifts the context in which questions about evil are asked. Normally, we want to know why there is evil at all if God is good and overseeing creation. But what would happen if we instead asked, "Since God is good and he oversees creation, what has God done about the evil in creation?" The Christian answer to this is the Cross. God has redeemed His creation through Christ, and is even now working all things toward healing and salvation. The Gospel message is not only the forgiveness of sins, but the power of God to make all

things good. This doctrine does not negate the reality of evil; to the contrary, it affirms it and redeems it. Thus the proper Christian response is not “to justify the ways of God to man” (Milton), but to declare the salvation of God for man and indeed all of creation. Merely justifying the existence of evil leaves evil in place. God has done something far greater—He has made possible the overcoming of all evil.

- God’s redemption of evil in our lives provides the basis for Christian love and action in the world. We seek to care for the sick, the poor, the victims of hurricanes and earthquakes, the victims of murder and corruption, because we are working with and for God’s redemption of all things. Salvation and renewal of all things is not just a vain human wish, but the very real purpose of God for the world. Although we may not have explanations for evil, we do have hope that evil will not have the last word.
- Nonetheless, we can gesture at possibilities for why there is evil. Two major possibilities are (1) the regularity of the world and (2) the freedom of human choices. The first possibility suggests that “natural evil,” like hurricanes and asteroids, are a result of having the consistent world described by science. We should prefer our universe, where the events follow regularities and scientific laws allowing us to understand and even anticipate events, over a universe where nothing is consistent, such that you might be walking down a sidewalk one moment only to find yourself, alas, inside of a black hole in the next, for no reason at all. But having a regular universe means that nature follows its regularities regardless of the effect on us, thus placing great emphasis on our foresight to anticipate what will happen. The second possibility suggests that “human evil,” like murders and unjust business practices, are outcomes of the very reality that humans are free, i.e. able to choose from amongst various possibilities. Some possibilities are good, and others are not, and human evils result when we make choices to produce evil in the world. Evil is the risk for having the possibility of also choosing what is good and doing what is worth doing by seeking after the heart of God and furthering His Kingdom.
- Any discussion of evil involves thinking about the meaning of the biblical Fall in relation to scientific history. Therefore, a history of human evolution is important in thinking about the meaning of the stories of Genesis.
- Until about 66 million years ago (mya), the dominant large land organisms were reptiles, particularly dinosaurs. But at the 66 mya mark, a mass-extinction occurred, destroying over three quarters of all life-forms on the earth. At the time, one of the smaller and more minor class of animals were the *mammals*, small creatures with hair, mammary glands and a neocortex in the brain. These unique features, especially the neocortex, the area of higher brain functions and sense perception, allowed the mammals to survive the extinction and become the dominant large land animals. Among these mammals were *primates*, tree-dwelling mammals with opposable thumbs and stereoscopic vision. Opposable thumbs allow primates to grasp tree limbs and snatch insects, while stereoscopic vision produces precise depth perception, allowing a primate to track flying

insects through the air. Eventually, about 30 mya *monkeys* evolved. This evolutionary branch would further sub-divide between monkeys and *hominoids* (apes and humans) about 20 mya. These hominoids eventually diverged at ancestors which would become modern-day orangutans and gorillas. About 5 mya, the common ancestors diverged between chimpanzees/bonobos and humans. This means that after this division, we do not share any more recent ancestor with any other living creature today.



- *Hominins* is the family of humans. When the hominids split with apes, their distinguishing feature was bipedalism, the ability to walk upright on two-legs. As tribes continued to evolved, they developed larger craniums, which allowed for bigger brains. It was with this increased brain size that the first members of the genus *Homo* evolved. *Homo* is the genus which houses the various types of essentially human species. *Homo habilis* was among the first, appearing in Africa about 2 mya with the ability for tool making. The tools were generally sharpened stones, used for cutting meat and even cracking open animals bones for marrow. The introduction of tools gave the *Homo* tribes a strong survival boost. Another species of *Homo*, *Homo erectus*, evolved around the same time. *Erectus* began the great human migration, leaving Africa for other continents and environments. *Erectus* also developed more advanced stone tools, and fossil remains demonstrate an essentially modern body frame and a brain nearly 72% of our modern brain size. This brain size was to rapidly increase about 700,000 years ago, until only 250,000 years ago it was essentially the same size as our modern brains. Thus, when the

Neandertals appeared on the scene roughly about 130,000 years ago and spread throughout what is today Europe and the Middle East, they still had the long ape-like face of their past, but possessed the first signs of complex culture, including burying the dead, caring for the elderly, and possibly even the beginnings of proto-language. However, the final evolutionary step of *Homo sapiens* occurred between 200,000-100,000 years ago. This final species of Homo, which would be the only one to survive into the present, originated somewhere in Africa, but migrated north into Europe and Asia, eventually interbreeding with Neandertals and probably also contributing to their extinction. Homo sapiens developed language and art, major innovations which allowed for complex communication during hunting and the preservation of cultural wisdom from generation to generation. They developed ways of creating shelter and manipulating fire. However, they were generally small populations and nomadic. Only with the discovery of agriculture 10,000-12,000 years ago did humans develop the technology to settle in one location. With the advent of agriculture also came a stable oral tradition, and the beginnings of mythology and history—and religion.

- *The literal Adam and Eve* refer to the belief of some Christian traditions that Adam and Eve represent specific, historical human beings that existed at some point in the past. Incorporating this view into the foregoing evolutionary history is difficult, because that would mean there was one specific set of early homo sapiens which had the relationship with God described in the Bible. It would be hard to verify such a claim. It is true that all human DNA traces to a “Mitochondrial Eve,” a female living in Africa nearly 200,000 years ago to which all humans trace the mtDNA in their cell mitochondria. However, she would have lived right near the origination of modern humans, long before any development of language, culture or religion. The same is true of “Y-chromosomal Adam,” who lived even earlier than Mitochondrial Eve.
- *The typological Adam and Eve* refer to the belief of some Christian traditions that Adam and Eve represent the species of homo sapiens, not any particular historical persons, though such persons may have existed. Adam, from the Hebrew *adama*, means “humankind,” and Eve, from the Hebrew *hawwa*, simply means “source of life.” Thus they are representatives of humankind and all future generations. They represent the struggle of homo sapiens coming into conscious and self-conscious life, including the experiences of discovering that some things are good and others evil. This means that the Fall describes not a particular event in a real garden, but rather an evolutionary transition, wherein our ancestors discovered the existence of their own soul, and the destructive power of their newfound freedom. Adam and Eve also represent the early struggle of our ancestors to understand and know God.

Consider watching and discussing as a group the BioLogos excerpt from the documentary, “From the Dust,” on how to understand Adam in light of evolution:

<<http://biologos.org/resources/multimedia/pauls-adam>>

- Another place that evolutionary biology intersects with biblical creation is the belief that humans really are free. If the Fall represents our human evolution into freedom and our abuse of it, then any scientific account which says that we are not free challenges this basic doctrine of faith. However, most accounts of this sort are based on “nothing buttery,” or *reductionism*. Reductionism is a philosophical thesis that is often inferred from or projected onto scientific theories. In short, reductionism in biology says that organisms are nothing more than the interactions of their parts. Thus, you are not a human person, you’re “really just” a bunch of organs in slavish service to your genes. However, although it is quite true that our abilities to reason about possibilities and make effective decisions and act in the world all arise out of the interactions of our genes and proteins and amino acids and organs, it does not follow that these abilities are not real. That would be like saying that a brick house is “nothing but” a pile of bricks. But there is a real difference—the kind of difference construction companies make a living on—between a pile of bricks scattered any which way, and a set of bricks organized and combined intentionally to form a home. The difference is that the former won’t keep your head dry in a storm, but the latter will! It is true that the house is made of bricks, but it is not true that it is “nothing but” bricks. Likewise, we are indeed biological organisms and products of the grand evolutionary history of our earth. But that history really has produced persons who are free and make choices.
- Another challenge to human freedom is the philosophical thesis of *determinism*. Determinism, put simply, is the claim that from any particular state and time of the universe, all future states and times are determined, or forced, by that earlier state and time. Such a thesis makes the idea that we have free (unforced) choices seem rather illusory. However, two important responses from the sciences themselves suggest that determinism does not describe our universe. The first is that the determinist assumes there is only one kind of thing, namely *necessary events*. Necessary events are events which must happen. But with the advent of quantum mechanics, a revival happened in physics to reinvigorate an old idea from Aristotle of *potential events*. Potential events are events which could happen but may not, and you won’t really know until you get there. Quantum mechanics does not describe what will happen. Rather, quantum mechanics, through a mathematical formalism known as the Schrödinger equation, gives a precise description and prediction of what the probabilities are for different potential outcomes of a quantum mechanical system. But this means that there are different real possibilities, even though only one will actually happen. If something is necessary, there is one and only one possibility, but if there is more than one possibility, then neither possibility is necessary. Saying that two or more outcomes are possible just means that all of them are consistent with the prior states and times of the universe—no possibility is forced.

The second reply is to point out that it is in evolutionary biology that human freedom actually becomes fully coherent. Evolutionary history is a history of organisms developing to become more and more aware of possibilities, such that they can become planners and avoiders, responsive to their environment. Philosopher Alfred North

Whitehead calls the appearance of life on earth “a bid for freedom.” Rocks are great examples of deterministic things, since rocks are always forced by other things to do what they do. But organisms do not respond the same way rocks do. Organisms respond in often surprising ways, and they do so according to their own internal interests or goals. As long as we understand freedom to be the awareness of possible outcomes and response to them, we see that throughout the biological world, there are different degrees of freedom. When we look at ourselves, we see that we have the additional abilities to rationally and compassionately weigh possibilities, including the expectations God places on our lives and the needs of others. Far from contradicting our biology, our freedom is its very essence.

- The final place where evil and science challenge our biblical doctrine is our belief in God’s providence. *Providence*, however, does not necessarily imply that God makes all things happen. If it did, then God makes evil things happen. Rather, Cootsona lists out the three aspects of providence at the core of Christian theology. First, God sustains all things. This means that the regularity and continuity of creation is a product of God’s power. Second, God interacts and works with all things, creating anew without overruling the freedom of creatures. God does this by creating possibilities and producing outcomes cooperatively with creation, such that no event happens entirely because of God’s action (that would be another determinism), but neither does any action happen apart from God. Third, God guides all of creation forward. Nothing happens which God does not care about. God is not impartial and disinterested, removed from His creation; rather, God is *omnipartial* and *totally* interested in what happens, giving guidance that holds the good of all things in view. This view of providence shows us that God is not at the fringes of the universe or far removed from everyday life. Doctrines of miracles and God’s intervention sometime give the impression that God only cares when he intervenes, and the rest of the time he is absent. In contrast, God’s providence declares that he is in the center of everything, working all things to the good.

Consider watching as a group Greg Cootsona’s discussion of God’s providence in the sense of primary and secondary causation, as a way of describing God’s interaction with the world: <Cootsona Video #3 4:11-6:33>

Discussion Questions

- Why do some scientists think that certain scientific discoveries or theories make the universe seem more pointless or devoid of meaning? How is this a response to the reality of evil? Does meaninglessness satisfy you in addressing the problem of evil?
- What is evil biblically? How does sin relate to evil? Where do we see the reality of sin in our world? How have you experienced it personally in your life?
- What is the Bible’s answer to evil and sin in Jesus Christ? Does this answer satisfy you spiritually and personally? Why doesn’t the Bible justify the reality of evil instead?

- Cootsona notes that we may have to settle for mystery regarding evil (p. 63). What place does mystery have in theology? In science? Cootsona adds that God can transform evil into good, and that God will always have the last word. How do these theological truths speak to you?
- Does the regularity of the universe and freedom in human agency soften the reality of evil in the world? Why or why not? Why is regularity and freedom worth creating? What do they reveal to us about God?
- What stands out to you in the history of human evolution? How do you see your relationship to the animals and plants around you in light of your evolutionary ancestry? Do you feel more connected to creation knowing your evolutionary heritage?
- Who were Adam and Eve? What is the significance of their story, both their creation, their vocation, and their fall? Is their story about them as individuals, or is it about all of humanity? How does their story relate to the evolutionary history of humans?
- What is the Fall, and what is its relationship to evil and sin in the world?
- What are reductionist and determinist theories? How do they remove our freedom? What reasons do we have to think they are not good theses about being human? In what ways does being free press more responsibility on your life?
- How do the three aspects of God's providence illuminate for you God's relationship to the world? How might these relations be true in the world described by science? If God is continuously interacting with creation, what impact does this have on the problem of evil?
- How do we "live with grace" in a world suffering from evil and sin? What is our role as image-bearers in this context? Does God's call to compassion and grace further reflect a relational world and a relational God?

Additional Reading Suggestions:

The Problem of Evil & The Problem of God - D. Z. Phillips

The Evolution of Adam: What the Bible Does and Doesn't Say about Human Origins - Peter Enns

Perspectives on an Evolving Creation - Ed. Keith B. Miller

7. Lesson Five: From Creation to New Creation (pp. 78-102)

Discussion Points

- Science and theology both speak not only to the history of creation to the present, but also to where the universe is headed. Neither can give definite details, but each can give broad overviews. The goal in this lesson is to fully answer the evil we encountered in the last lesson with the Christian hope in God's promises.
- The central Christian doctrine, if there is one, must be the resurrection of Jesus Christ. A theologically pregnant doctrine, it is also attested by scripture and Christian tradition as a historical reality. This places the resurrection event firmly within space and time, and within God's purposes for creation. The resurrection signifies many things, including last things. *Eschatology* is the study of those last things. In particular, it is the exegesis of the promise in scripture of what God's creation looks like when God has completed His progressive work in creation. We have seen throughout this study that God works in and through history. He does not act "at once," but rather through time. This action is understood as having two fulfillments, one in Christ's first coming—the life, death and resurrection of Jesus—and in Christ's second coming, which is not just the salvation of sinners, but the restoration and healing of all creation, and the vanquishing of evil. God promises to set right all that is broken, and to make all things new.
- The study of *cosmology*, a branch of physics which focuses on the evolution of the universe at the largest scales, works to describe both the history of the universe from the Big Bang to the present, and from the present into the future. One of the most significant concepts in cosmology is the principle of *entropy*, which is the measure of how many different ways the parts of a system can be arranged. Cosmology looks at the system of the universe as a whole. What the principle of entropy says is that, statistically, there are more ways for the universe to be disordered than ordered. For example, there are more ways for your house to be disorganized and chaotic, than for it to be put together. More importantly, it takes work to keep your house organized; if you stop cleaning your house or putting your used items away, it will become very disorganized (and inhospitable). The same is true of the universe as a whole. At the Big Bang, the universe was in a low-entropy state—it was very dense and energy was evenly distributed throughout the universe. Another way to say this is that the universe was far from thermal-equilibrium. *Thermal-equilibrium* refers to the inability of a system to do any work. It takes energy to do work, to change things. Phase transitions and elements and galaxies and ourselves all require fresh energy to act. When we have energy, we are far from thermal-equilibrium: Not only are we are highly ordered, we have the potential to do lots of work. But if our energy sources run out (in our case, sunlight, food and water), then we will quickly break down, and return to thermal-equilibrium, where the particles of our body would disperse and all energy work would cease.

The significance of the early universe beginning far from thermal-equilibrium is that it allowed for billions and billions of years of work to be done throughout the universe, forming elements and galaxies and us. But, the cost of this wonderful blessing is that, since there is a finite amount of energy in the universe, eventually there won't be enough energy to sustain all these aspects of creation, and once the energy runs out, everything will tend towards thermal-equilibrium throughout the universe. The stars will burn up the last of their energy and cease to give off light. The universe, brilliantly shining in our telescopes, will become completely dark, a fate known as the "heat death" of the universe. Once the universe reaches thermal-equilibrium, all things will be effectively "dead", and cosmology knows of no principle for their resurrection.

It is important to understand that these predictions apply to billions, perhaps even trillions of years in the future. Nonetheless, they do suggest that there is an ultimate end to the universe. And this challenges the ultimate end to the universe described by Christian theology.

- An important related concept to these scientific predictions is the notion of *ceteris paribus*. *Ceteris paribus* is a Latin phrase meaning "while other things remain the same." Every scientific theory makes its predictions *ceteris paribus*, which means that its predictions are what will happen provided that nothing about the context changes. The "heat death" of the universe is a *ceteris paribus* claim—provided that nothing changes in the laws of physics, that the geometry of the universe remains flat, that dark energy continues making the universe expand, and that the amount of energy in the universe remains constant, "heat death" is what the universe will eventually reach. This prediction does not mean it is impossible for the universe to have a different fate, only that if it does have a different fate, something in the context was changed. This is an extremely important point, because Christian eschatology does not contradict the claims of cosmology for the future. The Christian can agree that, *ceteris paribus*, the universe will end in a "heat death." What the Christian offers instead is the claim that *ceteris paribus* will not hold in the end, that at some point in the universe's future, God will change the context and make all things new. And nothing in our cosmology prevents this possibility. *Ceteris paribus* is an assumption, not a law.

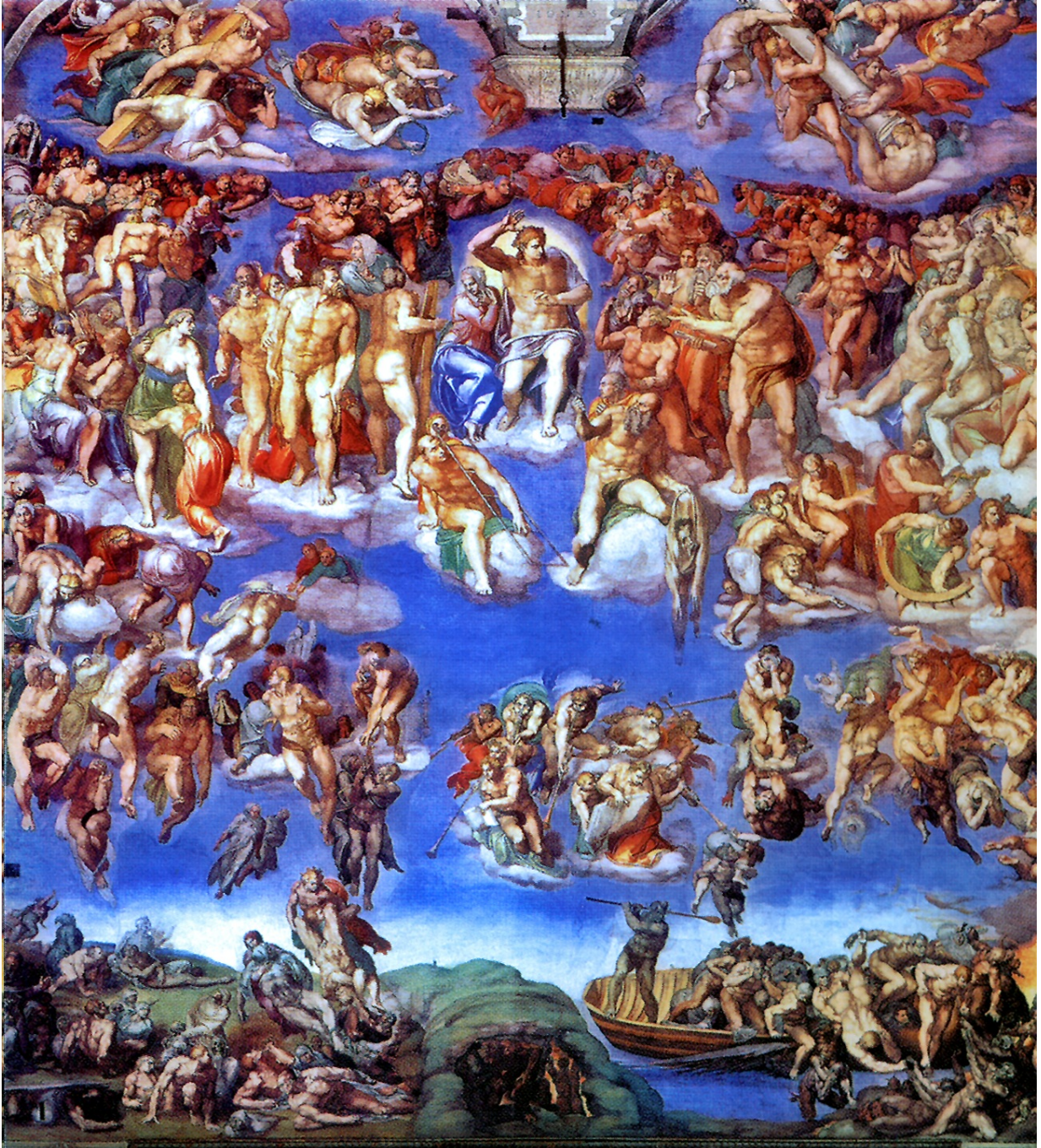
Consider watching together Cootsona's contrast of the scientific picture of the future with the Christian hope of the resurrection: <Cootsona Video #3 16:58-25:07>

- Because of the resurrection of Christ, Christians hope for the obviation of the *ceteris paribus* in cosmologists' predictions, and instead look for the second coming of Christ. This second coming is the belief that Christ will return and make all things new. Christ will establish himself as the true Lord of this world, and in the process redeem all the destruction of evil and sin. Two major events will be involved in this process.

The first event is the *resurrection of the body*. Recall in an earlier lesson we suggested that Christian faith does not support dualism, which allows for the separation of body and soul. Rather, Christian faith affirms that God has made both and has joined them together. This means that to restore us to the new creation, we will be resurrected, body and soul, just as Jesus was on Easter. The resurrected body will not be “spiritual,” some kind of ethereal ghostly body. No, as N. T. Wright argues, it will be fully physical but it will be a physics of the new creation, not the old. The *ceteris paribus* clause will have been broken, and a new, imperishable type of body will unify with our souls. But where will our souls have been in the “meantime”? Well, since time is a concept that only applies to spatio-temporal existence, it’s hard to know if such a question even make sense. Still, Cootsona suggests following Polkinghorne, Wright and others, that our soul is “remembered” in the mind of God until the resurrection. We certainly are not our full selves in that interim state, since we lack a body, but the preservation is sufficient for us to be resurrected anew in the last things.

The second event is *the last judgment*. This idea has been politely ignored in many Christian circles because it sounds so arrogant and cruel. However, much of this dismissal is a result of misunderstanding. The declaration that Christ will come again to judge “the quick and the dead” does not mean vengeance on our “enemies” and harps for the “good guys”. Rather, it is a two-fold realization. One, that Christ is our Judge; He is the standard by which our sin is held accountable and the authority by which the earth and the universe will be renewed. Two, this same Judge is also our Savior. Christ comes not only to judge but to save. Christ is for us, and “wants all people to be saved and to come to a knowledge of the truth” (1 Timothy 2:4). The last judgment is not the source of our fear, but the expression of our hope for salvation.

Consider discussing the iconic image of Michelangelo’s fresco *The Last Judgement*.



- Associated with the last judgment are the ideas of *heaven* and *hell*. The most important point is that heaven is not some place we go when we die. Rather, heaven describes where God is (as opposed to where we are), and the Christian hope of heaven is that when Christ comes again to reclaim His rightful governance of the universe, heaven will come down to the new earth. In Revelation 21 and 22, we see an image not of God's children leaving earth for heaven, but rather of heaven coming down in splendor to earth. This profound reversal is God's affirmation of creation. It was created good, and in the end, it will be re-made good. All things will be resurrected. Nor will this melding of heaven and earth be a place of eternal boredom. Rather, it will be a world of never-ending growth and exploration into God. C. S. Lewis gives an outstanding image of this hope in his novella, *The Great Divorce*. He describes God's presence as atop mountains so high one cannot even see their peaks from the valley below. The journey of a heavenly person is one of continually journeying into and up the mountains, an ascent which takes an eternity, but in which every step is a joyful one that deepens our proximity to the center of God. In other words, it takes an eternity to know his fullness. Thus heaven will not be an end, but a beginning that never ends.

Hell is a particularly less popular doctrine, and it coincides with two other notions: universalism and eternal damnation. Hell actually houses many different Greek and Hebrew concepts, such as *Sheol*, *Hades*, and *Gehenna*. All of these seem to be metaphors and suggestions about Hell, not concrete doctrines. It is clear that Hell is separation from God, an "outer darkness" into which none could ever rationally want to go. The purpose of Hell is even more obscure, but it is related to the last judgment, in that those who are not found with Christ are lost. But are they eternally lost? This idea is known as eternal damnation, which says that people who do not choose Christ on earth are lost in Hell forever. Not all Christians believe this. Some lean towards universalism, the doctrine that, in the end, all will be saved. Should we commit ourselves to one doctrine or the other? Karl Barth and C. S. Lewis have urged reticence and openness to both possibilities, arguing that we cannot know the end of the story in full from within our limited, temporal vantage-point. Moreover, we have no right to declare the limits of God's grace and love. If God can save all people, we can only hope and pray that he will. It is more important that we pray and work for the entrance of all into the future Kingdom of Heaven, than that we know here and now whether everyone will enter in.

- Most importantly, the hope of last things, namely the hope of the resurrection and the entrance of heaven into our universe, do not merely leave us to "tread water" in the meantime. We are called as Christians to be ready and watchful, always aware that Christ could return at any moment. Yet because of this hope, we are also called to be laborers for the kingdom, such that the mission of the church is to begin here and now in the work of renewing God's creation. This includes sharing the Gospel, but it also includes taking care of creation, feeding the hungry and giving to the poor, working together to address social ills, and growing in the fruits of the spirit to become daily more and more like Christ. Implicated in these earthly goals for Christian living is the reality that we are to

partner with researchers working on technological innovations to help guide technology towards goals that promote God's kingdom. Technology is the application of ideas learned in scientific research. Technology is not good or bad in itself; rather, its goodness or badness depends on how we choose to integrate technology into our societies. As Christ's representatives on the earth, we have a responsibility to bring a perspective of Christian ethics to these technologies and work for heavenly goals. Because apart from God, human sin will invariably lead our research towards self-serving and power-gaining goals, rather than the purposes of Christ, which are to spread the love of God to all people, to all things, and into to all creation, until Christ is Lord of all, the Alpha and the Omega.

Consider watching selections with the group from N. T. Wright's discussion of eschatology at Calvin College, "Rethinking Life After Death":

<http://www.youtube.com/watch?v=rZC6tbgpsl4>

Discussion Questions

- What is the resurrection of Jesus Christ? Why is it the center of your Christian faith? What is eschatology, and how does the resurrection of Christ relate to these "last things"?
- What does cosmology tell us about the cosmic story? Why do cosmologists believe the universe ends, as T. S. Eliot once wrote in a poem, "Not with a bang, but with a whimper"? What implications does this have for our hope today?
- What is the "ceteris paribus clause" in scientific theories? How does the ceteris paribus clause allow us to connect Christian eschatology to the predictions for our universe to end in a "heat death"? What does Christian eschatology teach will happen instead of a "heat death"?
- What "end times" behavior have you experienced as part of your community or in the church? How does this over-anxiety for Christ's return tarnish the credibility of the Christian witness? Do the large time-scales of the universe do anything to humble our expectations?
- Discuss the Christian hope of the resurrection of the body vs. going to heaven when you die. Which is the more biblical doctrine? What does Paul say about the resurrection? Why does the resurrection of Christ bring hope?
- How do you view the last judgment? Is it an occasion for hope or fear for you? How do heaven and hell relate to the last judgment? According to Revelation 21-22, what happens after this judgment for all who are saved? Do we know for sure there will be some who will not be saved?

- Discuss the church's mission in light of the future hope of Christ's second coming. Why is it that we cannot just sit by quietly and wait? How does the church's present activity reflect the desire of God to save all people and all things?
- How does the church's mission play out in interacting with the sciences? What role should Christians have in the development of new technologies? What about social crises, such as overpopulation and global warming?
- How has this overview of the theological themes of creation and last things, interacting with the sciences, illuminated your understanding of and relationship with God? Has it increased your ability to worship him and see him as Creator? Why or why not? Are the discoveries of the sciences less threatening, or more so? Are they more enjoyable, or not? What intersection of science and theology would you like to study next?
- Conclude as a group with a discussion of how you have seen science and theology interacting, and bring up what questions you still have on the topics discussed. Some of these remaining questions can be areas for new studies on the relationship between science and theology.

Additional Reading Suggestions:

Surprised by Hope: Rethinking Heaven, the Resurrection, and the Mission of the Church - N. T.

Wright

The God of Hope and the End of the World - John Polkinghorne

Heaven is a Place on Earth: Why Everything You Do Matters to God - Michael Wittmer

Eschatology - Hans Schwarz