
CHRISTIAN ANSWERS TO HARD QUESTIONS
DID ADAM EXIST?
VERN S. POYTHRESS

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Christian Interpretations of Genesis 1

Christianity and the Role of Philosophy

Creation, Evolution, and Intelligent Design

Did Adam Exist?

How Can I Know for Sure?

How Did Evil Come into the World?

The Morality of God in the Old Testament

Should You Believe in God?

Was Jesus Really Born of a Virgin?

Peter A. Lillback and Steven T. Huff, Series Editors

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PHILADELPHIA, PENNSYLVANIA

P&R
PUBLISHING
P.O. BOX 817 • PHILLIPSBURG • NEW JERSEY 08865-0817

Westminster Seminary Press, LLC, a Pennsylvania limited liability company, is a wholly owned subsidiary of Westminster Theological Seminary.

This work is a co-publication of P&R Publishing and Westminster Seminary Press, LLC.

An earlier form of this booklet was published as "Adam versus Claims from Genetics," *Westminster Theological Journal* 75, 1 (2013): 65–82. Used by permission.

ISBN: 978-1-59638-917-5 (pbk)
ISBN: 978-1-59638-918-2 (ePub)
ISBN: 978-1-59638-919-9 (Mobi)

Printed in the United States of America

Library of Congress Cataloging-in-Publication Data

Poythress, Vern S.
Did Adam exist? / Vern S. Poythress.
pages cm. -- (Christian answers to hard questions)
Includes bibliographical references.
ISBN 978-1-59638-917-5 (pbk.)
1. Adam (Biblical figure) 2. Bible and science. I. Title.
BS580.A4P69 2013
222'.11092--dc23

2013030936

DID ADAM AND EVE EXIST? Does science say otherwise? The Human Genome Project has produced voluminous data about the information contained in human DNA. Various news media and scientists tell us that this information demonstrates our ape ancestry. How do we evaluate these claims?

We cannot within a short compass examine all the claims and all the evidence in detail. But we can summarize some of the main points and direct readers to more extensive information. Other works discuss the biblical and theological basis for believing that Adam was a historical person.[1] Here we concentrate on the arguments that depend on appeals to science.

99 PERCENT COMMON DNA

We may begin with a commonly cited statistic: the 99 percent identity between human DNA and chimp DNA. In 2005 the Cornell University News Service reported, "Chimpanzees and humans share a common ancestor, and even today 99 percent of the two species' DNA is identical."[2] In 2010 the University of California at San Francisco News Center mentioned the same figure: "The genetic codes of chimps and humans are 99 percent identical."[3] In 2005 the *National Institutes of Health News* reported that "our closest living relatives share perfect identity with 96 percent of our DNA sequence."[4]

But assessing these claims is more challenging than it may appear. Note that the NIH report mentions 96 percent instead of 99 percent. Why? The same NIH report also includes the figure of 99 percent further on in its description, so none of the figures is in error. It turns out that the 99 percent figure arises from using a number of restrictions: (1) ignore repetitive portions; (2) compare only sequences that can be aligned naturally with

one another; and (3) consider only base-pair substitutions, not "indels" (see below).

Before we move on

- What do we discover as we investigate the commonly cited statistic that 99 percent of human and chimp DNA is identical?
- What does this discovery tell us about how we should receive even widely reported scientific claims?
- How much do you know about DNA? What does this mean for you as you assess information about it?

Comparisons of this kind get technical because there can be several kinds of correspondence and noncorrespondence between DNA strands. Let us lay out briefly some of the issues. At the level of molecular structure, DNA contains a "code" composed of four "letters," namely, ACGT (the letters stand for four distinct bases: adenine, cytosine, guanine, and thymine). The DNA code uses a particular sequence of letters, such as ATTGTTCTCGGC, to specify the exact sequence of amino acids to be used to construct a protein.[5] Human DNA and chimp DNA align when one finds the same sequence of letters in both kinds of DNA:

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Human:  G-C-C-G-A-T-A-A-G-C-A-C
Chimp:  G-C-C-G-A-T-A-A-G-C-A-C
```

A variation is called a *substitution* when there is a different letter at some one point in the sequence:

```
Human:  G-C-C-G-A-T-A-A-G-C-A-C
            | | | | |   | | | | | |
Chimp:  G-C-C-G-A-G-A-A-G-C-A-C
```

(The T does not match the G in the middle of the sequence.) A variation is called an *indel* (short for insertion/deletion) when one of the sequences has extra letters:

```
Human:  G-C-C-G-A-T-G-C-T-G-T-A-A-A-G-C-A-C
        | | | | | |               | | | | | |
Chimp:  G-C-C-G-A-T-               A-A-G-C-A-C
```

If the comparison focuses only on substitutions within aligned protein-coding regions, the match is 99 percent. Indels constitute roughly a 3 percent difference in addition to the 1 percent for substitutions, leading to the figure of 96 percent offered by the NIH.

Before we move on

- What are three kinds of correspondence and noncorrespondence between DNA strands?
- How was the 99 percent statistic reached? What about the 96 percent statistic? What is the difference between substitutions and indels?

OR LESS

But we have only begun. The 96 percent figure deals only with DNA regions for which an alignment or partially matching sequence can be found. It turns out that not all the regions of human DNA align with chimp DNA. A technical article in 2002 reported that 28 percent of the total DNA had to be excluded because of alignment problems, and that "for 7% of the chimpanzee sequences, no region with similarity could be detected in the human genome."[6]

Even when there is alignment, the alignment with other primate DNA may be closer than the alignment with chimp

DNA: "For about 23% of our genome, we share no immediate genetic ancestry with our closest living relative, the chimpanzee. This encompasses genes and exons to the same extent as intergenic regions."[7] The study in question analyzed similarities with orangutan, gorilla, and rhesus monkey, and found cases in which human DNA aligns better with one of these than with chimpanzees.

Before we move on

- What new issue have we discovered about the 96 percent "identical" genetic codes? How does this change the situation?
- Does human DNA always align best with chimp DNA? How might this change your attitude to the first statistic given?

THE CHALLENGE OF INTERPRETING DATA

The data from the Human Genome Project and similar projects for chimpanzees and other animals has to be interpreted. It does not interpret itself. What is the significance of the similarities? Do they in fact show that human beings have ape ancestry? Do they imply that we are little more than naked apes? Do they tell us who we are as human beings?

The reigning framework for the interpretation of genetic information and biological origin is Darwinism. Darwinism is much more than the observation that we can breed dogs or that we can study the effects of mutations in fruit flies.[8] Darwinism says that all kinds of living things came into being by purely gradualistic processes. In the popular mind, and indeed also among many scientists, Darwinism also involves the additional assumption that the process of change over time was unguided

and purposeless—in other words, God, if he exists, is absent. When applied to the question of human origins, Darwinism implies that we are here by accident, and the kind of race that we are is an accident. Darwinism excludes design by a supernatural Designer; it also excludes in principle the idea of a sudden origin of a new kind of living thing through direct creation from nonliving material, or through multiple simultaneous mutations, or through large-scale reorganization of living cells, or through any other kind of event that could realistically have taken place only through the presence of a Designer.

We must take into account the influence of Darwinism as a framework, because the framework guides how people interpret the significance of genetic similarities. The similarities exist—of that there is no doubt. But what do they mean?

Before we move on

- Scientific data does not interpret itself. What would happen if it did? What happens because it does not?
- What does the author mean by calling Darwinism a *framework*?
- On the most basic level, what does Darwinism say about living creatures? What do many people assume that Darwinism also says? What does this brand of Darwinism exclude?

NO PURPOSE?

First, we should distinguish two issues: the issue of purpose and the issue of gradual processes. They are distinct. According to the teaching of the Bible, God is continually involved in ruling the world providentially. He is intimately involved in regular, gradual processes; his presence is not confined to miracles or

exceptions. The following verses in the Bible illustrate God's involvement:

> You [God] make springs gush forth in the valleys.
> (Ps. 104:10)

> You cause the grass to grow for the livestock
> and plants for man to cultivate. (Ps. 104:14)

> You make darkness, and it is night. (Ps. 104:20)

> When you send forth your Spirit, they [the next generation
> of animals] are created,
> and you renew the face of the ground. (Ps. 104:30)

In particular, God is active in the formation of human life in a mother's womb:

> For you formed my inward parts;
> you knitted me together in my mother's womb. (Ps. 139:13)

God is active as the Primary Cause in addition to the secondary causes that are involved in springwater, the growth of grass, the coming of darkness, the birth of animals, and the gestation and birth of human beings. God has purposes in all these events. Within the picture presented in the Bible, scientific analysis of the secondary causes describes *how* God brings about his purposes—he does so through gradual processes.

Now, for the sake of argument, let us suppose that the mainstream picture of gradualism is true; that is, purely gradual processes produced all living things. That picture is completely compatible with God's having done it all for his own purposes.[9] When Darwinism says that the process is "purposeless," it might

mean merely that scientific research, narrowly conceived, is not competent to discern the purposes, but only the processes. But in the popular mind, Darwinism is much more: it implies that the purposelessness of the process is definitively established. And that claim overreaches the evidence and the competence of science. It is really a philosophical and religious claim. It makes sense only if a person already knows or believes that God does not exist or that he cannot have purposes that he is accomplishing in gradual processes. The belief is simply smuggled in; it is not an inference just from raw data.

Moreover, the belief about absence of purpose has the potential for feeding back into scientific investigation and influencing scientific interpretation. If there is no God or no purpose, gradualism is virtually the only option, and adherents may cling to it uncritically.[10]

Before we move on

- In what ways does the Bible describe God's involvement with the world? If God is the Primary Cause, why and how do secondary causes work?
- How would we know whether something were purposeless? If we believe in purposelessness, what options do we have?

GRADUALISM

Now consider the second issue, the issue of gradualism. According to the picture in the Bible, God can work as he wishes. Many times he works through gradual processes, as we have observed. The regularity of these processes reflects God's faithfulness. But he is not a prisoner within these processes. His rule over the world is what establishes the processes in the first place.[11] He is free to work exceptionally, whenever he wishes. The

experimental aspect of science is possible because of the regularities in God's rule. But rightly understood, science is subject to God and cannot presume to dictate to him what he *has* to do. It cannot forbid exceptions. Thus, exceptions are possible in the case of one-time, unrepeatable events, such as the origin of the universe, the origin of the first life, and the origin of human beings. The gradual processes that represent the usual means for God's rule may have exceptions.

Before we move on

- How does God's rule over the world make science possible?
- What does it mean to say that God can and does work "exceptionally"? What is the relationship between science and God's exceptional work?

It has now become customary for mainstream representatives of Darwinism to say that the discussion of possible exceptions is a matter not of science but of religion. Of course, it depends on how one defines science. But it also depends on how one defines religion. If Darwinism says that the events involving the origins of living things are purposeless, it is making a quasi-religious claim about the lack of God's involvement. If it says that there are no exceptions to gradualism, it is also presuming that it knows beforehand how God will interact with life, and that, too, is a religious claim. Atheism is a "religion" in this sense because it makes a claim about God, namely, that he does not exist. And Darwinism is a "religion" in this sense because it makes claims about the involvement of God.

The important feature here is that within the mainstream of modern culture, Darwinism is not *seen* as religious, but as merely "neutral" and "scientific." Why? Because the religious assumptions have already been incorporated into the "scien-

tific" theory in the form of underlying assumptions about lack of purpose and gradualism. We are simply told that "this is how science is done."[12] Because of the cultural prestige of science and scientists, many people simply accept the present state of things as if it were the only possibility. But once we question the underlying assumptions, it becomes clear that there are other possible ways of construing the meaning of science: science studies the regularities of God's providential rule, and can do so *without* making assumptions that ban the idea of divine purposes or ban God's exceptional acts.

Before we move on

- Over the years, how has science come to be defined?
- What assumptions are included in this definition? Are those assumptions religious, scientific, or both?
- Is this the only way we must view science? What other perspectives might we take?

INTERPRETING THE EVIDENCE

Now we can return to consider the similarities between human DNA and chimp DNA. What is the meaning of this evidence? It depends on the framework that we have for interpreting the evidence. If our framework is Darwinism, with its purposelessness and gradualism, clearly the similarities confirm the standard picture of gradualism. We postulate a gradual series of mutations by which a common pool of ancestors gradually separated into protohuman and protochimp lines. The evidence confirms the framework because we already have the framework.

If, on the other hand, we use a framework in which God has purposes, he may act either gradually or exceptionally. Whichever means he uses, the DNA is fundamentally his design. The

similarities are the product of his intelligent design. Both the similarities and the differences have purposes in the mind of God (though we ought not to presume to claim detailed knowledge about all his purposes). They testify to his wisdom, whether he brought about the present situation by gradual processes or by one or more exceptional acts. We cannot presume to say just how he did it without looking both at the data and at whatever we have come to know about God.

Before we move on

- What are two fundamental components of Darwinism? How are these components applied to interpreting similarities in DNA?
- What are two aspects of a framework that takes God into account? How can these aspects be applied to interpreting similarities in DNA? Using this framework, what can we not presume?

The most striking genetic similarities between humans and chimps lie in many of the protein-coding regions within the DNA. That is understandable from the standpoint of design because proteins are the backbone of chemical machinery inside a cell. Cells have to have machinery for metabolism, for cell division, for translating DNA into proteins, for dealing with toxins, and for responding to the environment. The machinery has to accomplish many of the same things in cells of many kinds, so it should not be surprising that there are similarities among proteins not only between man and chimpanzee but throughout the world of living things. God may have brought about these marvelous similarities through gradual processes, if he so chose, but it is up to him.[13]

Given the prevailing Darwinist framework, it is natural that media reports would concentrate on the striking similarities in

protein-coding regions because these allegedly confirm the Darwinian framework. In popular reports, difficulties arising from dissimilarities in other regions of DNA are left in silence, with the expectation that these will be explained by the same framework sometime in the future. Without any malicious intent, the evidence is naturally selected to put in the forefront the "confirming" evidence rather than evidence that is still problematic. But before ordinary people are bowled over by the claims, they should ask themselves whether the claims are colored by the assumptions of the framework.[14]

Before we move on

- From a design point of view, what is understandable and not surprising about the similarities in the DNA of different living creatures?
- From a Darwinist point of view, what is not surprising about the similarities in the DNA? In this view, how are the dissimilarities received and understood? Is there anything malicious about this?

Does it make sense that God would create human beings with so much similarity to animals? It is up to God how he wants to do it. If he wants to make similarities, he can do so—however many similarities he wants. We have to investigate, not presume beforehand to know how he would do it.

The Bible does not offer details about chemical composition or other technical matters about the human body. God had the Bible written for all of us, to tell us about himself and about what is important for our practical living, not to overwhelm us with technical details that many people would not understand. But it is interesting that the Bible does give hints concerning similarities between human beings and the animal world. Genesis 2:7 says

that when God made man, "the man became a living creature." The expression "living creature" is the same as the expression used in Genesis 1:20, 21, and 24 to describe animals. Man is created from "dust from the ground" (2:7), which also hints at the common material stuff making up his body. Man made in the image of God is supreme over the animals (1:28), but he also has a definite solidarity with them. The language about "the image of God" underlines human uniqueness, but even here there is a subordinate similarity. The Bible indicates that Adam fathered a son "after his image" (Gen. 5:3). This imaging process through fathering has analogies to animal reproduction, such as even ancient people could observe. The common pattern of fathering derives by analogy from God, who is God the Father in relation to his divine Son.[15] This divine original pattern is reflected in an analogical fashion in all the patterns of similarity that we see among living things.

Before we move on

- Does it make sense for God to create human beings in a way similar to animals? In what ways does the Bible suggest that he has done this?
- What is the purpose of the Bible? Do technical scientific details fit with this purpose?

MIRACLES AND SOLIDARITY

We can illustrate the principle of solidarity in other kinds of cases. John 2:1–11 describes a miracle in which Jesus turned water into wine. If a scientist had been there to test the product, would the wine have tasted, smelled, and looked like ordinary wine? Would its chemical composition have been the same as wine? We do not know the details, but it is certainly a reasonable

possibility that God would choose to work a miracle in such a way that the product would fit naturally into the world that he had already made.

Matthew 1:18–25 and Luke 1:34–37 indicate that Jesus was born of a virgin. If a scientist had been able to test a sample of DNA from Jesus' cells, would he have found a normal human Y chromosome, such as is present in the human DNA of men but not women? The Bible does not speak directly about such details, but Hebrews 2:14, 17; 4:15, and other passages indicate that Jesus was fully human. (Other passages, of course, indicate that he is also fully divine. He is one person with two natures, a divine nature and a human nature. This is a great mystery.) It is reasonable to infer that Jesus' full humanity extended even to such details as the Y chromosome. If so, the Y chromosome is an example of a thoroughgoing DNA match that was *not* the product of ordinary mammalian reproductive processes. The match is a product of a miracle, and it has a clear divine purpose—namely, that Jesus should be fully human, in solidarity with the rest of humanity, so that he may represent us as our Sin-Bearer and High Priest: "Therefore he had to be made like his brothers in every respect, so that he might become a merciful and faithful high priest in the service of God, to make propitiation for the sins of the people" (Heb. 2:17).

(Of course, some people may reject water becoming wine and the virgin birth because they reject miracles in principle. But that is another issue. If God is God, he can work miracles when he chooses.)

Jesus' virgin birth is clearly a most exceptional case, but it shows that we must reckon with more than one possible account for DNA matches. The solidarity of human beings with animals and with primates belongs to a different order from solidarity within the human race, but the broad principle of

solidarity remains.[16] John Bloom perceptively asks, "Does man *have to be different* to be proof that God made him directly?" The answer is no.[17]

Before we move on

- What is the *principle of solidarity*? How does it apply to the miraculous, exceptional work of God? How does it apply to the relationship between humans and animals?
- Why do human beings not have to be different from animals in order to prove that God created them directly?

DO PERCENTAGES MATTER?

Now, for the sake of argument, suppose that human DNA had matched chimp DNA in 99 percent of the cases all along the DNA strands, not merely in cases of single-base substitutions in aligned regions. What would that prove? Within a Darwinian framework, it might suggest that human beings are merely one more primate. But if God exists and is interested in human beings—if indeed he created human beings uniquely in his image, as the Bible indicates (Gen. 1:26–27)—the essential character of human nature is not to be found in quantitative comparisons in the chemistry of DNA. A merely quantitative approach to human nature is part and parcel of a materialistic worldview, in which virtually everything reduces in the end to matter and motion. On the other hand, if persons are significant because God made them, it matters little what their exact chemical makeup is. What matters is that they are persons who can relate to God, who is personal. The framework for interpretation is different, and that framework leads to a different assessment of the significance of humanity. The question of genetic similarity remains of interest to scientists, but it is entirely secondary to the question of human significance.[18]

Before we move on

- How is Darwinism forced to take a "merely quantitative approach to human nature"? What does this mean? Is this problematic?
- How does a design framework change the whole perspective brought to DNA evidence? Is the design framework dismissive of the evidence? Why, or why not?
- Can Darwinism say anything about the significance of humanity? Can design? Why?

JUNK DNA

About 1.2 percent of human DNA has code that is translated into proteins.[19] What about all the rest? When geneticists became aware of noncoding DNA, the Darwinist framework provided an explanation. Noncoding DNA was interpreted as giving us a record of broken evolutionary pieces that no longer had a function—it was "junk" DNA.[20] Francis Collins pointed to this "junk" as one evidence for the gradualistic character of human genetic origins.[21]

But further research has uncovered many positive functions in what was formerly termed "junk." The ENCODE project (the "Encyclopedia of DNA Elements") has endeavored to catalogue systematically the noncoding DNA, and reports that more than 80 percent has "now been assigned at least one biochemical function."[22] The leader of the ENCODE project accordingly called for retiring the word *junk*.[23]

Before we move on

- How was noncoding DNA once interpreted? Why did this view change?
- What does this show us about interpretative frameworks?

THE FUNCTION OF THE FRAMEWORK

Is Darwinism in trouble? In one sense, no, because Darwinism has become a flexible framework. Is 98 percent of the genome alleged to be nonfunctional? No problem, because it confirms that Darwinian evolution is messy. Is at least 80 percent of it functional? No problem, because it confirms how efficient natural selection, mutations, and DNA rearrangements are in producing superb fitness and complex functionality.

Many kinds of evidence can be plausibly fit into the Darwinian framework, because the framework itself has evolved over a hundred years to provide space to accommodate evidence.[24] The pervasiveness of the framework makes it difficult for people to stand back far enough to ask crucial questions.[25] Should we exercise skepticism about reigning assumptions? Should we ask whether the framework as a whole needs questioning? A few people see problems. Nobel Prize winner Robert B. Laughlin complains,

> Most important of all, however, the presence of such corollaries [from mass behavior in solid-state physics] raises the concern that much of present-day biological knowledge is ideological. A key symptom of ideological thinking is the explanation that has no implications and cannot be tested. I call such logical dead ends antitheories because they have exactly the opposite effect of real theories: they stop thinking rather than stimulate it. Evolution by natural selection, for instance, which Charles Darwin originally conceived as a great theory, has lately come to function more as an antitheory, called upon to cover up embarrassing experimental shortcomings and legitimize findings that are at best questionable and at worst not even wrong. Your protein defies the laws of mass action? Evolution did it! Your complicated

> mess of chemical reactions turns into a chicken? Evolution! The human brain works on logical principles no computer can emulate? Evolution is the cause! Sometimes one hears it argued that the issue is moot because biochemistry is a fact-based discipline for which theories are neither helpful nor wanted. The argument is false, for theories are needed for formulating experiments. Biology has plenty of theories. They are just not discussed—or scrutinized—in public. The ostensibly noble repudiation of theoretical prejudice is, in fact, a cleverly disguised antitheory, whose actual function is to evade the requirement for logical consistency as a means of eliminating falsehood.[26]

One basic problem is that gradualism has become a built-in, unchallengeable assumption of the theory. In cases in which gradualism is difficult to manage, Darwinism papers over the difficulties by citing other kinds of confirmatory evidence, by assuring us that the theory is well established ("fact"), that the presence of the final form demonstrates that there must be a gradualistic path leading to it,[27] and that the difficulties would dissolve if we had more information. Scientists trust in current scientific theories, and in many cases the trust is warranted. But such trust is a form of faith, and it is unwise to denounce those who find themselves unable to muster the same faith.

Before we move on

- What is the problem with having a flexible interpretative framework? How can this be seen in regard to Darwinism? In what way is Darwinism *not* flexible?
- In scientific fields of study, why is it unwise to denounce "unbelievers"? How might these people be a help or a hindrance in scientific investigation?

DOES NONFUNCTIONALITY MATTER?

And now, for the sake of argument, suppose it were the case that 98 percent of the human genome were biochemically nonfunctional. Would this outcome be decisive for our understanding of human nature and human origins? No, because we do not know the mind of God. Nonfunctionality, if it had existed, would still have to be interpreted, and it takes a framework to do this interpretation. More than one framework is possible, as we have already pointed out. If the framework is Darwinism, then nonfunctionality confirms Darwinian claims about the purposeless character of evolution. If the framework includes an affirmation of God's providential control—an affirmation found repeatedly in the Bible—then God has his purposes, whether or not we can discern them. Many of the ways of God are past finding out. The fact that we cannot figure out purposes does not mean that God does not have any.

And there is at least one possible purpose that is actually suggested by the Bible's teaching on the creation of man—namely, solidarity. Man is created both to rule and to have solidarity with the animals and plants over which he rules. The solidarity may be extensive, and if some DNA were to prove not to have biochemical functionality, it might still include either reminders of the fall of man or reminders that the original unfallen creation, though good, was a beginning point that would lead to something even better—a new heavens and a new earth (Rev. 21:1). Thus, even if, for the sake of argument, we were to imagine for ourselves a world in which large amounts of DNA are nonfunctional from a narrow, biochemical point of view, it might still be the case that God could give it a "function" at a completely different level, as an expression of either solidarity or reminders of the fall or reminders of hope for the future. It is presumptuous to assume that if we could find no function

within narrow boundaries, we could draw firm conclusions about the purposes of God or lack of purpose.

Before we move on

- Why does a completely different (hypothetical) set of facts about the human genome still not prove decisive? How do our two frameworks interpret this information?
- What can human beings conclusively say about the purposes of God?

THE MINIMUM-POPULATION BOTTLENECK

We should also consider arguments about population size. A number of claims have been made based on studies of the present genetic diversity in the human population. Statistical analysis allegedly shows that there never was a single original human pair, but a larger population—figures of 5,000 or 10,000 are sometimes encountered as minimal figures for any population "bottleneck" in human ancestry.

(A "bottleneck" is a point in time at which the population of a group temporarily falls to a small number. A population can suddenly fall if a famine or plague or other disaster suddenly wipes out most of the population.)

For example, a 1994 study by Francisco Ayala et al. focused on polymorphisms (multiple variations among aligned DNA sequences) that "are shared among contemporary species."[28] Since the polymorphisms are shared by two or more species, they must have been passed on from a group of common ancestors, and the group must be large enough to have contained all the variations in DNA sequences that match across species. The paper estimates that any population bottleneck must have included "several thousand individuals."[29]

Before we move on

- What is a bottleneck? What is the minimal figure given for human populations?
- What are polymorphisms? Why do investigators think that polymorphisms shared between species indicate a fairly large group of common ancestors?

The result sounds impressive, but there are difficulties. The particular genomic area on which Ayala's study focused was the major histocompatibility complex (MHC), which is involved in immune response. This particular area changes more rapidly over time than most other areas of the genome because human beings and other animals are forced to adapt in their immune systems to new challenges from attacking parasites, bacteria, and other invaders. Moreover, new invasive threats may confront human beings and other animals simultaneously, and similar changes in the MHC may take place in more than one species in response to the challenges. So similarities in variations in the MHC of different species may result from common invasive challenges. A 2006 article reexamines the MHC evidence and concludes:

> Most MHC diversity is *de novo* generated [i.e., within the human species] and not the result of trans-species inheritance as initially thought (Figueroa *et al.* 1988; Lawlor *et al.* 1988). This result finally puts the MHC in line with the bulk of population and evolutionary genetics data, which firmly conclude that a narrow bottleneck [!] has occurred at the origin of our species (Cann *et al.* 1987; Hammer 1995), a fact inconsistent with massive flow of alleles from one species to the next as required by the trans-species postulate (Ayala *et al.* 1994).[30]

Notably, the quotation just given cites Ayala's 1994 paper and implies that it is now obsolete.

Before we move on

- What area in the human genome changes more rapidly than most others? Why?
- Twelve years after Ayala's paper was published, what new explanation was given for the diversity in the MHC? Why does this permit a much narrower bottleneck than Ayala supposed?

Dennis Venema cites several lines of evidence concerning human population size.[31] One paper by Albert Tenesa et al. analyzes linkage disequilibrium.[32] We cannot enter into the details of the technical analysis. Tenesa's paper depends on assumptions about constant rates of mutation and constant rates for chromosomal crossovers (recombinations). Even granted these assumptions, the study indicates that there is an effective limitation to how far one can probe into the past.[33] Information based on correlations between nearer locations on a chromosome probes further into the past, but the analysis always results in figures that represent a rough average over many generations in the human population. Consequently, the principal figures, such as 3,100 for non-African populations and 7,500 for the African population, represent average populations over many generations.[34] They say nothing one way or the other about whether the size decreased rapidly to two individuals in the more distant past.

Before we move on

- Analysis of linkage disequilibrium produces what kind of figures for human population sizes? Can this analysis be used to give more specific information?

Another line of evidence uses cases in which human DNA matches gorilla DNA more closely than chimpanzee DNA. Two

supporting technical papers that Venema cites assume that common ancestry is the explanation for these similarities, and then use mathematical models to estimate the average and minimal population of the group of common ancestors for humans and chimpanzees. One paper gives as a principal figure a population of 52,000 to 96,000,[35] while the other gives 12,000 to 21,000.[36] If one grants all the assumptions leading to these figures, they describe the time at which lineages that would eventually lead to humans and to chimpanzees initially separated. They say nothing directly about whether there was a later bottleneck in the population size in the lineage leading to humans.[37] By leaving the question open, the papers do not in fact exclude the possibility of a bottleneck consisting in a single pair—Adam and Eve.

We should, however, be careful to note what assumptions go into these papers. They assume that a purely gradualistic process led to the human race, and then try to calculate, based on that assumption and others, what might be the average population size at the time at which the protochimp and protohuman lineages initially diverged. The built-in assumptions imply that a later bottleneck consisting in a single human pair would still be purely gradualistic in nature: the key pair would have arisen by normal processes of primate birth and growth, and would differ only gradualistically from their parents. The assumption of gradualism thus leads to an overall picture that differs from the biblical teaching on Adam and Eve. But the differences arise from the assumption of gradualism, not from the genetic evidence in itself.

Before we move on

- What assumptions form the groundwork of the papers described? How do these assumptions lead to a different

picture of human origins from the one given in the Bible? Does the genetic evidence dictate this approach?

- Assuming that common ancestry is the explanation for similarities between humans and chimpanzees, can anything be said about the size of the original human population?

Another paper uses genetic diversity among humans today to estimate average population size over the remote past, and offers nine different estimates in the region of 10,000.[38] But these numbers depend on models that assume a constant population size through many generations.[39] The figures are in fact giving us rough averages over long periods of time, so they say nothing about the possibility of two original individuals.

Before we move on

- Considering all the papers just described, can we draw any conclusions from the evidence? Why, or why not? What can we learn from this research?

HOW LONG AGO DID ADAM AND EVE LIVE?

The studies from population genetics do seem to suggest long periods for the past of human populations. Figures of 40,000 years, 100,000 years, and more crop up in various articles. How do we evaluate these large figures? To begin with, we should observe that these figures all depend on mathematical models that rely on assumptions about the past. The models assume that the past is like the present, and that the rates of mutation and other genetic processes remain the same. If we receive the Bible's instruction, we must be cautious about such assumptions. The assumptions may be

right, but then again they may not: the fall into sin resulted in a curse that may have had extended, multigenerational effects on mankind.

In addition, we should try to understand the information that the Bible is giving us with its genealogical records (primarily in Genesis 5 and 10). In his famous chronological calculations, Archbishop Ussher assumed that the main genealogical records in Genesis 5 and 10 had no gaps, that is, that they had omitted no names for intermediate generations. Using that assumption, he calculated backward to a date for creation in 4004 B.C. But the Bible does not say anywhere that its genealogies have no gaps. Moreover, the genealogy in Matthew 1:2–16 places the name of Uzziah immediately after Joram (v. 8). When it does so, it omits the names of the intervening generations, Ahaziah, Joash, and Amaziah, which 2 Chronicles 22–25 mentions. Matthew 1:8 thus has a "gap."

William Henry Green did an extensive analysis of biblical genealogies and concluded that they might contain gaps.[40] If they do, the gaps mean that we cannot use Ussher's procedure of adding up the years in the genealogies to obtain a date for the creation of Adam and Eve. The Bible simply does not tell us how long ago it was. Thus, Adam and Eve may have lived further back in time.[41]

Before we move on

- In mathematical models of past human populations, what assumption is made? Why is this a risky assumption?
- What assumption did Archbishop Ussher make as he calculated the year of creation? What evidence do we have that this assumption might be false? What does this mean for attempts to use the Bible to calculate the age of the earth?

THREE SIDES TO THE ANALYSIS

The question about Adam and Eve is challenging for several reasons. For one thing, research on the genomic information in primates and in other living things continues at a great pace. What looked like firm conclusions in the excitement at an early stage might be modified later. We need patience to assess the research.

In the midst of rapidly expanding research, popular claims made in the name of science easily fall victim to one of three failings: they overreach or exaggerate the implications of evidence; they misread the significance of technical research; or they argue in a circle by assuming the principle of purely gradualistic evolution at the beginning of their analysis.

In addition, the question about Adam and Eve contains several dimensions. It has a scientific side, because scientific reasoning about hominid bones[42] or DNA similarities or population genetics is being cited in favor of dismissing Adam and Eve.[43] For the most part, we have focused on this scientific side. But the question also has a side focusing on biblical interpretation, since one of the questions is what the Bible teaches in the various passages that mention Adam or Eve or both.[44] It has a theological side, because theology undertakes the task of summarizing the teaching of the Bible as a whole and asking about its implications for our own understanding of Christianity, for our understanding of ourselves as human beings (are we descended from Adam, whose one sin has resulted in universal human sin?), and for our living.[45]

Before we move on

- What three mistakes are easily made by popular scientific claims? How might we identify these mistakes in our encounters with them?

- What are several dimensions to the issue of Adam and Eve? What does this mean for how we should approach questions of their historicity, origin, year of creation, and so on?

COMMITMENTS

I am a follower of Christ. So I do not come to this issue in a religiously neutral way.[46] But neither does anyone else. Science itself cannot be practiced without a prescientific faith or trust.[47] For example, scientists must believe (1) that the world displays regularities, (2) that human beings have minds so attuned to these regularities that they have a chance of discerning them, (3) that examination of the world and experimentation concerning its regularities are ethically legitimate, and (4) that scientists ought to and for the most part do remain honest in their examination of the world and their reports of their conclusions.

We can distinguish between approximate formulations of scientific laws by scientists and the real laws "out there," the systems of regularities that scientists believe in even before they do their investigations. I have argued elsewhere that the real law is God's speech, by which he rules the world.[48] All scientists actually rely on God. But within our modern secularist environment, many scientists attempt to replace God with an impersonalist conception of law—law is just a kind of cosmic mechanism.

The difference is more than academic. If the laws are impersonal and mechanistic, there can be no exceptions to observed regularities. On the other hand, if God as a personal God is governing the world, his personal purposes may include several dimensions. He is faithful in his governance, and his faithfulness leads to the regularities. At the same time, he is personally involved in relation to human beings, and his personal involve-

ments and personal commitments may lead to special acts in accord with special purposes. No one can stop him from working exceptionally if he wishes.

Before we move on

- What are some prescientific assumptions made by scientists? Are these reasonable? Why, or why not?
- What is the difference between the formulations of scientific laws by scientists and the "systems of regularities" that are really out there?
- What is the difference between personal and impersonal laws? What does this mean for science? If the law is personal, what does this mean for the working of the world?

UNDERSTANDING THE CREATION OF HUMAN BEINGS

This view of God's involvement has implications for Adam and Eve. It is up to God how he wants to go about creating the world. He is sovereign. He specifies all the laws that scientists later explore. He is not a victim or a prisoner of his own laws! He may if he wishes create new species through gradual processes; he may also create in unique ways.[49]

God gave us the Bible in order to guide us. This guidance includes instruction concerning our understanding of who we are as human beings and our understanding of sin as rebellion against God and a disruption of an initially good creation. Most significantly, it also includes the good news of redemption from the pit of sin, accomplished by Christ. If we understand God's purposes in this way from the Bible,[50] we may continue to have confidence that he gave us a reliable account when he spoke about Adam and Eve. They did exist, and they were specially created—"in the image of God." Because of Adam's fall, we are

all subject to sin (Rom. 5:12–21; 1 Cor. 15:21–22). We must come to Christ for deliverance.

In conclusion

- We started with a question that is often considered a matter for science. But what can science actually tell us on this issue?
- In what ways is the Darwinist framework flexible? In what ways is the design framework flexible? Does one framework allow for more internal consistency than the other? If so, why? How?
- What different kinds of evidence did we consider in this booklet? Did some interpretations of the evidence seem more convincing than others? What made those interpretations convincing to you? What assumptions were made by those interpretations?
- As we investigate scientific claims, what should we keep in mind? What questions should we ask? Is it fitting to bring "religious" questions or answers into the investigation? Why, or why not?

FOR FURTHER READING

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NOTES

1. See in particular J. P. Versteeg, *Adam in the New Testament: Mere Teaching Model or First Historical Man?*, trans. and with a foreword by Richard B. Gaffin Jr., 2d ed. (Phillipsburg, NJ: P&R Publishing, 2012).

2. Krishna Ramanujan, "Genetic Divergence on Man from Chimp Has Aided Human Fertility but Could Have Made Us More Prone to Cancer, Cornell Study Finds," Cornell University News Service, May 13, 2005, http://www.news.cornell.edu/stories/May05/Chimps.kr.html (accessed September 19, 2012). As of June 19, 2013, the original news post is not found on the Internet, but an "Overview" containing the same quotation is at http://vivo.cornell.edu/display/individual11525.
3. Jeffrey Norris, "What Makes Us Human? Studies of Chimp and Human DNA May Tell Us," UCSF News Center, June 28, 2010, http://www.ucsf.edu/news/2010/06/5993/what-makes-us-human-studies-chimp-and-human-dna-may-tell-us (accessed September 19, 2012).
4. "New Genome Comparison Finds Chimps, Humans Very Similar at the DNA Level," *NIH News*, August 31, 2005, http://www.genome.gov/15515096 (accessed September 27, 2012).
5. But some DNA has functions other than coding for proteins. See below. Further explanations of DNA can be found in many places, e.g., Stephen C. Meyer, *Signature in the Cell: DNA and the Evidence for Intelligent Design* (New York: HarperOne, 2009).
6. Ingo Ebersberger et al., "Genomewide Comparison of DNA Sequences between Humans and Chimpanzees," *American Journal of Human Genetics* 70, 6 (June 1, 2002): 1492–93, http://www.cell.com/AJHG/abstract/S0002-9297%2807%2960701-0 (accessed September 19, 2012).
7. Ingo Ebersberger et al., "Mapping Human Genetic Ancestry," *Molecular Biology and Evolution* 24, 10 (2007): 2266, http://mbe.oxfordjournals.org/content/24/10/2266.full.pdf (accessed September 19, 2012); referenced by Casey Luskin, "Study Reports a Whopping '23% of Our Genome' Contradicts Standard Human-Ape Evolutionary Phylogeny," *Evolution News*, June 3, 2011, http://www.evolutionnews.org/2011/06/study_reports_a_whopping_23_of047041.html (accessed September 19, 2012).
8. For a clear exposition of different meanings of *evolution*, one may see John C. Lennox, *God's Undertaker: Has Science Buried God?* (Oxford: Lion, 2009), 100–108.
9. Similarly, Alvin Plantinga distinguishes between unguided and guided evolutionary processes. *Where the Conflict Really Lies: Science, Religion, and Naturalism* (Oxford: Oxford University Press, 2011), 16–17, 39, 55, 63.
10. Lennox, *God's Undertaker*, 96–99.

11. Vern S. Poythress, *Redeeming Science: A God-Centered Approach* (Wheaton, IL: Crossway, 2006), esp. chap. 1.
12. On "methodological naturalism," see ibid., chap. 19.
13. Because of "redundancy" ("degeneracy") in the DNA code, two distinct codons, consisting of triplets such as CTT and CTA, may code for the same amino acid, such as leucine. Although distinct codons could code for the very same amino acid, distinct species tend to reuse the same codon at the same position in analogous proteins. This evidence is not explained merely by appeals to common protein function. So an additional explanation is called for, and of course, Darwinism supplies it in the form of common descent and gradual modification.
14. On the importance of frameworks of interpretation, see Thomas S. Kuhn, *The Structure of Scientific Revolutions: 50th Anniversary Edition*, 4th ed. (Chicago: University of Chicago Press, 2012).
15. See Poythress, *Redeeming Science*, chap. 18.
16. John Bloom mentions the wine in John 2 and suggests further illustrations of special action that authenticate the special character of the product: the president of a firm personally signs a letter typed by his secretary; or, in the ancient Near East, a king might personally make the first brick for a temple. "On Human Origins: A Survey," http://www.asa3.org/ASA/education/origins/humans-jb.htm (accessed September 26, 2012).
17. Ibid. (italics in original).
18. The Bible focuses on man's religious status and relationship to God. This focus is appropriate because it is vital to our understanding of God himself, human sin, and Christ's redemption. In addition, our personal relation to God really does constitute what is most weighty and distinctive about humanity in comparison to animals. A number of authors, observing the importance of religious status, have theorized that a sudden appearance of religious consciousness or a sudden transition to relatedness to God or a sudden initial act of divine revelation is compatible in principle with a gradualistic origin of humanity at the biological level. They distinguish sharply between religious relationship and biological history.

    In reply, we may indeed acknowledge that in theory many possible biological stories for how God brought man into existence might be minimally compatible with the general principle that man is made in the image of God (Gen. 1:26–17). But Genesis 2:7 and 2:21–22 are more specific. These verses along with the entire context make points about

man's religious relation to God, but in my judgment they resist being interpreted as if they had no implications about processes. See Poythress, *Redeeming Science*, 249–51.

19. The ENCODE Project Consortium, "An Integrated Encyclopedia of DNA Elements in the Human Genome," *Nature* 489 (September 6, 2012): 71, http://www.nature.com/nature/journal/v489/n7414/pdf/nature11247.pdf (accessed September 25, 2012).
20. Jonathan Wells, *The Myth of Junk DNA* (Seattle: Discovery Institute Press, 2011), 19–27.
21. Francis Collins, *The Language of God* (New York: Free Press, 2006), 136–37. It should be noted that Collins, because he is a Christian, believes in divine purpose. Moreover, he has now changed his mind and stopped using the term *junk DNA*. Wells, *Myth of Junk DNA*, 99.
22. Magdalena Skipper, Ritu Dhand, and Philip Campbell, "Presenting ENCODE," *Nature* 489, 45 (September 6, 2012), http://www.nature.com/nature/journal/v489/n7414/full/489045a.html (accessed September 25, 2012); see also ENCODE Project Consortium, "An Integrated Encyclopedia of DNA"; the issue is discussed further in Casey Luskin, "Junk No More: ENCODE Project *Nature* Paper Finds 'Biochemical Functions for 80% of the Genome,'" *Evolution News and Views*, September 5, 2012, http://www.evolutionnews.org/2012/09/junk_no_more_en_1064001.html (accessed September 25, 2012). In addition, we may note that many geneticists tend to interpret biochemical function narrowly to mean a coding function: the sequence of ACGT bases is functional if it is translated into RNA that has a function, or if it is recognized as a "promoter" or regulatory region that influences the expression of neighboring DNA. But in addition to these functions, parts of the DNA may serve "structural" functions, such as forming a key environment for the centromere, serving as spacers, and influencing DNA folding into chromatin. Wells, *Myth of Junk DNA*, 62–63, 72–77.
23. Ewan Birney, quoted in an interview by Stephen S. Hall, "Journey to the Genetic Interior," *Scientific American* 307, 4 (October 2012): 82.
24. A biblically informed Christian framework can also flexibly accommodate many forms of biological data. The difference is that the Christian framework does not claim to establish its case by appeals to biology, but rather by appeals to biblical testimony, to history, and to the universal evidence for God (Rom. 1:18–25).

25. There is also an ideological taboo against criticism. Lennox, *God's Undertaker*, 94–96, 99.
26. Robert B. Laughlin, *A Different Universe: Reinventing Physics from the Bottom Down* (New York: Basic Books, 2006), 168–70.
27. Lennox, *God's Undertaker*, 112.
28. Francisco J. Ayala et al., "Molecular Genetics of Speciation and Human Origins," *Proceedings of the National Academy of Science USA* 91, 15 (July 19, 1994): 6787, http://www.ncbi.nlm.nih.gov/pmc/articles/PMC44284/?tool=pubmed (accessed September 26, 2012).
29. Ibid.
30. Takashi Shiina et al., "Rapid Evolution of Major Histocompatibility Complex Class I Genes in Primates Generates New Disease Alleles in Humans via Hitchhiking Diversity," *Genetics* 173 (July 2006): 1569; see also Ann Gauger, "The Science of Adam and Eve," in Ann Gauger, Douglas Axe, and Casey Luskin, *Science and Human Origins* (Seattle: Discovery Institute Press, 2012), 105–22.
31. Dennis R. Venema, "Genesis and the Genome: Genomics Evidence for Human-Ape Common Ancestry and Ancestral Hominid Population Sizes," *Perspectives on Science and Christian Faith* 63, 3 (2010): 166–78, http://www.asa3online.org/PSCF/2010/08/20/genesis-and-the-genome-genomics-evidence-for-human-ape-common-ancestry-and-ancestral-hominid-population-sizes/ (accessed September 26, 2012).
32. Albert Tenesa et al., "Recent Human Effective Population Size Estimated from Linkage Disequilibrium," *Genome Research* 17 (2007): 520–26, http://genome.cshlp.org/content/17/4/520 (accessed September 26, 2012).
33. "Pairwise r^2 was calculated . . . only for SNP pairs between 5 kb and 100 kb apart . . . to avoid the influence of gene conversion on observed LD at SNPs that are closer [and that might otherwise probe more remote times]." Ibid., 521.
34. Ibid., 524.
35. Feng-Chi Chen and Wen-Hsiung Li, "Genomic Divergences between Humans and Other Hominoids and the Effective Population Size of the Common Ancestor of Humans and Chimpanzees," *American Journal of Human Genetics* 68 (2001): 444–56, http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1235277/ (accessed September 27, 2012).
36. Ziheng Yang, "Likelihood and Bayes Estimation of Ancestral Population Sizes in Hominoids Using Data from Multiple Loci," *Genetics* 162, 4

(2002): 1811–23, http://www.ncbi.nlm.nih.gov/pubmed/12524351 (accessed September 26, 2012).

37. In fact, Chen and Li explicitly mention the issue of a bottleneck at a later time: "the human lineage apparently has undergone a significant reduction in effective population size since its separation from the chimpanzee lineage." "Genomic Divergences," 455.
38. Zhongming Zhao et al., "Worldwide DNA Sequence Variation in a 10-Kilobase Noncoding Region on Human Chromosome 22," *Proceedings of the National Academy of Sciences of the USA* 97, 21 (October 10, 2000): 11354–58, http://www.ncbi.nlm.nih.gov/pmc/articles/PMC17204/ (accessed September 26, 2012). This paper is one of many that use data from present-day human genetic diversity.
39. Ibid., 11355, uses two models: (1) G. A. Watterson, "On the Number of Segregating Sites in Genetical Models without Recombination," *Theoretical Population Biology* 7 (1975): 257; and (2) Fumio Tajima, "Evolutionary Relationship of DNA Sequences in Finite Populations," *Genetics* 105 (October 1983): 438, http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1202167/ (accessed September 26, 2012).
40. William Henry Green, "Primeval Chronology," *Bibliotheca Sacra* 47 (1890): 285–303.
41. Genesis 4:2 describes Cain and Abel as engaging in agriculture and sheepherding. This description has suggested to some interpreters that the text is referring to the Neolithic period (around 10,000 B.C.), when archaeologists can see evidence of these activities. But Cain and Abel might have lived earlier. They might have taken the first steps, and yet have had their steps aborted by subsequent human decline due to sin. For a discussion of still other options for interpretation of Genesis 4–5, one may consult any number of Old Testament commentaries. Derek Kidner succinctly discusses the genealogies in Kidner, *Genesis: An Introduction and Commentary* (London: Inter-Varsity Press, 1967), 82–83.
42. On the assessment of fossils, see Casey Luskin, "Human Origins and the Fossil Record," in Gauger, Axe, and Luskin, *Science and Human Origins*, 45–84; also Bloom, "On Human Origins: A Survey."
43. For critical appraisals of mainstream media claims, one may also look to websites such as "Evolution News and Views," http://www.evolutionnews.org; and "Reasons to Believe," http://www.reasons.org, which respond to current news.

44. Versteeg, *Adam*; C. John Collins, *Genesis 1–4: A Linguistic, Literary, and Theological Commentary* (Phillipsburg, NJ: P&R Publishing, 2006).
45. See Richard B. Gaffin Jr., "Translator's Foreword," in Versteeg, *Adam*, ix–xxv.
46. Vern S. Poythress, "Evaluating the Claims of Scientists," New Horizons (March 2012): 6–8, http://www.opc.org/nh.html?article_id=739 (accessed September 26, 2012); also at http://www.frame-poythress.org/wp-content/uploads/2012/05/2012Evaluating.pdf (accessed September 26, 2012).
47. Michael Polanyi analyzes the element of personal commitment at length in *Personal Knowledge: Towards a Post-Critical Philosophy* (Chicago: University of Chicago Press, 1964).
48. Poythress, *Redeeming Science*, esp. chap. 1.
49. On the broader question of the origin of various kinds of life, see ibid., chap. 18; on the creation of Eve, see ibid., 249–51.
50. Discussions on biblical authority and purposes are, of course, voluminous. See particularly John M. Frame, *The Doctrine of the Word of God* (Phillipsburg, NJ: P&R Publishing, 2010).

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Cover design by Trinet Internet Solutions, Inc.

APOLOGETICS
ISBN: 978-1-59638-917-5

EAN 9 781596 389175 50499