

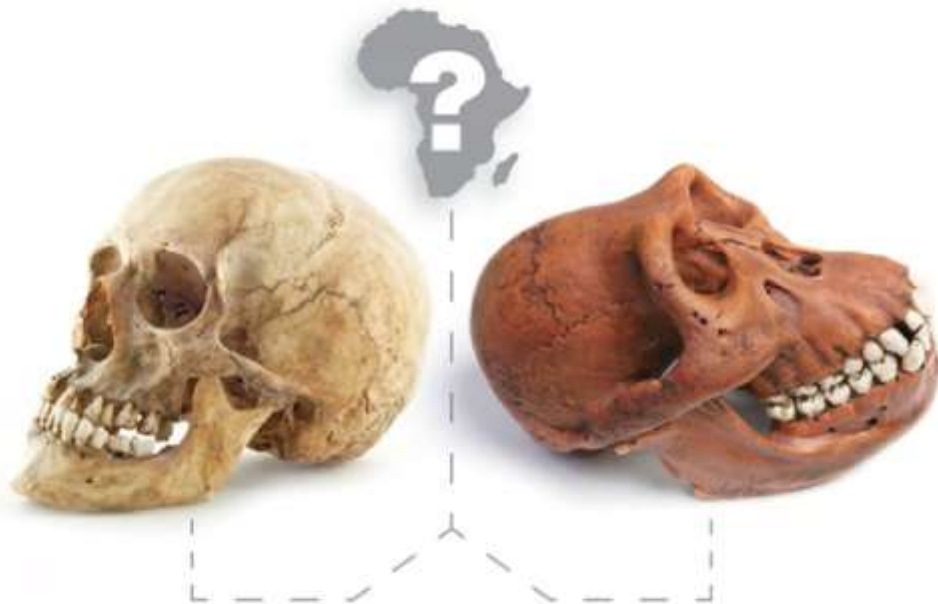
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Science and Human Origins

By: Ann Gauger, Douglas Axe & Casey Luskin

DISCOVERY INSTITUTE PRESS

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BY ANN GAUGER, DOUGLAS AXE, & CASEY LUSKIN

Introduction

- G. K. Chesterton put it well in *The Everlasting Man*: “Man is not merely an evolution but rather a revolution.” [G. K. Chesterton, *The Everlasting Man* (San Francisco: Ignatius Press, 1993), 26.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p7.]
- Even Alfred Russel Wallace, co-founder with Darwin of the theory of evolution by natural selection, eventually rejected a fully Darwinian explanation of human beings, preferring a form of intelligent design as an alternative.² [See Michael Flannery, *Alfred Russel Wallace: A Rediscovered Life* (Seattle: Discovery Institute Press, 2011).] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p7.]
- Ann Gauger is a developmental and molecular biologist with research experience at MIT, the University of Washington, and Harvard University. Douglas Axe is a molecular biologist who has held research scientist positions at Cambridge University, the Cambridge Medical Research Council Centre, and the Babraham Institute in Cambridge. Casey Luskin holds a graduate degree in earth sciences from the University of California at San Diego and has conducted geological research at the Scripps Institute for Oceanography. All three have published work in peer-reviewed science journals. All three have done “bench” science, not just science writing. And all three think Darwin’s theory is inadequate to account for both human origins and human uniqueness. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p7, 8.]
- Strictly speaking, modern Darwinian theory (often called “neo-
- Darwinism”) has two key planks: common descent and natural selection acting on unplanned genetic variations. Common descent is the idea that all animals now living have descended from one or a few original ancestors through a process Darwin called “descent with modification.” According to this idea, not only humans and apes share an ancestor, but so do humans, clams, and fungi. Natural selection is the idea of “survival of the fittest.” Modern Darwinian theory combines natural selection with the insights of modern genetics: Randomly occurring mutations and recombinations in

genes produce unplanned variations among individual organisms in a population. Some of these variations will help organisms survive and reproduce more effectively. Over time, these beneficial variations will come to dominate a population of organisms, and over even more time, these beneficial variations will accumulate, resulting in entirely new biological features and organisms. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p8.]

- As Darwin himself made clear, natural selection is an unintelligent process that is blind to the future. It cannot select new features based on some future goal or potential benefit. As a result, evolution in a Darwinian sense is “the result of an unguided, unplanned process,” to cite the words of 38 Nobel laureates who issued a statement defending Darwin’s theory in 2005.³ [Letter from Nobel Laureates to Kansas State Board of Education, Sept. 9, 2005. The letter was sent out under the auspices of the Elie Wiesel Foundation. A copy or the letter was posted at http://media.ljworld.com/pdf/2005/09/15/nobel_letter.pdf (accessed Aug. 8, 2006).] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p8.]
- In the Darwinian view, amazing biological features such as the vertebrate eye, or the wings of butterflies, or the blood-clotting system, are in no way the purposeful result of evolution. Rather, they are the unintended byproducts of the interplay of chance (random genetic mutations and recombinations) and necessity (natural selection). The same holds true for higher animals such as human beings. In the words of late Harvard paleontologist George Gaylord Simpson: “Man is the result of a purposeless and natural process that did not have him in mind.”⁴ [George Gaylord Simpson, *The Meaning of Evolution: A Study of the History of Life and of Its Significance for Man*, revised edition (New Haven: Yale University Press, 1967), 345.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p9.]
- Many secular Darwinians employ Darwin’s theory as a battering ram to topple the idea of human exceptionalism. According to late Harvard paleontologist Stephen Jay Gould, Darwinian “biology took away our status as paragons created in the image of God.”⁵ Indeed, in the Darwinian view human beings

are but “a fortuitous cosmic afterthought.”⁶ [5. Stephen J. Gould, *Ever Since Darwin: Reflections in Natural History* (New York: W. W. Norton and Company, 1977), 147.] [6. Stephen J. Gould, *Dinosaur in a Haystack: Reflections in Natural History* (New York: Harmony Books, 1995), 327.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p9.]

- Princeton University bioethicist Peter Singer expresses a similar view. A champion of infanticide for handicapped human newborns, Singer makes clear that Darwinism supplies the foundation for his debased view of human beings: “All we are doing is catching up with Darwin. He showed in the 19th century that we are simply animals. Humans had imagined we were a separate part of Creation, that there was some magical line between Us and Them. Darwin’s theory undermined the foundations of that entire Western way of thinking about the place of our species in the universe.”⁷ [Quoted in Johann Hari, “Peter Singer: Some people are more equal than others,” *The Independent*, July 1, 2004, <http://www.independent.co.uk/news/people/profiles/peter-singer-some-people-are-more-equal-than-others-6166342.html> (accessed on March 6, 2012).] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p9.]
- Darwin is likewise a patron saint for many radical environmentalists. In the approving words of former Earth First! activist Christopher Manes, “Darwin invited humanity to face the fact that the observation of nature has revealed not one scrap of evidence that humankind is superior or special, or even particularly more interesting than, say, lichen.”⁸ [Christopher Manes, *Green Rage: Radical Environmentalism and the Unmaking of Civilization* (Boston: Little, Brown, and Company, 1990), 142.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p9.]
- Karl Giberson, a co-founder of the pro-theistic-evolution BioLogos Foundation, argues that human beings were evil from the start because evolution is driven by selfishness; therefore, Christians must abandon the idea that human beings were originally created by God morally good.⁹ [Karl Giberson, *Saving Darwin: How to Be a Christian and Believe in Evolution*

(New York: HarperOne, 2008), 11–13. The book has a Foreword by Francis Collins. For a discussion of Giberson’s view, see John G. West, “Nothing New Under the Sun” in Jay Richards, *God and Evolution: Protestants, Catholics, and Jews Explore Darwin’s Challenge to Faith* (Seattle: Discovery Institute Press, 2010), 33–52.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p9, 10.]

- Current BioLogos president Darrel Falk urges Christians to scrap their outdated belief in Adam and Eve as parents of the human race, claiming that evolutionary biology now proves “there was never a time when there was a single first couple, two people who were the progenitors of the entire human race.”¹⁰ [Darrel Falk, “BioLogos and the June 2011 ‘Christianity Today’ Editorial,” June 6, 2011, <http://biologos.org/blog/biologos-and-the-june-2011-christianity-today-editorial> (accessed March 6, 2012).] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p10.]
- And geneticist Francis Collins, the original inspiration for BioLogos, puts forward a watered-down view of God’s sovereignty over the natural world. In one part of his book *The Language of God*, Collins claims (wrongly) that the human genome is riddled with functionless “junk DNA,” which he claims is evidence against the idea that human beings were specifically designed by God.¹¹ [Francis S. Collins, *The Language of God: A Scientist Presents Evidence for Belief* (New York: Free Press, 2006), 135–136. For a rebuttal of some of Collins’s scientific arguments, see chapter four of this book by Casey Luskin. Also see Jonathan Wells, “Darwin of the Gaps,” in Richards, *God and Evolution*, 117–128.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p10.]
- Biologist Kenneth Miller, author of *Finding Darwin’s God*, goes considerably further. Miller explicitly argues that God neither knows nor directs the specific outcomes of evolution—including human beings. In Miller’s view, “mankind’s appearance on this planet was not preordained... we are here not as the products of an inevitable procession of evolutionary success, but as an afterthought, a minor detail, a happenstance in a history that might just as

well have left us out.”¹³ According to Miller, God did know that undirected evolution would produce some sort of rational creature eventually, but the creature produced by evolution might have been a “a big-brained dinosaur” or “a mollusk with exceptional mental capabilities” rather than a human being.¹⁴ [13. Kenneth R. Miller, *Finding Darwin’s God: A Scientist’s Search for Common Ground Between God and Evolution* (New York: HarperCollins, 1999), 272.] [14. Miller, quoted in John G. West, *Darwin Day in America: How Our Politics and Culture Have Been Dehumanized in the Name of Science* (Wilmington, DE: ISI Books, 2007), 226.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p10.]

- Whether secular or religious, these champions of modern Darwinian theory all share the same underlying assumption: In their view, science has proven Darwinian evolution beyond a shadow of a doubt; therefore our understanding of human beings and the rest of life must be radically reshaped according to Darwinian tenets. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p10, 11.]
- Although much of this book focuses on the shortcomings of Darwinian theory, the scientists represented here are not merely critics of the existing paradigm. Instead, they share a positive vision that much of biology would make better sense from the perspective of intelligent design rather than unguided Darwinian evolution. Often mischaracterized (and wrongly conflated with creationism), intelligent design is simply the effort to investigate empirically whether the exquisitely coordinated features we find throughout nature are the result of an intelligent cause rather than a blind and undirected process like natural selection.¹⁵ [For good introductions to intelligent design, see Guillermo Gonzalez and Jay Richards, *The Privileged Planet: How Our Place in the Cosmos is Designed for Discovery* (Washington DC: Regnery, 2004); Stephen C. Meyer, *Signature in the Cell: DNA and the Evidence for Intelligent Design* (New York: HarperOne, 2009), and William Dembski and Jonathan Wells, *The Design of Life* (Dallas: Foundation for Thought and Ethics, 2008).] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p11.]

1 Science and Human Origins (Ann Gauger)

- When I first saw these stories, it struck me how uncritically all these people accepted the scientific arguments for human evolution. This is a mistake. Science is not an error-free enterprise, so arguments need to be carefully evaluated. This is especially the case when it comes to a highly charged issue like human evolution. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p15.]
- Most of the argument for our common ancestry with ape-like creatures is based on similarity—similarity in anatomy, and similarity in DNA sequence. Yet I know from my own experiments that similarity between two complex structures does not reliably indicate an evolutionary path between them. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p15.]
- Similarity by itself says nothing about what mechanisms are responsible for the apparent relatedness, especially when substantial genetic change is necessary. In fact, there is a surprising disregard among evolutionary biologists for the amount of genetic change that would be needed to actually accomplish the evolutionary transitions they propose, and the amount of time it would require. As I shall explain, these obstacles are a significant factor in human evolution and indicate we cannot have come from an ape-like ancestor by any unguided process. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p16.]
- Since Darwin's time, paleoanthropologists have uncovered fossil remains that appear to be intermediate in form between great apes and humans. These fossils, together with more recent DNA sequence comparisons from living species, have led to a proposed tree of common descent for the great apes and humans (together referred to as hominids). [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p16.]
- What evidence is there for this tree? As I said previously, it hinges on two kinds of data: anatomical similarities and differences among the great apes, fossil hominins and us; and comparative analysis of DNA sequences from living species. It also depends on one very big but unproven assumption—

that any similarities found are due to descent from a common ancestor. It is that assumption I wish to challenge in this chapter. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p17.]

- The fossil evidence for our evolution from apes is actually quite sketchy.³ Ancient hominin fossils are rare, and they typically consist of bone fragments or partial disarticulated skeletons obtained from different locations around the world and from different geologic strata. They fall into two basic categories: ape-like fossils, and Homo-like fossils. This discontinuity between fossil types is well-known. Nonetheless, the hominin fossils have been interpreted as historical, physical evidence of our common ancestry with apes. [For more details on the subject, see chapter 3 on “Human Origins and the Fossil Record” by Casey Luskin later in this volume.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p17.]
- Ernst Mayr, a well-known evolutionary biologist, acknowledged both the gap and the story-telling in his book *What Makes Biology Unique: The earliest fossils of Homo, Homo rudolfensis and Homo erectus, are separated from Australopithecus by a large, unbridged gap. How can we explain this seeming saltation? Not having any fossils that can serve as missing links, we have to fall back on the time-honored method of historical science, the construction of a historical narrative.*⁴ [Ernst Mayr, *What Makes Biology Unique?* (New York: Cambridge University Press, 2004), 198.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p17.]
- The evidence from DNA comparisons is similarly enigmatic. DNA sequences are strings of nucleotides millions or billions in length. Aligning DNA sequences in order to compare them is a tricky business. There can be single bases changes, insertions or deletions, duplications, and rearrangements of the DNA that complicate things and may or may not be included in comparisons.⁵ The degree of similarity calculated depends on how the analysis is done, and what is excluded or included.⁶ [5. For a discussion of one kind of rearrangement that is often used as evidence for common descent, see chapter 4 by Casey Luskin on “Francis Collins, Junk DNA, and

Chromosomal Fusion.”] [6. T. C. Wood, “The chimpanzee genome and the problem of biological similarity,” *Occas Papers of the BSG* 7 (2006): 1–18; G. Glazko, et. al., “Eighty percent of proteins are different between humans and chimpanzees,” *Gene* 346 (2005): 215–219; J. Cohen, “Relative differences: The myth of 1%,” *Science* 316 (2007): 1836.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p17, 18.]

- For any story about common ancestry to be verified, including the proposed story of our common ancestry, two things must be shown. First, a step-wise adaptive path must exist from the ancestral form to the new form, whether it is to a new gene, a new protein, or a new species; and second, if it is to have happened by an unguided, neo-Darwinian mechanism, there must be enough time and probabilistic resources for neo-Darwinian processes to traverse that path. The neo-Darwinian mechanisms of mutation, recombination, genetic drift and natural selection must be enough to produce the proposed innovation in the time available. These two things, a step-wise, adaptive path, and enough time and probabilistic resources for the path to be traversed, are absolutely necessary for neo-Darwinian evolution to have occurred. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p18.]
- Proteins that look alike are commonly assumed to have a common evolutionary origin. If the proteins have different functions, then it is assumed that some sort of neo-Darwinian process led to their duplication and divergence. This is the story of common descent writ small. But unlike humans and chimps, proteins can be easily manipulated and tested in the lab for successful functional change. We can actually establish how many mutations are required to switch old proteins to new functions, and thus determine what kinds of innovations are possible according to the rules of neo-Darwinism. If the neo-Darwinian story fails here, it fails everywhere. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p 19.]
- Yet when we experimentally determined how many mutations it would take, we found that it would take at least seven mutations to evolve one enzyme into the other—too many mutations to have occurred by an unguided neo-

Darwinian process.⁷ [A. K. Gauger and D. D. Axe, “The evolutionary accessibility of new enzyme functions: A case study from the biotin pathway,” *BIO-Complexity* 2, no. 1 (2011): 1–17.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p20.]

- The waiting time for seven coordinated neutral mutations to arise in a bacterial population is on the order of 10^{27} years. To put that in some sort of perspective, remember that the universe is only about 10^{10} years old.⁸ It can't have happened. [A. K. Gauger and D. D. Axe, “The evolutionary accessibility of new enzyme functions: A case study from the biotin pathway,” *BIO-Complexity* 2, no. 1 (2011): 1–17.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p20.]
- Let's begin by considering what distinguishes us from great apes. What are our distinctive characteristics? There are significant anatomical differences, of course: Our upright walking, longer legs and shorter arms, changes in muscle strength, our significantly larger brains and skulls (three times bigger than great apes), and our refined musculature in hands, lips and tongues. There are also our relative hairlessness and changes to our eyes. More importantly, there are whole realms of intellect and experience that make us unique as humans. Abstract thought, art, music, and language: These things separate us from lower animals fundamentally, not just in degree but in kind. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p21.]
- Chimps are suited for life in the trees. Humans are suited for life on the ground, walking and running. The anatomical changes needed to move from tree-dwelling to complete terrestrial life are many. To walk and run effectively requires a new spine, a different shape and tilt to the pelvis, and legs that angle in from the hips, so we can keep our feet underneath us and avoid swaying from side to side as we move. We need knees, feet and toes designed for upright walking, and a skull that sits on top of the spine in a balanced position. (The dome of our skull is shifted rearward in order to accommodate our larger brain and yet remain balanced.) Our jaws and muscle attachments must be shifted, our face flattened, and the sinuses

behind the face and the eye sockets located in different places, to permit a forward gaze and still be able to see where to put our feet. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p21.]

- If our common ancestry with chimps is true, the transition to fully human must include something like the shift from *A. afarensis* to *H. erectus*. And here is where the discontinuity lies. *H. erectus* is the first fossil species with a nearly modern human anatomy and a constellation of traits not seen in any prior hominin. There simply is no good transitional species to bridge the gap. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p23.]
- As John Hawks, a paleoanthropologist at the University of Wisconsin/Madison states: No australopithecine species is obviously transitional [to *Homo erectus*].... Our interpretation is that the changes are sudden and interrelated and reflect a bottleneck that was created because of the isolation of a small group from a parent australopithecine species. In this small population, a combination of drift and selection resulted in a radical transformation of allele frequencies, fundamentally shifting the adaptive complex; in other words, a genetic revolution.¹² [J. Hawks et al., “Population bottlenecks and Pleistocene human evolution,” *Mol Biol Evol* 17 (2000): 2–22.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p23.]
- Two questions then arise: (1) How many mutations would it take to turn an australopithecine species into a *Homo erectus*? And (2) If there are only one and a half million years between *A. afarensis* and *H. erectus*, can neo-Darwinism produce the necessary changes in the time allotted? [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p24.]
- How many mutations would it take? Bramble and Lieberman count sixteen features of the human body that first appear in *H. erectus* or *H. sapiens*.¹³ These features are necessary to stabilize the head, permit counter-rotation of the torso with the head and hips, stabilize the trunk, absorb shock and transfer energy during running. Many of these changes must occur together to be of any benefit. [Bramble and Lieberman, “Endurance running.” For a list of

hundreds of phenotypic traits in humans that differ from the great apes, see A. Varki and T. K. Altheide, “Comparing the human and chimpanzee genomes: Searching for needles in a haystack,” *Genome Research* 15 (2005): 1746–1758.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p24.]

- Is there enough time to get sixteen anatomical changes by a neo-Darwinian process? Each of these new features probably required multiple mutations. Getting a feature that requires six neutral mutations is the limit of what bacteria can produce. For primates (e.g., monkeys, apes and humans) the limit is much more severe. Because of much smaller effective population sizes (an estimated ten thousand for humans instead of a billion for bacteria) and longer generation times (fifteen to twenty years per generation for humans vs. a thousand generations per year for bacteria), it would take a very long time for even a single beneficial mutation to appear and become fixed in a human population. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p24.]
- You don’t have to take my word for it. In 2007, Durrett and Schmidt estimated in the journal *Genetics* that for a single mutation to occur in a nucleotide-binding site¹⁴ and be fixed in a primate lineage would require a waiting time of six million years.¹⁵ The same authors later estimated it would take 216 million years for the binding site to acquire two mutations, if the first mutation was neutral in its effect.¹⁶ [14. A nucleotide-binding site is a piece of DNA eight nucleotides long. Durrett and Schmidt (see below) calculated how long it would take for a single mutation to generate a seven out of eight match for an eight nucleotide binding site (with six out of eight nucleotides already correct) in a stretch of DNA one thousand nucleotides long. Creation of such a binding site might affect the behavior of genes in the region, thus affecting the phenotype of the organism.] [15. R. Durrett and D. Schmidt, “Waiting for regulatory sequences to appear,” *Annals of Applied Probability* 17 (2007): 1–32. The relevant information appears on p. 19, where the time to fixation is factored in.] [16. R. Durrett and D. Schmidt, “Waiting for two mutations: With applications to regulatory sequence evolution and the limits of Darwinian evolution,” *Genetics* 180 (2008): 1501–1509.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p24, 25.]

- But six million years is the entire time allotted for the transition from our last common ancestor with chimps to us according to the standard evolutionary timescale. Two hundred and sixteen million years takes us back to the Triassic, when the very first mammals appeared. One or two mutations simply aren't sufficient to produce the necessary changes— sixteen anatomical features—in the time available. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p25.]
- Many of the anatomical changes seen in *H. erectus* had to occur together to be of benefit. Individually they would be useless or even harmful. So even if a random mutation or two resulted in one change, they would be unlikely to be preserved. And getting all sixteen to appear and then become fixed within six million years, let alone the one and a half million that it apparently took, can't have happened through an unguided process. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p25.]
- How many mutations would it take to evolve the anatomical changes
- necessary for walking and running? Dozens if not hundreds or thousands—
- if it could happen by random mutation at all. If the time span available for human evolution from a chimp-like ancestor is six million years, the effective population size is ten thousand, the mutation rate is 10^{-8} per nucleotide per generation and the generation time is five to ten years (for a chimp-like ancestor), only a single change to a particular DNA binding site could be expected to arise. It strains credibility to think that all sixteen anatomical features evolved fortuitously in that same time frame, especially if each required multiple mutations. Given these numbers, it is extremely improbable, if not absolutely impossible, for us to have evolved from hominin ancestors by a gradual, unguided process. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p26.]
- At the fine motor level, we have many abilities that require anatomical features that apes lack —we have many more finely controlled muscles in our hands, face, and tongues, for example. Without them our dexterity as artists or craftsmen, our ability to converse, and our ability to express fine

distinctions in emotion by our facial expressions would be impossible. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p27.]

- But even more significant are our cognitive and communicative abilities. We are much more than upright apes with fine motor control. Our capacity for abstract thought, self-conscious reflection, and ability to communicate put us in another category entirely. These attributes are orders of magnitude more complex than anything animals can do. For example, language requires both anatomical features (the position of our larynx and language centers in our brains), and a mysterious innate knowledge of the rules of grammar that appears to be hard-wired into our brain. Three-year-olds know these rules instinctively. Apes don't. True language requires the ability to think abstractly. Words are symbols that stand in for things and ideas. We communicate by arranging words into complex symbolic utterances. We think new thoughts and convey new ideas to others. We reflect on ourselves. We discuss our origins, write sonnets, and describe both imaginary worlds and the real one we inhabit. Language both reflects and enriches our capacity for abstract thinking and creativity. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p27.]
- Where did these massive increases in fine-motor dexterity, and the quantum leaps of language, art, and abstract thought come from? Our uniquely human attributes constitute a quantum leap, not just an innovation, a leap that cannot have arisen without guidance.¹⁸ We are not souped-up apes. [For a review pointing out unsolved conundrums concerning our uniqueness, see a recent review by A. Varki et al., "Explaining human uniqueness: genome interactions with environment, behavior and culture," *Nature Reviews Genetics* 9 (2008): 749–763.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p27.]
- When evaluating explanatory causes for beings such as ourselves, we need to choose a cause that is up to the task. I personally am convinced that unguided, unintelligent processes can't do the job, not only because the neo-Darwinian mechanism is utterly insufficient, but also because we are beings capable of intelligence and creativity. These qualities are what make us human, and

together with our capacity for empathy and our desire for goodness and beauty, they point toward the kind of cause that is sufficient to explain our origins. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p28.]

2 Darwin's Little Engine That Couldn't (Douglas Axe)

- Biologist Richard Dawkins, a vocal atheist, once described biology as “the study of complicated things that give the appearance of having been designed for a purpose.”¹ According to him, that appearance is entirely deceptive. Life needed no personal inventor because there is an impersonal one powerful enough to do the job, namely “[n]atural selection, the blind, unconscious, automatic process which Darwin discovered, and which we now know is the explanation for the existence and apparently purposeful form of all life,”² including us. [1. Richard Dawkins, *The Blind Watchmaker* (New York: Penguin, 1986), 1.] [2. *Ibid.*, 5.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p31.]
- Science has always progressed by the conflict of ideas, and whatever benefit some of those ideas have received from things other than the twin pillars of observation and reasoning, those pillars alone will remain standing in the end. Every conclusion they don't support will fall... eventually. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p32.]
- The best arguments are simple, so the very exercise of distilling an argument to its essence is, in my opinion, the best way for someone who labors over the technical details to step back and see whether anything good has come of it. I believe it has—that careful science now stands decisively against Darwinism. But whether you're inclined to agree or disagree, my aim is to equip you to decide for yourself. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p32.]
- The technical details of our study are available for those who may want to examine them,³ but all you need to know to follow what I'll say here is that each gene inside a cell carries the instructions for building a particular protein, and each protein is a tiny machine-like device that carries out one of the many tasks that must be accomplished for the cell to function properly.

[A. K. Gauger and D. D. Axe, “The evolutionary accessibility of new enzyme functions: a case study from the biotin pathway,” *BIO-Complexity* 2, no. 1 (2011): 1–17, accessed March 6, 2012, doi:10.5048/BIO-C.2011.1.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p33.]

- Apparently not, according to the results of our experiment. Darwin’s engine proved to be the little engine that couldn’t... certainly not in the few billion years in which it is supposed to have done everything, and probably not even in a few trillion years. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p34.]
- It will be helpful to summarize our result in the form of a principle as follows: Darwinian transitions from A to B that accomplish invention cannot be presumed plausible simply because A and B are substantially similar. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p35.]
- It is now clear that Darwin’s engine can’t climb a peak corresponding to a new invention unless that peak happens to be remarkably close to its current location—closer than the peak-to-peak distance between any pair of proteins that we know of with distinct functions. Even if such an extraordinary case were to be found, it would be just that—an extraordinary case. Traversing long distances would still depend on a very long and well-coordinated succession of extraordinary cases, which amounts to nothing short of a miracle. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p40.]
- If the show on earth was spectacular when the likes of fireflies and geckos and orcas made their successive entrances, it became something incomparably deeper when humans took their place. Crickets brought more crickets, and chimps more chimps. All very good. Humans, on the other hand, brought the products of their own contemplation: music and drama and literature and painting and sculpture and philosophy and theology and mathematics and science and technology and athletics and culture and movements and politics and war. The best of good mixed with the worst of bad, all of it categorically unlike what came before—the chirping of crickets and the screeching of chimps. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human*

Origins, Discovery Institute Press, Seattle 2012, p41.]

- It's one thing to say that chimps and humans are similar enough that their likeness calls for careful explanation (few would argue with that), but as we've now seen it's quite another to say that they are similar enough for Darwin's engine to have traversed the gap between them. To insist on that is to ignore the evidence. A comparison of the complete human and chimp genomes has identified twenty distinct gene families, each with multiple genes, that are present in humans but absent from chimps and other mammals.⁷ That's a huge gap when you compare it to the single in-family gene transition that we examined. [J. P. Demuth, T. De Bie, J. E. Stajich, N. Cristianini, and M. W. Hahn, "The evolution of mammalian gene families," *PLoS One* 1 (2006): e85, accessed March 6, 2012, doi: 10.1371/journal.pone.0000085.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p41.]
- Have they thought seriously about what an ape-to-human transition would entail? Have they figured out how to wire a brain for speech, or for the intelligence needed to make use of speech? Do they know how to configure the lips, the tongue, and the vocal tract in order for speech to be physically possible? Have they discovered how to coordinate these inventions with all the changes needed for females to give birth to bigbrained offspring? And if they've mastered all these points while wearing their bioengineers' hats, have they switched to their geneticists' hats and identified a series of single mutations that would orchestrate this whole inventive process? They may think they know some of the answers to these problems, and that's a start, but have they gone into the primate lab and done the work that should convince those of us who wonder whether they have it right? Have they been hard at work for decades, quietly validating their ideas by producing talking chimps? If so, have they done the experiments to measure the fitness effect of each single mutation along the line of chimps that eventually produced the ones that talk? Did they verify that each increases the fitness enough to become established in a natural population? And assuming they have checked all the boxes to this point, did they do the math to verify that the whole transition can happen naturally in an ape population within a few hundred thousand generations? Hard questions are humbling, and humility

may be the best way for scientists to earn the trust of their benefactors (the public) on this subject. In truth, almost nothing on the above checklist is technically feasible at present, so we don't need to lose any sleep over the ethical issues. My point is simply that virtually everything that would need to be done to establish the sheer physical possibility of turning apes into humans remains undone. And even in a strange sci-fi thought experiment where it has been done, the knowledge so gained would only further confirm how naive it is to think that Darwin's little engine could have done it. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p42.]

3 Human Origins and the Fossil Record (Casey Luskin)

- Evolutionary scientists commonly tell the public that the fossil evidence for the Darwinian evolution of humans from ape-like creatures is incontrovertible. For example, anthropology professor Ronald Wetherington testified before the Texas State Board of Education in 2009 that human evolution has “arguably the most complete sequence of fossil succession of any mammal in the world. No gaps. No lack of transitional fossils... So when people talk about the lack of transitional fossils or gaps in the fossil record, it absolutely is not true. And it is not true specifically for our own species.”¹ According to Wetherington, the field of human origins provides “a nice clean example of what Darwin thought was a gradualistic evolutionary change.”² [Ronald Wetherington testimony before Texas State Board of Education (January 21, 2009). Original recording on file with author, SBOECommtFullJan2109B5.mp3, Time Index 1:52:00-1:52:44.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p45.]
- First, hominin fossils tend to be few and far between. It's not uncommon for long periods of time to exist for which there are few fossils documenting the evolution that was supposedly taking place. As paleoanthropologists Donald Johanson (the discoverer of Lucy) and Blake Edgar observed in 1996, “[a]bout half the time span in the last three million years remains undocumented by any human fossils” and “[f]rom the earliest period of hominid evolution, more than 4 million years ago, only a handful of largely undiagnostic fossils have been found.”³ So “fragmentary” and

“disconnected” is the data that in the judgment of Harvard zoologist Richard Lewontin, “no fossil hominid species can be established as our direct ancestor.”⁴ [3. Donald Johanson and Blake Edgar, *From Lucy to Language* (New York: Simon & Schuster, 1996), 22–23.] [4. Richard Lewontin, *Human Diversity* (New York: Scientific American Library, 1995), 163.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p46.]

- The second challenge faced by paleoanthropologists is the fossil specimens themselves. Typical hominin fossils consist literally of mere bone fragments, making it difficult to make definitive conclusions about the morphology, behavior, and relationships of many specimens. As the late paleontologist Stephen Jay Gould noted, “[m]ost hominid fossils, even though they serve as a basis for endless speculation and elaborate storytelling, are fragments of jaws and scraps of skulls.”⁵ [Stephen Jay Gould, *The Panda’s Thumb: More Reflections in Natural History* (New York: W. W. Norton & Company, 1980), 126.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p46.]
- A third challenge is accurately reconstructing the behavior, intelligence, or internal morphology of extinct organisms. Using an example from living primates, primatologist Frans de Waal observes that the skeleton of the common chimpanzee is nearly identical to its sister species, the bonobo, but they have great differences in behavior. “On the sole basis of a few bones and skulls,” writes de Waal, “no one would have dared to propose the dramatic behavioral differences recognized today between the bonobo and the chimpanzee.”⁶ He argues this should serve as “a warning for paleontologists who are reconstructing social life from fossilized remnants of long-extinct species.”⁷ De Waal’s example pertains to a case where the investigators have complete skeletons, but the late University of Chicago anatomist C. E. Oxnard explained how these problems are intensified when bones are missing: “A series of associated foot bones from Olduvai [a locality bearing australopithecine fossils] has been reconstructed into a form closely resembling the human foot today although a similarly incomplete foot of a chimpanzee may also be reconstructed in such a manner.”⁸ [6. Frans B. M. de Waal, “Apes from Venus: Bonobos and Human Social Evolution,” in *Tree of Origin: What Primate Behavior Can Tell Us about Human Social*

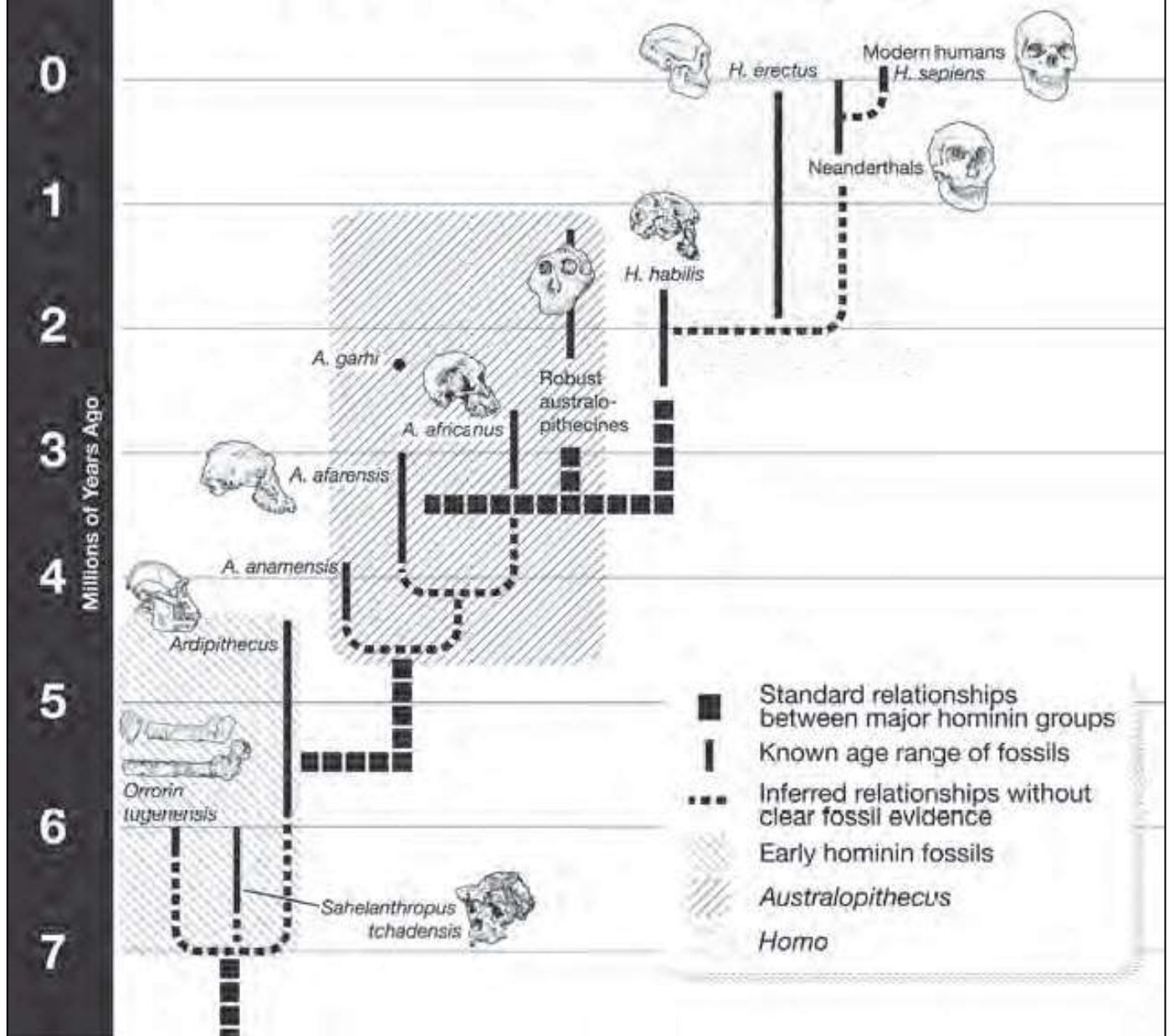
Evolution, ed. Frans B. M. de Waal (Cambridge: Harvard University Press, 2001), 68.] [7. Ibid.] [8. C. E. Oxnard, “The place of the australopithecines in human evolution: grounds for doubt?,” *Nature*, 258 (December 4, 1975): 389–95 (internal citation removed).] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p46, 47.]

- Flesh reconstructions of extinct hominins are likewise often highly subjective. They may attempt to diminish the intellectual abilities of humans and overstate those of animals. For example, one popular high school textbook caricatures Neanderthals as intellectually primitive even though they exhibited signs of art, language, and culture,¹⁰ and casts *Homo erectus* as a bungling, stooped form even though its postcranial skeleton is extremely similar to that of modern humans.¹¹ Conversely, the same textbook portrays an ape-like australopithecine with gleams of human-like intelligence and emotion in its eyes—a tactic common in illustrated books on human origins.¹² [9. See Alton Biggs, Kathleen Gregg, Whitney Crispin Hagins, Chris Kapicka, Linda Lundgren, Peter Rillero, National Geographic Society, *Biology: The Dynamics of Life* (New York: Glencoe, McGraw Hill, 2000), 442–43.] [10. See notes 124–139 and accompanying text.] [11. Sigrid Hartwig-Scherer and Robert D. Martin, “Was ‘Lucy’ more human than her ‘child’? Observations on early hominid postcranial skeletons,” *Journal of Human Evolution*, 21 (1991): 439–49.] [12. For example, see Biggs et al., *Biology: The Dynamics of Life*, 438; Esteban E. Sarmiento, Gary J. Sawyer, and Richard Milner, *The Last Human: A Guide to Twenty-two Species of Extinct Humans* (New Haven: Yale University Press, 2007), 75, 83, 103, 127, 137; Johanson and Edgar, *From Lucy to Language*, 82; Richard Potts and Christopher Sloan, *What Does it Mean to be Human?* (Washington D.C.: National Geographic, 2010), 32–33, 36, 66, 92; Carl Zimmer, *Smithsonian Intimate Guide to Human Origins* (Toronto: Madison Press, 2005), 44, 50.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p47.]
- University of North Carolina, Charlotte anthropologist Jonathan Marks warns against this when lamenting the “fallacies” of “humanizing apes and ape-ifying humans.”¹³ The words of the famed physical anthropologist Earnest A. Hooton from Harvard University still ring true: “alleged restorations of

ancient types of man have very little, if any, scientific value and are likely only to mislead the public.”¹⁴ [13. Jonathan Marks, *What It Means to be 98% Chimpanzee: Apes, People, and their Genes* (University of California Press, 2003), xv.] [14. Earnest Albert Hooton, *Up From The Ape*, Revised ed. (New York: McMillan, 1946), 329.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p47.]

- As Donald Johanson and Blake Edgar admit, ambition and lifelong quests for recognition, funding, and fame, can make it difficult for paleoanthropologists to admit when they are wrong: “The appearance of discordant evidence is sometimes met with a sturdy reiteration of our original views... it takes time for us to give up pet theories and assimilate the new information. In the meantime, scientific credibility and funding for more fieldwork hang in the balance.”¹⁸ [Johanson and Edgar, *From Lucy to Language*, 32.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p48.]
- After interviewing paleoanthropologists for a documentary in 2002, PBS NOVA producer Mark Davis reported that “[e]ach Neanderthal expert thought the last one I talked to was an idiot, if not an actual Neanderthal.”¹⁹ [Mark Davis, “Into the Fray: The Producer’s Story,” PBS NOVA Online (February 2002), accessed March 12, 2012, <http://www.pbs.org/wgbh/nova/neanderthals/producer.html>.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p48.]
- In 2001, Nature editor Henry Gee conceded, “[f]ossil evidence of human evolutionary history is fragmentary and open to various interpretations.”²⁰ [Henry Gee, “Return to the planet of the apes,” *Nature*, 412 (July 12, 2001): 131–32.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p48.]

Standard Hominin Phylogeny



- Sahelanthropus tchadensis: “Toumai Skull”. Despite the fact that Sahelanthropus tchadensis (also called the “Toumai skull”) is known only from one skull and some jaw fragments, it has been called the oldest known hominin that lies directly on the human line. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p50.]
- When the fossil was first reported, Brigitte Senut, a leading researcher at the Natural History Museum in Paris, said “I tend towards thinking this is the skull of a female gorilla.”²² Writing in *Nature* with Milford H. Wolpoff,

Martin Pickford, and John Hawks, Senut later noted there are “many... features that link the specimen with chimpanzees, gorillas or both, to the exclusion of hominids,” and argued “Sahelanthropus does not appear to have been an obligate biped.”²³ In their view, “Sahelanthropus was an ape.”²⁴ [22. “Skull find sparks controversy,” BBC News (July 12, 2002), accessed March 4, 2012, “One of Dr Senut’s colleagues, Dr Martin Pickford, who was in London this week, is also reported to have told peers that he thought the new Chadian skull was from a ‘proto-gorilla.’”] [23. Milford H. Wolpoff, Brigitte Senut, Martin Pickford, and John Hawks, “Sahelanthropus or ‘Sahelpithecus’?,” *Nature*, 419 (October 10, 2002): 581–82.] [24. *Ibid.*] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p50.]

- This debate has continued, but leading paleoanthropologists have cautioned in the Proceedings of the National Academy of Sciences (USA) that teeth and skull fragments alone are insufficient to properly classify or understand species as a hominin: “[O]ur results show that the type of craniodental characters that have hitherto been used in hominin phylogenetics are probably not reliable for reconstructing the phylogenetic relationships of higher primate species and genera, including those among the hominins.”²⁵ [Mark Collard and Bernard Wood, “How reliable are human phylogenetic hypotheses?,” *Proceedings of the National Academy of Sciences (USA)*, 97 (April 25, 2000): 5003–06.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p50.]
- Commenting on the Toumai skull in the journal *Nature*, Bernard Wood of George Washington University opened by observing, “A single fossil can fundamentally change the way we reconstruct the tree of life.”²⁷ He went on to state: If we accept these as sufficient evidence to classify *S. tchadensis* as a hominid at the base, or stem, of the modern human clade, then it plays havoc with the tidy model of human origins. Quite simply, a hominid of this age should only just be beginning to show signs of being a hominid. It certainly should not have the face of a hominid less than one-third of its geological age. Also, if it is accepted as a stem hominid, under the tidy model the principle of parsimony dictates that all creatures with more primitive faces (and that is a very long list) would, perforce, have to be excluded from the ancestry of modern humans.²⁸ [Bernard Wood, “Hominid revelations

from Chad,” *Nature*, 418 (July 11, 2002):133–35.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p51.]

- In other words, if the Toumai skull is accepted as a stem ancestor of humans, then many later supposed human ancestors—including the acclaimed australopithecines—ought not be considered human ancestors. Wood concludes that fossils like Sahelanthropus show “compelling evidence that our own origins are as complex and as difficult to trace as those of any other group of organisms.”²⁹ [Bernard Wood, “Hominid revelations from Chad,” *Nature*, 418 (July 11, 2002):133–35.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p51.]
- Orrorin tugenensis: “Orrorin”. Orrorin, which means “original man” in a local Kenyan language, was a chimpanzee-sized primate which is known only from “an assortment of bone fragments,”³⁰ including pieces of the arm, thigh, and lower jaw, as well as some teeth. [Potts and Sloan, *What Does it Mean to be Human?*, 38.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p51.]
- Some paleoanthropologists claimed that Orrorin’s femur indicates a bipedal mode of locomotion which was “appropriate for a population standing at the dawn of the human lineage.”³⁴ But as a later Yale University Press commentary admitted, “All in all, there is currently precious little evidence bearing on how Orrorin moved.”³⁵ [34. K. Galik, B. Senut, M. Pickford, D. Gommery, J. Treil, A. J. Kuperavage, and R. B. Eckhardt, “External and Internal Morphology of the BAR 1002’00 Orrorin tugenensis Femur,” *Science*, 305 (September 3, 2004): 1450–53.] [35. Sarmiento, Sawyer, and Milner, *The Last Human: A Guide to Twenty-two Species of Extinct Humans*, 35.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p52.]
- Evolutionary paleoanthropologists often assume that bipedality is a litmus test for membership along the human line. So if Orrorin did prove to be an upright-walking ape-like creature from six million years ago (mya), would that qualify it as a human ancestor? Not at all. In fact, the fossil record contains bipedal apes which evolutionists recognize were far removed from

the human line. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p52, 53.]

- In 1999, UC San Diego biologist Christopher Wills observed that “[u]pright posture may not be unique to our own lineage” since “[a]n ape that lived ten million years ago on Sardinia, *Oreopithecus bambolii*, seems to have acquired similar capabilities, perhaps independently.”³⁶ [Christopher Wills, *Children Of Prometheus: The Accelerating Pace Of Human Evolution* (Reading: Basic Books, 1999), 156.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p53.]
- A more recent article in ScienceDaily elaborated: *Oreopithecus bambolii*, a fossil ape from Italy shares many similarities with early human ancestors, including features of the skeleton that suggest that it may have been well adapted for walking on two legs. However, the authors observe, enough is known of its anatomy to show that it is a fossil ape that is only distantly related to humans, and that it acquired many “human-like” features in parallel.³⁷ [“Fossils May Look Like Human Bones: Biological Anthropologists Question Claims for Human Ancestry,” *Science Daily* (February 16, 2011), accessed March 4, 2012, <http://www.sciencedaily.com/releases/2011/02/110216132034.htm>.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p53.]
- A 2011 paper in *Nature* by Bernard Wood and Terry Harrison explains the implications of bipedal apes that had nothing to do with human origins: The object lesson that *Oreopithecus* provides is critical to the debate about interpreting the relationships of the earliest purported hominins. It demonstrates how features considered to be hominin specializations can be shown to have been acquired independently in a non-hominin lineage in association with inferred behaviours that are functionally related to, but not necessarily narrowly restricted to, terrestrial bipedalism.³⁸ [Bernard Wood and Terry Harrison, “The evolutionary context of the first hominins,” *Nature*, 470 (February 17, 2011): 347–52.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p53.]

- While Orrorin offers evolutionary paleoanthropologists the tantalizing possibility of a bipedal creature that lived around the time of the supposed split between humans and chimpanzees, simply too little of it is known at present to make confident claims about its locomotion, or its proper place in the supposed evolutionary tree. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p54.]
- Calling this fossil “new” may have been a poor word choice on the part of Science, since Ardi was discovered in the early 1990s. Why did it take over 15 years for reports to be published? A 2002 article in Science explains that initially the bones were so “soft,” “crushed,” “squished,” and “chalky,” that White reported, “when I clean an edge it erodes, so I have to mold every one of the broken pieces to reconstruct it.”⁴⁶ [Gibbons, “In Search of the First Hominids,” 1214–19.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p56.]
- Later reports similarly acknowledged that “some portions of Ardi’s skeleton were found crushed nearly to smithereens and needed extensive digital reconstruction,” and that its pelvis initially “looked like an Irish stew.”⁴⁷ [Michael D. Lemonick and Andrea Dorfman, “Ardi Is a New Piece for the Evolution Puzzle,” Time (October 1, 2009), accessed March 4, 2012, <http://www.time.com/time/printout/0,8816,1927289,00.html>.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p55.]
- The 2009 report in Science tells a striking story of the fossil’s poor quality: “[T]he team’s excitement was tempered by the skeleton’s terrible condition. The bones literally crumbled when touched. White called it road kill. And parts of the skeleton had been trampled and scattered into more than 100 fragments; the skull was crushed to 4 centimeters in height.”⁴⁸ [Gibbons, “A New Kind of Ancestor: Ardipithecus Unveiled,” 36–40. See also Gibbons, *The First Human: The Race to Discover our Earliest Ancestors*, 15 (“The excitement was tempered, however, by the condition of the skeleton. The bone was so soft and crushed that White later described it as road-kill”).] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p55.]
- In an article titled “Oldest Skeleton of Human Ancestor Found,” the science

editor at National Geographic, put it this way: “After Ardi died, her remains apparently were trampled down into mud by hippos and other passing herbivores. Millions of years later, erosion brought the badly crushed and distorted bones back to the surface. They were so fragile they would turn to dust at a touch.”⁴⁹ [Jamie Shreeve, “Oldest Skeleton of Human Ancestor Found,” National Geographic (October 1, 2009), accessed March 4, 2012, <http://news.nationalgeographic.com/news/2009/10/091001-oldest-human-skeleton-ardi-missinglink-chimps-ardipithecus-ramidus.html>.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p55.]

- Several skeptical paleoanthropologists felt those claims warranted little credence. As Science reported: [S]everal researchers aren’t so sure about these inferences. Some are skeptical that the crushed pelvis really shows the anatomical details needed to demonstrate bipedality. The pelvis is “suggestive” of bipedality but not conclusive, says paleoanthropologist Carol Ward of the University of Missouri, Columbia. Also, *Ar. ramidus* “does not appear to have had its knee placed over the ankle, which means that when walking bipedally, it would have had to shift its weight to the side,” she says. Paleoanthropologist William Jungers of Stony Brook University in New York state is also not sure that the skeleton was bipedal. “Believe me, it’s a unique form of bipedalism,” he says. “The postcranium alone would not unequivocally signal hominin status, in my opinion.”⁵⁰ [Gibbons, “A New Kind of Ancestor: *Ardipithecus* Unveiled,” 36–40.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p56.]
- A subsequent paper by primatologist Esteban Sarmiento in Science noted that “All of the *Ar. ramidus* bipedal characters cited also serve the mechanical requisites of quadrupedality, and in the case of *Ar. ramidus* foot-segment proportions, find their closest functional analog to those of gorillas, a terrestrial or semiterrestrial quadruped and not a facultative or habitual biped.”⁵¹ [Esteban E. Sarmiento, “Comment on the Paleobiology and Classification of *Ardipithecus ramidus*,” Science, 328 (May 28, 2010): 1105b.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p56.]

- Critics also questioned the claim that Ardi was necessarily ancestral to humans. When Ardi's reports were first published, Bernard Wood stated, "I think the head is consistent with it being a hominin... but the rest of the body is much more questionable."⁵² Two years later, Wood cowrote a paper in *Nature* elaborating on those criticisms, observing that if "Ardipithecus is assumed to be a hominin," and ancestral to humans, then this implies the fossil had "remarkably high levels of homoplasy among extant great apes."⁵³ In other words, Ardi had many ape-like characteristics which, if we set aside the preferences of many evolutionary paleoanthropologists, might imply a much closer relationship to living apes than to humans. [52. Gibbons, "A New Kind of Ancestor: Ardipithecus Unveiled," 36–40.] [53. Wood and Harrison, "The evolutionary context of the first hominins," 347–52.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p56.]
- According to a ScienceDaily article reporting on Wood's *Nature* paper, the claim of Ardi "being a human ancestor is by no means the simplest, or most parsimonious explanation."⁵⁴ ["Fossils May Look Like Human Bones: Biological Anthropologists Question Claims for Human Ancestry."] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p56.]
- [Stanford University] anthropologist Richard Klein put it this way: "I frankly don't think Ardi was a hominid, or bipedal."⁵⁵ [John Noble Wilford, "Scientists Challenge 'Breakthrough' on Fossil Skeleton," *New York Times* (May 27, 2010), accessed March 4, 2012, <http://www.nytimes.com/2010/05/28/science/28fossil.html>.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p57.]
- Sarmiento observed that Ardi had characters which were different not just from humans, but also from apes. In a *Time Magazine* interview titled, "Ardi: The Human Ancestor Who Wasn't?," he elaborated: "[Tim White] showed no evidence that Ardi is on the human lineage," Sarmiento says. "Those characters that he posited as relating exclusively to humans also exist in apes and ape fossils that we consider not to be in the human lineage." The biggest mistake White made, according to the paper, was to use outdated characters

and concepts to classify Ardi and to fail to identify anatomical clues that would rule her out as a human ancestor. As an example, Sarmiento says that on the base of Ardi's skull, the inside of the jaw joint surface is open as it is in orangutans and gibbons, and not fused to the rest of the skull as it is in humans and African apes—suggesting that Ardi diverged before this character developed in the common ancestor of humans and apes.⁵⁶ [Eben Harrell, “Ardi: The Human Ancestor Who Wasn't?,” Time (May 27, 2010), at <http://www.time.com/time/health/article/0,8599,1992115,00.html>.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p57.]

- Whatever Ardi may have been, everyone agrees that this fossil was initially badly crushed and needed extensive reconstruction. Its discoverers adamantly maintain the specimen was a bipedal human ancestor, or something very close to it. No doubt this debate will continue, but are we obligated to take for granted the bold talking points promoted by Ardi's discoverers in the media? Sarmiento doesn't think so. According to Time Magazine, he “regards the hype around Ardi to have been overblown.”⁵⁷ [Eben Harrell, “Ardi: The Human Ancestor Who Wasn't?,” Time (May 27, 2010), at <http://www.time.com/time/health/article/0,8599,1992115,00.html>.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p57.]
- In April 2006, National Geographic ran a story titled “Fossil Find Is Missing Link in Human Evolution, Scientists Say,”⁵⁸ which reported the discovery of what the Associated Press called “the most complete chain of human evolution so far.”⁵⁹ The fossils, belonging to the species *Australopithecus anamensis* were said to link *Ardipithecus* to its supposed australopithecine descendants. [58. John Roach, “Fossil Find Is Missing Link in Human Evolution, Scientists Say,” National Geographic News (April 13, 2006), accessed March 4, 2012, http://news.nationalgeographic.com/news/2006/04/0413_060413_evolution.html.] [59. Seth Borenstein, “Fossil discovery fills gap in human evolution,” MSNBC (April 12, 2006), accessed March 4, 2012, <http://www.msnbc.msn.com/id/12286206/>.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press,

Seattle 2012, p57.]

- What exactly was found? According to the technical paper reporting the find, the bold claims were based upon a few fragmented canine teeth which were said to be “intermediate” in size and shape. The technical description used in the paper was intermediate “masticatory robusticity.”⁶⁰ If a couple of four million-year-old teeth of “intermediate” size and shape make “the most complete chain of human evolution so far,” then the evidence for human evolution must be indeed quite modest. [See Figure 4, Tim D. White, Giday WoldeGabriel, Berhane Asfaw, Stan Ambrose, Yonas Beyene, Raymond L. Bernor, Jean-Renaud Boisserie, Brian Currie, Henry Gilbert, Yohannes Haile-Selassie, William K. Hart, Leslea J. Hlusko, F. Clark Howell, Reiko T. Kono, Thomas Lehmann, Antoine Louchart, C. Owen Lovejoy, Paul R. Renne, Haruo Saegusa, Elisabeth S. Vrba, Hank Wesselman, and Gen Suwa, “Asa Issie, Aramis and the origin of Australopithecus,” *Nature*, 440 (April 13, 2006): 883–89.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p58.]
- Besides learning to distrust media hype, there is another important lesson to be gained from this episode. Accompanying the praise of this “missing link” were what might be called retroactive confessions of ignorance. In this common phenomenon, evolutionists acknowledge a severe gap in their evolutionary claims only after they think they have found evidence to plug that gap. Thus, the technical paper that reported these teeth admitted that, “Until recently, the origins of Australopithecus were obscured by a sparse fossil record,”⁶¹ further stating: “The origin of Australopithecus, the genus widely interpreted as ancestral to Homo, is a central problem in human evolutionary studies. Australopithecus species differ markedly from extant African apes and candidate ancestral hominids such as Ardipithecus, Orrorin and Sahelanthropus.”⁶² Following these comments, an article on MSNBC.com acknowledged that “Until now, what scientists had were snapshots of human evolution scattered around the world.”⁶³ [61. 62. See Figure 4, Tim D. White, Giday WoldeGabriel, Berhane Asfaw, Stan Ambrose, Yonas Beyene, Raymond L. Bernor, Jean-Renaud Boisserie, Brian Currie, Henry Gilbert, Yohannes Haile-Selassie, William K. Hart, Leslea J. Hlusko, F. Clark Howell, Reiko T. Kono, Thomas Lehmann, Antoine Louchart, C. Owen Lovejoy, Paul R. Renne, Haruo Saegusa, Elisabeth S.

Vrba, Hank Wesselman, and Gen Suwa, “Asa Issie, Aramis and the origin of Australopithecus,” *Nature*, 440 (April 13, 2006): 883–89.] [63. Borenstein, “Fossil discovery fills gap in human evolution.”] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p58.]

- Given the fragmentary and enigmatic nature of those earlier species, a more objective analysis might suspect that this period of supposed early hominin evolution remains what Tim White once called it: “a black hole in the fossil record.”⁶⁴ [Tim White, quoted in Gibbons, “In Search of the First Hominids,” 1214–19.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p58, 59.]
- By far, the most well-known australopithecine fossil is Lucy because she is one of the most complete fossils among known pre-Homo hominins. She is commonly claimed to have been a bipedal ape-like creature which serves as an ideal precursor to the human species. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p59.]
- In 2009, Lucy’s skeleton came to the Pacific Science Center in my hometown of Seattle. Upon entering the room containing the thick glass case holding her bones, I was immediately struck by the incompleteness of her skeleton. Only 40% was found, and a significant percentage is mere rib fragments. Very little useful material from Lucy’s skull was recovered, and yet she is one of the most significant specimens ever found. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p59, 60.]
- In a video playing at the exhibit, Lucy’s discoverer Donald Johanson admitted that when he found the fossil, the bones were scattered across a hillside, where he “looked up the slope and there were other bones sticking out.” Johanson’s written account explains further how the bones were not found together: “[S]ince the fossil wasn’t found in situ, it could have come from anywhere above. There’s no matrix on any of the bones we’ve found either. All you can do is make probability statements.”⁶⁶ [Tim White, quoted in Donald Johanson and James Shreeve, *Lucy’s Child: The Discovery of a Human Ancestor* (New York: Early Man Publishing, 1989), 163.] [Ann

Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p60.]

- This was therefore not a case where the bones were found connected forming a contiguous skeleton, but rather they were scattered across a hillside. Ann Gibbons notes that Johanson’s “entire team fanned out over the gully to collect Lucy’s bones.”⁶⁷ At one point, Johanson explains that if there had been only one more rainstorm, Lucy’s bones might have been washed away, never to be seen again. This does not inspire confidence in the integrity of the skeleton: If the next rainstorm could have washed Lucy away completely, what might have happened during prior storms to mix her up with who-knows-what? Could “Lucy” represent bones from multiple individuals or even multiple species? [Gibbons, *The First Human: The Race to Discover our Earliest Ancestors*, 86.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p61.]
- Lucy did have a small, chimp-like head in both size and shape—as University of Witwatersrand paleoanthropologist Lee Berger observes, “Lucy’s face would have been prognathic, jutting out almost to the same degree as a modern chimpanzee.”⁶⁸ But many have disagreed with claims that she looked like an ape-human hybrid. Bernard Wood refutes this misapprehension: “Australopithecines are often wrongly thought to have had a mosaic of modern human and modern ape features, or, worse, are regarded as a group of ‘failed’ humans. Australopithecines were neither of these.”⁶⁹ [68. Berger and Hilton-Barber, *In the Footsteps of Eve: The Mystery of Human Origins*, 114.] [69. See for example Bernard A. Wood, “Evolution of the australopithecines,” 232.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p61.]
- Moreover, many have challenged the claim that Lucy walked like
 - we do, or was even significantly bipedal. Mark Collard and Leslie Aiello
 - observe in Nature that much of the rest of her body was “quite ape-like,” especially with respect to the “relatively long and curved fingers, relatively
 - long arms, and funnel-shaped chest.”⁷⁰ Their article also reports “good
 - evidence” from Lucy’s hand-bones that her species “‘knuckle-walked’, as
 - chimps and gorillas do today.”⁷¹ [70. Mark Collard and Leslie C. Aiello, “From forelimbs to two legs,” *Nature*, 404 (March 23, 2000): 339–40.] [71.

Collard and Aiello, “From forelimbs to two legs,” 339–40. See also Brian G. Richmond and David S. Strait, “Evidence that humans evolved from a knuckle-walking ancestor,” *Nature*, 404 (March 23, 2000): 382–85.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p61, 62.]

- Science writer Jeremy Cherfas explains why this argument is doubtful: Everything about her skeleton, from fingertips to toes, suggests that Lucy and her sisters retain several traits that would be very suitable for climbing in trees. Some of those same treeclimbing adaptations can still be detected, albeit much reduced, in much later hominids such as the 2-million-year old specimens of *Homo habilis* from the Olduvai gorge. It could be argued that Lucy’s arboreal adaptations are just a hangover from her treedwelling past, but animals do not often retain traits that they do not use, and to find those same features in specimens 2 million years later makes it most unlikely that they are remnants.⁷³ [Jeremy Cherfas, “Trees have made man upright,” *New Scientist*, 97 (January 20, 1983): 172–77.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p62.]
- Richard Leakey and Roger Lewin argue that *A. afarensis* and other australopithecines “almost certainly were not adapted to a striding gait and running, as humans are.”⁷⁴ [Richard Leakey and Roger Lewin, *Origins Reconsidered: In Search of What Makes Us Human*, (New York: Anchor Books, 1993), 195.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p62.]
- Their quotation of anthropologist Peter Schmid’s surprise at the non-human qualities of Lucy’s skeleton is striking: “We were sent a cast of the Lucy skeleton, and I was asked to assemble it for display,” remembers Peter Schmid, a paleontologist at the Anthropological Institute in Zurich... “When I started to put [Lucy’s] skeleton together, I expected it to look human,” Schmid continues. “Everyone had talked about Lucy as being very modern, very human, so I was surprised by what I saw”... “What you see in *Australopithecus* is not what you’d want in an efficient bipedal running animal,” says Peter. “The shoulders were high, and, combined with the funnel-shaped chest, would have made arm swinging very improbable in the

human sense. It wouldn't have been able to lift its thorax for the kind of deep breathing that we do when we run. The abdomen was potbellied, and there was no waist, so that would have restricted the flexibility that's essential to human running.”⁷⁵ [Richard Leakey and Roger Lewin, *Origins Reconsidered: In Search of What Makes Us Human*, (New York: Anchor Books, 1993), 193–94.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p62, 63.]

- Other studies confirm australopithecine differences with humans, and similarities with apes. Their inner ear canals—responsible for balance and related to locomotion—are different from those of *Homo* but similar to those of great apes.⁷⁷ Their ape-like developmental patterns⁷⁸ and ape-like ability for prehensile grasping by their toes⁷⁹ led one reviewer in *Nature* to say that whether australopithecines “were phylogenetically hominines or not, it seems to me that ecologically they may still be considered as apes.”⁸⁰ [77. Fred Spoor, Bernard Wood, and Frans Zonneveld, “Implications of early hominid labyrinthine morphology for evolution of human bipedal locomotion,” *Nature*, 369 (June 23, 1994): 645–48.] [78. See Timothy G. Bromage and M. Christopher Dean, “Re-evaluation of the age at death of immature fossil hominids,” *Nature*, 317 (October 10, 1985): 525–27.] [79. See Ronald J. Clarke and Phillip V. Tobias, “Sterkfontein Member 2 Foot Bones of the Oldest South African Hominid,” *Science*, 269 (July 28, 1995): 521–24.] [80. Peter Andrews, “Ecological Apes and Ancestors,” *Nature*, 376 (August 17, 1995): 555–56.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p64.]
- In 1975 C. E. Oxnard published a paper in *Nature* using multivariable statistical analysis to compare key australopithecine skeletal characteristics to living hominids. He found that australopithecines have “a mosaic of features unique to themselves and features bearing some resemblances to those of the orangutan” and concluded: “If these estimates are true, then the possibility that any of the australopithecines is a direct part of human ancestry recedes.”⁸¹ Even the teeth of Lucy's species have been found to conflict with the hypothesis she was a human ancestor. A 2007 paper in *Proceedings of the National Academy of Sciences (USA)* reported “[g]orilla-like anatomy on *Australopithecus afarensis* mandibles,” which was

“unexpected,” and “cast[s] doubt on the role of *Au. afarensis* as a modern human ancestor.”⁸² [81. Oxnard, “The place of the australopithecines in human evolution: grounds for doubt?,” 389–95.] [82. Yoel Rak, Avishag Ginzburg, and Eli Geffen, “Gorilla-like anatomy on *Australopithecus afarensis* mandibles suggests *Au. afarensis* link to robust australopiths,” *Proceedings of the National Academy of Sciences (USA)*, 104 (April 17, 2007): 6568–72.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p64.]

- As for Lucy’s pelvis, many have claimed it supports a bipedal form of locomotion, but Johanson and his team reported it was “badly crushed” with “distortion” and “cracking” when first discovered.⁸³ These problems led one commentator to propose in the *Journal of Human Evolution* that the reason Lucy’s pelvis is “so different from other australopithecines and so close to the human condition” was “error in the reconstruction... creating a very ‘human-like’ sacral plane.”⁸⁴ Another paper in the same journal concluded that the lack of clear fossil data about Lucy prevents paleoanthropologists from making firm conclusions about her mode of locomotion: “Prevailing views of Lucy’s posture are almost impossible to reconcile... To resolve such differences, more anatomical (fossil) evidence is needed. The available data at present are open to widely different interpretations.”⁸⁵ [83. Donald C. Johanson, C. Owen Lovejoy, William H. Kimbel, Tim D. White, Steven C. Ward, Michael E. Bush, Bruce M. Latimer, and Yves Coppens, “Morphology of the Pliocene Partial Hominid Skeleton (A.L. 288-1). From the Hadar Formation, Ethiopia,” *American Journal of Physical Anthropology*, 57 (1982): 403–51.] [84. François Marchal, “A New Morphometric Analysis of the Hominid Pelvic Bone,” *Journal of Human Evolution*, 38 (March, 2000): 347–65.] [85. M. Maurice Abitbol, “Lateral view of *Australopithecus afarensis*: primitive aspects of bipedal positional behavior in the earliest hominids,” *Journal of Human Evolution*, 28 (March, 1995): 211–29 (internal citations removed).] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p64.]
- Many paleoanthropologists have cited *Homo habilis*, dated at about 1.9 mya,⁸⁷ as a transitional species between the australopithecines and our genus *Homo*. But there are many questions about what exactly habiline specimens were. In the words of Ian Tattersall, an anthropologist at the American

Museum of Natural History, the species is “a wastebasket taxon, little more than a convenient recipient for a motley assortment of hominin fossils.”⁸⁸ As recent as 2009, Tattersall reaffirmed this view, writing with Jeffrey Schwartz that *habilis* represents “a rather heterogeneous assemblage, and it is probable that more than one hominid species is represented.”⁸⁹ [87. F. Spoor, M. G. Leakey, P. N. Gathogo, F. H. Brown, S. C. Antón, I. McDougall, C. Kiarie, F. K. Manthi, and L. N. Leakey, “Implications of new early *Homo* fossils from Ileret, east of Lake Turkana, Kenya,” *Nature*, 448 (August 9, 2007): 688–91.] [88. Ian Tattersall, “The Many Faces of *Homo habilis*,” *Evolutionary Anthropology*, 1 (1992): 33–37.] [89. Ian Tattersall and Jeffrey H. Schwartz, “Evolution of the Genus *Homo*,” *Annual Review of Earth and Planetary Sciences*, 37 (2009): 67–92. Paleoanthropologists Daniel E. Lieberman, David R. Pilbeam, and Richard W. Wrangham likewise co-write that “fossils attributed to *H. habilis* are poorly associated with inadequate and fragmentary postcrania.” Daniel E. Lieberman, David R. Pilbeam, and Richard W. Wrangham, “The Transition from *Australopithecus* to *Homo*,” in *Transitions in Prehistory: Essays in Honor of Ofer Bar-Yosef*, eds. John J. Shea and Daniel E. Lieberman (Cambridge: Oxbow Books, 2009), 1. See also Ann Gibbons, “Who Was *Homo habilis*—And Was It Really *Homo*?” *Science*, 332 (June 17, 2011): 1370–71 (“researchers labeled a number of diverse, fragmentary fossils from East Africa and South Africa ‘*H. habilis*,’ making the taxon a ‘grab bag... a *Homo* waste bin,’ says paleoanthropologist Chris Ruff of Johns Hopkins University in Baltimore, Maryland”).] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p65.]

- Penn State University paleoanthropologist Alan Walker explains the severity of disagreements over this species: “[T]his is not a matter of some fragmentary fossils that are difficult to agree on. Whole crania are placed by different people in different species or even genera.”⁹⁰ One reason for the disagreements is that the quality of the fossils is often poor. As Walker puts it, “[d]espite the number of words published on this species... there is not as much bony evidence as we would like.”⁹¹ [90. 91. Alan Walker, “The Origin of the Genus *Homo*,” in *The Origin and Evolution of Humans and Humanness*, ed. D. Tab Rasmussen (Boston: Jones and Bartlett, 1993), 31.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*,

Discovery Institute Press, Seattle 2012, p¹⁰.]

- A 2011 article in *Science* similarly noted that *habilis* “matured and moved less like a human and more like an australopithecine,” had a dietary range “more like Lucy’s than that of *H. erectus*.”⁹⁴ Like the australopithecines, many features of *habilis* indicate they were more similar to modern apes than humans. According to Wood, *habilines* “grew their teeth rapidly, like an African ape, in contrast to the slow dental development of modern humans.”⁹⁵ [94. Gibbons, “Who Was *Homo habilis*—And Was It Really *Homo*?,” 1370–71.] [95. Wood’s views are described in Gibbons, “Who Was *Homo habilis*—And Was It Really *Homo*?,” 1370–71. See also Wood and Collard, “The Human Genus,” 65–71.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p66.]
- An analysis in *Nature* of the ear canals of *habilis* similarly found that its skull is most similar to baboons and suggested the fossil “relied less on bipedal behaviour than the australopithecines.”⁹⁶ The article concluded that “[p]hylogenetically, the unique labyrinth of [the *habilis* skull] represents an unlikely intermediate between the morphologies seen in the australopithecines and *H. erectus*.”⁹⁷ [96. 97. Spoor, Wood, and Zonneveld, “Implications of early hominid labyrinthine morphology for evolution of human bipedal locomotion,” 645–48.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p66.]
- Additionally, a study by Sigrid Hartwig-Scherer and Robert D. Martin in the *Journal of Human Evolution* found that the skeleton of *habilis* was more similar to living apes than were other australopithecines like Lucy.⁹⁸ They concluded: “It is difficult to accept an evolutionary sequence in which *Homo habilis*, with less human-like locomotor adaptations, is intermediate between *Australopithecus afaren[s]is* ... and fully bipedal *Homo erectus*.”⁹⁹ [98. 99. Hartwig-Scherer and Martin, “Was ‘Lucy’ more human than her ‘child’? Observations on early hominid postcranial skeletons,” 439–49.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p66.]
- Got a big head? Don’t get a big head. Brain size is not always a good indicator

of intelligence or evolutionary relationships. Case in point: Neanderthals had a larger average skull size than modern humans. Moreover, skull size can vary greatly within an individual species. (See Figure 3-8.) Given the range of modern human genetic variation, a progression of relatively small to very large skulls could be created by using the bones of living humans alone. This could give the misimpression of some evolutionary lineage when in fact it is merely the interpretation of data by preconceived notions of what happened. The lesson is this: don't be too impressed when textbooks, news stories, or TV documentaries display skulls lined up from small sizes to larger ones. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p68.]

- Noting these many changes, the study called the origin of humans, “a real acceleration of evolutionary change from the more slowly changing pace of australopithecine evolution” and stated that such a transformation would have included radical changes: “The anatomy of the earliest *H. sapiens* sample indicates significant modifications of the ancestral genome and is not simply an extension of evolutionary trends in an earlier australopithecine lineage throughout the Pliocene. In fact, its combination of features never appears earlier.”¹⁰⁹ [Hawks, Hunley, Lee, and Wolpoff, “Population Bottlenecks and Pleistocene Human Evolution,” 2–22.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p68.]
- The lack of fossil evidence for this hypothesized transition is confirmed by Harvard paleoanthropologists Daniel E. Lieberman, David R. Pilbeam, and Richard W. Wrangham, who provide a stark analysis of the lack of evidence for a transition from *Australopithecus* to *Homo*: Of the various transitions that occurred during human evolution, the transition from *Australopithecus* to *Homo* was undoubtedly one of the most critical in its magnitude and consequences. As with many key evolutionary events, there is both good and bad news. First, the bad news is that many details of this transition are obscure because of the paucity of the fossil and archaeological records.¹¹¹ [Lieberman, Pilbeam, and Wrangham, “The Transition from *Australopithecus* to *Homo*,” 1.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p69.]

- As for the “good news,” they still admit: “[A]lthough we lack many details about exactly how, when, and where the transition occurred from Australopithecus to Homo, we have sufficient data from before and after the transition to make some inferences about the overall nature of key changes that did occur.”¹¹² In other words, the fossil record provides ape-like australopithecines, and human-like Homo, but not fossils documenting a transition between them. [Lieberman, Pilbeam, and Wrangham, “The Transition from Australopithecus to Homo,” 1.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p69.]
- Ian Tattersall also acknowledges the lack of evidence for a transition to humans: Our biological history has been one of sporadic events rather than gradual accretions. Over the past five million years, new hominid species have regularly emerged, competed, coexisted, colonized new environments and succeeded—or failed. We have only the dimmest of perceptions of how this dramatic history of innovation and interaction unfolded...¹¹³ [Ian Tattersall, “Once we were not alone,” *Scientific American* (January, 2000): 55–62.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p69.]
- Likewise, evolutionary biologist Ernst Mayr recognized our abrupt appearance when he wrote in 2004: The earliest fossils of Homo, Homo rudolfensis and Homo erectus, are separated from Australopithecus by a large, unbridged gap. How can we explain this seeming saltation? Not having any fossils that can serve as missing links, we have to fall back on the time-honored method of historical science, the construction of a historical narrative.¹¹⁴ [Ernst Mayr, *What Makes Biology Unique?: Considerations on the Autonomy of a Scientific Discipline* (Cambridge: Cambridge University Press, 2004), 198.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p69, 70.]
- In contrast to the australopithecines, the major members of Homo—such as erectus and the Neanderthals (Homo neanderthalensis)—are very similar to modern humans. They’re so similar to us that some paleoanthropologists have classified erectus and neanderthalensis as members of our own species, Homo sapiens.¹¹⁶ [See for example Eric Delson, “One skull does not a

species make,” *Nature*, 389 (October 2, 1997): 445–46; Hawks et al., “Population Bottlenecks and Pleistocene Human Evolution,” 2–22; Emilio Aguirre, “Homo erectus and Homo sapiens: One or More Species?,” in *100 Years of Pithecanthropus: The Homo erectus Problem* 171 Courier Forschungsinstitut Senckenberg, ed. Jens Lorenz (Frankfurt: Courier Forschungsinstitut Senckenberg, 1994), 333–339; Milford H. Wolpoff, Alan G. Thorne, Jan Jelinek, and Zhang Yinyun, “The Case for Sinking Homo erectus: 100 Years of Pithecanthropus is Enough!,” in *100 Years of Pithecanthropus: The Homo erectus Problem* 171 Courier Forschungsinstitut Senckenberg, ed. Jens Lorenz (Frankfurt: Courier Forschungsinstitut Senckenberg, 1994), 341–361.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p70.]

- As one paper in a 2007 Oxford University press volume notes, “despite having smaller teeth and jaws, H. erectus was a much bigger animal than the australopithecines, being humanlike in its stature, body mass, and body proportions.”¹²⁰ While the average brain-size of Homo erectus is less than modern humans, erectus cranial capacities are well within the range of normal human variation. [William R. Leonard, Marcia L. Robertson, and J. Josh Snodgrass, “Energetic Models of Human Nutritional Evolution,” in *Evolution of the Human Diet: The Known, the Unknown, and the Unknowable*, ed. Peter S. Ungar (Oxford University Press, 2007), 344–59.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p71.]

Figure 3-8. Cranial Capacities of Extant and Extinct Hominids¹²¹

TAXON	CRANIAL CAPACITIES	TAXON RESEMBLES
Gorilla (<i>Gorilla gorilla</i>)	340–752 cc	Modern Apes
Chimpanzee (<i>Pan troglodytes</i>)	275–500 cc	
<i>Australopithecus</i>	370–515 cc (Avg. 457 cc)	
<i>Homo habilis</i>	Avg. 552 cc	
<i>Homo erectus</i>	850–1250 cc (Avg. 1016 cc)	Modern Humans
Neanderthals	1100–1700 cc (Avg. 1450 cc)	
<i>Homo sapiens</i>	800–2200 cc (Avg. 1345 cc)	

- Though Neanderthals have been stereotyped as bungling, primitive precursors to modern humans, in reality, they were so similar to us that if a Neanderthal

walked past you on the street, you probably wouldn't notice many differences. Wood and Collard make this same point in drier, more technical language: "The numerous associated skeletons of *H. neanderthalensis* indicate that their body shape was within the range of variation seen in modern humans."¹²⁴ [See Wood and Collard, "The Human Genus," 65–71.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p71.]

- Washington University paleoanthropologist Erik Trinkaus likewise argues: "They may have had heavier brows or broader noses or stockier builds, but behaviorally, socially and reproductively they were all just people."¹²⁵ [Michael D. Lemonick, "A Bit of Neanderthal in Us All?," *Time* (April 25, 1999), accessed March 5, 2012, <http://www.time.com/time/magazine/article/0,9171,23543,00.html>.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p71.]
- In a 2007 Washington Post interview, Trinkaus dispelled the myth that Neanderthals were intellectually inferior: Although Neanderthals live in the public imagination as hulking and slow-witted "Alley Oops," Trinkaus and others say there is no reason to believe they were any less intelligent than the newly arrived 'modern humans.' Neanderthals were stockier and had larger brows, sharper teeth and more jutting jaws, but their brain capacity appears to have been no different than that of the newcomers.¹²⁶ [Marc Kaufman, "Modern Man, Neanderthals Seen as Kindred Spirits," *Washington Post* (April 30, 2007), accessed March 5, 2012, http://www.washingtonpost.com/wp-dyn/content/article/2007/04/29/AR2007042901101_pf.html.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p71, 72.]
- A 2003 article in *Smithsonian* magazine
- traces these myths back to prior European anthropologists, who,
- inspired by Darwin, wrongly promoted the "subhuman" view:
- "In the minds of the European anthropologists who first studied them, Neanderthals were the embodiment of primitive humans, subhumans if you will," says Fred H. Smith, a physical anthropologist at Loyola University in

Chicago who has been studying Neanderthal DNA. “They were believed to be scavengers who made primitive tools and were incapable of language or symbolic thought.” Now, he says, researchers believe that Neanderthals “were highly intelligent, able to adapt to a wide variety of ecological zones, and capable of developing highly functional tools to help them do so. They were quite accomplished.”¹²⁷ [Joe Alper, “Rethinking Neanderthals,” *Smithsonian* magazine (June, 2003), accessed March 5, 2012, <http://www.smithsonianmag.com/science-nature/neanderthals.html>.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p72.]

- University of Bordeaux archaeologist Francesco d’Errico affirms these comments, stating, “Neanderthals were using technology as advanced as that of contemporary anatomically modern humans and were using symbolism in much the same way.”¹²⁸ [Francesco d’Errico quoted in Alper, “Rethinking Neanderthals.”] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p72.]
- Anthropologist Stephen Molnar explains that “the estimated mean size of [Neanderthal] cranial capacity (1,450 cc) is actually higher than the mean for modern humans (1,345 cc).”¹²⁹ One paper in *Nature* suggested, “the morphological basis for human speech capability appears to have been fully developed” in Neanderthals.¹³⁰ Indeed, Neanderthal remains have with been found associated with signs of culture including art, burial of their dead, and technology including the usage of complex tools.¹³¹ At least one artifact shows Neanderthals made musical instruments like the flute.¹³² [129. Molnar, *Human Variation: Races, Types, and Ethnic Groups*, 5th ed., 189.] [130. B. Arensburg, A. M. Tillier, B. Vandermeersch, H. Duday, L. A. Schepartz, and. Y. Rak, “A Middle Palaeolithic human hyoid bone,” *Nature*, 338 (April 27, 1989): 758–60.] [131. Alper, “Rethinking Neanderthals”; Kate Wong, “Who were the Neandertals?,” *Scientific American* (August, 2003): 28–37; Erik Trinkaus and Pat Shipman, “Neandertals: Images of Ourselves,” *Evolutionary Anthropology*, 1 (1993): 194–201; Philip G. Chase and April Nowell, “Taphonomy of a Suggested Middle Paleolithic Bone Flute from Slovenia,” *Current Anthropology*, 39 (August/October 1998): 549–53; Tim Folger and Shanti Menon, “... Or Much Like Us?,” *Discover Magazine*, January, 1997, accessed March 5, 2012,

<http://discovermagazine.com/1997/jan/ormuchlikeus1026>; C. B. Stringer, “Evolution of early humans,” in *The Cambridge Encyclopedia of Human Evolution*, eds. Steve Jones, Robert Martin, and David Pilbeam (Cambridge: Cambridge University Press, 1992), 248.] [132. Philip G. Chase and April Nowell, “Taphonomy of a Suggested Middle Paleolithic Bone Flute from Slovenia,” *Current Anthropology*, 39 (August/October 1998): 549–553; Folger and Menon, “... Or Much Like Us?”] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p72.]

- Trinkaus says that when comparing ancient Europeans and Neanderthals: “Both groups would seem to us dirty and smelly but, cleaned up, we would understand both to be human. There’s good reason to think that they did as well.”¹³⁵ [Erik Trinkaus, quoted in Kaufman, “Modern Man, Neanderthals Seen as Kindred Spirits.”] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p73.]
- In 2010, Nature reported the finding of Neanderthal DNA markers in living humans: “A genetic analysis of nearly 2,000 people from around the world indicates that such extinct species interbred with the ancestors of modern humans twice, leaving their genes within the DNA of people today.”¹³⁷ [Rex Dalton, “Neanderthals may have interbred with humans,” *Nature news* (April 20, 2010), accessed March 5, 2012, <http://www.nature.com/news/2010/100420/full/news.2010.194.html>.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p73.]
- In the words of Jeffrey Long, a genetic anthropologist at the University of New Mexico, “Neanderthals didn’t completely disappear” because “[t]here is a little bit of Neanderthal leftover in almost all humans.”¹³⁸ Unsurprisingly, these observations have led to proposals that Neanderthals were a sub-race of our own species.¹³⁹ [138. 139. Rex Dalton, “Neanderthals may have interbred with humans,” *Nature news* (April 20, 2010), accessed March 5, 2012, <http://www.nature.com/news/2010/100420/full/news.2010.194.html>.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p73.]

- According to Siegrid Hartwig-Scherer, the differences between these humanlike members of the genus *Homo* can be explained as microevolutionary effects of “size variation, climatic stress, genetic drift and differential expression of [common] genes.”¹⁴¹ These small differences do not supply evidence of the evolution of humans from earlier ape-like creatures. [Hartwig-Scherer, “Apes or Ancestors,” 220.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p73.]

4 Francis Collins, Junk DNA, and Chromosomal Fusion (Casey Luskin)

- In his best-selling book *The Language of God* (2006), geneticist Francis Collins claims that human DNA provides “powerful support for Darwin’s theory of evolution, that is descent from a common ancestor with natural selection operating on randomly occurring variations.”¹ More specifically, he argues that our DNA demonstrates that humans and apes share a common ancestor. [Francis Collins, *The Language of God: A Scientist Presents Evidence for Belief* (New York: Free Press, 2006), 127–28.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p85.]
- These are common evolutionary arguments for ape/human common ancestry, but as this chapter will show, Collins’s case is based largely on outdated science and questionable assumptions. To be specific:
 - Numerous studies have found extensive evidence of function for non-coding DNA, showing that it is not genetic “junk” after all.
 - Human chromosomal fusion may imply that the human lineage experienced a fusion event, but this tells us nothing about whether our lineage extends back to share a common ancestor with apes. Moreover, the genetic evidence for human chromosomal fusion isn’t nearly as strong as Collins and others make it out to be. In sum, the evidence from DNA does not establish Collins’s conclusions about human evolution. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p86.]
- To his credit, Collins avoids the usual simplistic argument that shared functional genetic similarity between two species must demonstrate they shared a common ancestor, acknowledging that functional genetic similarity “alone does not, of course, prove a common ancestor” because a designer

could have “used successful design principles over and over again.”⁶ [Collins, *Language of God*, 134.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p86.]

- In his view, “[u]nless one is willing to take the position that God has placed these decapitated AREs in these precise positions to confuse and mislead us, the conclusion of a common ancestor for humans and mice is virtually inescapable.”⁸ Sounding much like Collins, atheist Darwinist Richard Dawkins likewise writes that “creationists might spend some earnest time speculating on why the Creator should bother to litter genomes with... junk tandem repeat DNA.”⁹ It’s worth noting that both Collins and Dawkins are making a theological argument (basically, “God wouldn’t do it that way”) as much as a scientific claim. I will leave the soundness of their theology to others, but their science has been overturned by the evidence. [8. Collins, *Language of God*, 136–37.] [9. Richard Dawkins, “The Information Challenge,” *The Skeptic*, 18 (December, 1998).] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p[^].]
- In 2002, biologist Richard Sternberg surveyed the literature and found extensive evidence for functions for AREs. Writing in the *Annals of the New York Academy of Sciences*, he found that ARE functions include: • Satellite repeats forming higher-order nuclear structures • Satellite repeats forming centromeres • Satellite repeats and other REs involved in chromatin condensation • Telomeric tandem repeats and LINE elements • Subtelomeric nuclear positioning/chromatin boundary elements • Non-TE interspersed chromatin boundary elements • Short, interspersed nuclear elements or SINEs as nucleation centers for methylation • SINEs as chromatin boundary/insulator elements • SINEs involved in cell proliferation • SINEs involved in cellular stress responses • SINEs involved in translation (may be connected to stress response) • SINEs involved in binding cohesin to chromosomes • LINEs involved in DNA repair¹⁰ [Richard Sternberg, “On the Roles of Repetitive DNA Elements in the Context of a Unified Genomic-Epigenetic System,” *Annals of the New York Academy of Sciences*, 981 (2002): 154–88.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p87, 88.]

- Sternberg concluded that “the selfish [junk] DNA narrative and allied frameworks must join the other ‘icons’ of neo-Darwinian evolutionary theory that, despite their variance with empirical evidence, nevertheless persist in the literature.”¹¹ [Richard Sternberg, “On the Roles of Repetitive DNA Elements in the Context of a Unified Genomic-Epigenetic System,” *Annals of the New York Academy of Sciences*, 981 (2002): 154–88.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p88.]
- Other genetic research has continued to uncover functions for various types of repetitive DNA, including SINE,¹² LINE,¹³ and Alu elements. ¹⁴ One paper even suggested that repetitive Alu sequences might be involved in “the development of higher brain function” in humans.¹⁵ [12. Sternberg, “On the Roles of Repetitive DNA Elements in the Context of a Unified Genomic-Epigenetic System,” 154–88.] [13. Tammy A. Morrish, Nicolas Gilbert, Jeremy S. Myers, Bethaney J. Vincent, Thomas D. Stamato, Guillermo E. Taccioli, Mark A. Batzer, and John V. Moran, “DNA repair mediated by endonuclease-independent LINE-1 retrotransposition,” *Nature Genetics*, 31 (June, 2002): 159–65.] [14. Galit Lev-Maor, Rotem Sorek, Noam Shomron, and Gil Ast, “The birth of an alternatively spliced exon: 3’ splice-site selection in Alu exons,” *Science*, 300 (May 23, 2003): 1288–91; Wojciech Makalowski, “Not junk after all,” *Science*, 300 (May 23, 2003): 1246–47.] [15. Nurit Paz-Yaacova, Erez Y. Levanonc, Eviatar Nevod, Yaron Kinare, Alon Harmelin, Jasmine Jacob-Hirscha, Ninette Amariglio, Eli Eisenberg, and Gideon Rechavi, “Adenosine-to-inosine RNA editing shapes transcriptome diversity in primates,” *Proceedings of the National Academy of Sciences USA*, 107 (July 6, 2010): 12174–79.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p88.]
- Numerous other functions have been discovered for various types of non-coding DNA, including:
 - Repairing DNA¹⁶
 - Assisting in DNA replication¹⁷
 - Regulating DNA transcription¹⁸
 - Aiding in folding and maintenance of chromosomes¹⁹
 - Controlling RNA editing and splicing²⁰
 - Helping to fight disease²¹
 - Regulating embryological development²²
 [16. Morrish et al., “DNA repair mediated by endonuclease-independent LINE-1

retrotransposition,” 159–65; Annie Tremblay, Maria Jasin, and Pierre Chartrand, “A Double-Strand Break in a Chromosomal LINE Element Can Be Repaired by Gene Conversion with Various Endogenous LINE Elements in Mouse Cells,” *Molecular and Cellular Biology*, 20 (January, 2000): 54–60; Ulf Grawunder, Matthias Wilm, Xiantuo Wu, Peter Kulesza, Thomas E. Wilson, Matthias Mann, and Michael R. Lieber, “Activity of DNA ligase IV stimulated by complex formation with XRCC4 protein in mammalian cells,” *Nature*, 388 (July 31, 1997): 492–95; Thomas E. Wilson, Ulf Grawunder, and Michael R. Lieber, “Yeast DNA ligase IV mediates non-homologous DNA end joining,” *Nature*, 388 (July 31, 1997): 495–98.] [17. Richard Sternberg and James A. Shapiro, “How repeated retroelements format genome function,” *Cytogenetic and Genome Research*, 110 (2005): 108–16.] [18. Jeffrey S. Han, Suzanne T. Szak, and Jef D. Boeke, “Transcriptional disruption by the L1 retrotransposon and implications for mammalian transcriptomes,” *Nature*, 429 (May 20, 2004): 268–74; Bethany A. Janowski, Kenneth E. Huffman, Jacob C. Schwartz, Rosalyn Ram, Daniel Hardy, David S. Shames, John D. Minna, and David R. Corey, “Inhibiting gene expression at transcription start sites in chromosomal DNA with antigene RNAs,” *Nature Chemical Biology*, 1 (September, 2005): 216–22; J. A. Goodrich, and J. F. Kugel, “Non-coding-RNA regulators of RNA polymerase II transcription,” *Nature Reviews Molecular and Cell Biology*, 7 (August, 2006): 612–16; L.C. Li, S. T. Okino, H. Zhao, H., D. Pookot, R. F. Place, S. Urakami, H.. Enokida, and R. Dahiya, “Small dsRNAs induce transcriptional activation in human cells,” *Proceedings of the National Academy of Sciences USA*, 103 (November 14, 2006): 17337–42; A. Pagano, M. Castelnovo, F. Tortelli, R. Ferrari, G. Dieci, and R. Cancedda, “New small nuclear RNA gene-like transcriptional units as sources of regulatory transcripts,” *PLoS Genetics*, 3 (February, 2007): e1; L. N. van de Lagemaat, J. R. Landry, D. L. Mager, and P. Medstrand, “Transposable elements in mammals promote regulatory variation and diversification of genes with specialized functions,” *Trends in Genetics*, 19 (October, 2003): 530–36; S. R. Donnelly, T. E. Hawkins, and S. E. Moss, “A Conserved nuclear element with a role in mammalian gene regulation,” *Human Molecular Genetics*, 8 (1999): 1723–28; C. A. Dunn, P. Medstrand, and D. L. Mager, “An endogenous retroviral long terminal repeat is the dominant promoter for human B1,3-

galactosyltransferase 5 in the

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- Sternberg, along with University of Chicago geneticist James Shapiro, predicted in 2005 that “one day, we will think of what used to be called ‘junk DNA’ as a critical component of truly ‘expert’ cellular control regimes.”²³ [Sternberg Shapiro, “How Repeated Retroelements format genome function,” 108–16.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p.]
- In 2007, the Washington Post reported that a huge scientific consortium, the ENCODE project, discovered that “the vast majority of the 3 billion ‘letters’ of the human genetic code are busily toiling at an array of previously invisible tasks.”²⁴ [Rick Weiss, “Intricate Toiling Found In Nooks of DNA Once Believed to Stand Idle,” *Washington Post* (June 14, 2007), accessed March 6, 2012, <http://www.washingtonpost.com/wp->

dyn/content/article/2007/06/13/AR2007061302466_pf.html.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p89.]

- According to an article in Nature reporting on the project: Biology’s new glimpse at a universe of non-coding DNA—what used to be called ‘junk’ DNA—has been fascinating and befuddling. Researchers from an international collaborative project called the Encyclopedia of DNA Elements (ENCODE) showed that in a selected portion of the genome containing just a few per cent of protein-coding sequence, between 74% and 93% of DNA was transcribed into RNA. Much non-coding DNA has a regulatory role; small RNAs of different varieties seem to control gene expression at the level of both DNA and RNA transcripts in ways that are still only beginning to become clear.²⁵ [Erika Check Hayden, “Human Genome at Ten: Life is Complicated,” *Nature*, 464 (April 1, 2010): 664–67.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p89.]
- A 2007 paper in *Nature Reviews Genetics*, titled “Genome-wide transcription and the implications for genomic organization,” explains the extensive, complex, and vital nature of these mysterious functions of non-coding DNA: Evidence indicates that most of both strands of the human genome might be transcribed, implying extensive overlap of transcriptional units and regulatory elements. These observations suggest that genomic architecture is not colinear, but is instead interleaved and modular, and that the same genomic sequences are multifunctional: that is, used for multiple independently regulated transcripts and as regulatory regions.²⁶ [Philipp Kapranov, Aaron T. Willingham, and Thomas R. Gingeras, “Genome-wide transcription and the implications for genomic organization,” *Nature Reviews Genetics*, 8 (June, 2007): 413–23.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p89.]
- Likewise, a 2008 paper in *Science* found that almost all parts of wellstudied eukaryotic genomes are transcribed, yielding immense amounts of non-protein-coding strands of RNA which likely have functions: The past few years have revealed that the genomes of all studied eukaryotes are almost

entirely transcribed, generating an enormous number of non-protein-coding RNAs (ncRNAs). In parallel, it is increasingly evident that many of these RNAs have regulatory functions. Here, we highlight recent advances that illustrate the diversity of ncRNA control of genome dynamics, cell biology, and developmental programming.²⁷ [Paulo P. Amaral, Marcel E. Dinger, Tim R. Mercer, and John S. Mattick, “The Eukaryotic Genome as an RNA Machine,” *Science*, 319 (March 28, 2008): 1787–89.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p89, 90.]

- The paper goes on to elaborate specifically that repetitive elements play important roles in this cellular control: “Given the abundance of transcribed repetitive sequences, this may represent a genome-wide strategy for the control of chromatin domains that may be conserved throughout eukaryotes.”²⁸ [Paulo P. Amaral, Marcel E. Dinger, Tim R. Mercer, and John S. Mattick, “The Eukaryotic Genome as an RNA Machine,” *Science*, 319 (March 28, 2008): 1787–89.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p90.]
- A 2003 article in *Science* acknowledged that “junk DNA” labels—similar to those used by Collins—have discouraged scientists from discovering the functions of noncoding repetitive elements: Although catchy, the term ‘junk DNA’ for many years repelled mainstream researchers from studying noncoding DNA. Who, except a small number of genomic clochards, would like to dig through genomic garbage? However, in science as in normal life, there are some clochards who, at the risk of being ridiculed, explore unpopular territories. Because of them, the view of junk DNA, especially repetitive elements, began to change in the early 1990s. Now, more and more biologists regard repetitive elements as a genomic treasure.²⁹ Despite widespread Darwinian assumptions to the contrary, the paper concluded that, “repetitive elements are not useless junk DNA but rather are important, integral components of eukaryotic genomes.”³⁰ [29. 30. Makalowski, “Not Junk After All,” 1246–47.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p90.]
- As with AREs, multiple functions for pseudogenes have been discovered. ³⁴

In fact, two leading biologists writing in *Annual Review of Genetics* reported that “pseudogenes that have been suitably investigated often exhibit functional roles.”³⁵ Likewise, a 2011 paper in the journal *RNA* titled “Pseudogenes: Pseudo-functional or key regulators in health and disease?” argues they should no longer be presumed “junk”: “Pseudogenes have long been labeled as ‘junk’ DNA, failed copies of genes that arise during the evolution of genomes. However, recent results are challenging this moniker; indeed, some pseudogenes appear to harbor the potential to regulate their protein-coding cousins.”³⁶ [34. See for example D. Zheng and M. B. Gerstein, “The ambiguous boundary between genes and pseudogenes: the dead rise up, or do they?,” *Trends in Genetics*, 23 (May, 2007): 219–24; S. Hirotsune et al., “An expressed pseudogene regulates the messenger-RNA stability of its homologous coding gene,” *Nature*, 423 (May 1, 2003): 91–96; O. H. Tam et al., “Pseudogene-derived small interfering RNAs regulate gene expression in mouse oocytes,” *Nature*, 453 (May 22, 2008): 534–38; D. Pain et al., “Multiple Retropseudogenes from Pluripotent Cell-specific Gene Expression Indicates a Potential Signature for Novel Gene Identification,” *The Journal of Biological Chemistry*, 280 (February 25, 2005):6265–68; J. Zhang et al., “NANOGP8 is a retrogene expressed in cancers,” *FEBS Journal*, 273 (2006): 1723–30.] [35. Evgeniy S. Balakirev and Francisco J. Ayala, “Pseudogenes, Are They ‘Junk’ or Functional DNA?,” *Annual Review of Genetics*, 37 (2003): 123–51.] [36. Ryan Charles Pink, Kate Wicks, Daniel Paul Caley, Emma Kathleen Punch, Laura Jacobs, and David Paul Francisco Carter, “Pseudogenes: Pseudo-functional or key regulators in health and disease?,” *RNA*, 17 (2011): 792–98.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p91.]

- Indeed, one study suggested that even the caspase-12 pseudogene which Collins cites³⁷ can produce a “CARD-only protein,”³⁸ a type of functional proteins in humans.³⁹ The study suggests that human caspase- 12 interacts in some biological pathways, and encourages scientists to study the caspase-12 pseudogene to understand its function: “Since human pseudo-caspase-12 is structurally comparable to ICEBERG and COP/Pseudo-ICE [CARD-only proteins], it would be interesting to study its involvement in similar pathways.”⁴⁰ [37. Collins acknowledges that the caspase-12 gene produces

a full-fledged protein in chimps, so this is not a case where humans share a non-functional stretch of DNA with another species. In fact, the gene is not always a pseudogene in humans. According to a paper in *The American Journal of Human Genetics*, 28% of people in sub-Saharan Africa have a functioning copy of the caspase-12 gene, as do lower percentages in some other human populations. Collins ignores the obvious possibility that caspase-12 was originally designed to produce a functional protein in humans but was rendered noncoding by a mutation in some human populations at some point the recent past. See Yali Xue, Allan Daly, Bryndis Yngvadottir, Mengning Liu, Graham Coop, Yuseob Kim, Pardis Sabeti, Yuan Chen, Jim Stalker, Elizabeth Huckle, John Burton, Steven Leonard, Jane Rogers, and Chris Tyler-Smith, “Spread of an Inactive Form of Caspase-12 in Humans Is Due to Recent Positive Selection,” *The American Journal of Human Genetics*, 78 (April, 2006): 659–70.] [38. M. Lamkanfi, M. Kalai, and P. Vandenabeele, “Caspase-12: an overview,” *Cell Death and Differentiation*, 11: (2004)365–68.] [39. Sug Hyung Lee, Christian Stehlik, and John C. Reed, “COP, a Caspase Recruitment Domain-containing Protein and Inhibitor of Caspase-1 Activation Processing,” *The Journal of Biological Chemistry*, 276 (September 14, 2001): 34495–500.] [40. Lamkanfi, Kalai, and Vandenabeele, “Caspase-12: an overview,” 365–68.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p91.]

- While there is much we still don’t know about noncoding DNA, Collins was wrong to simply assume that the vast majority of repetitive DNA is functionless “genetic flotsam and jetsam” or that pseudogenes are “broken” DNA. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p91.]
- Ironically, Collins himself participated in some of this research as head of the Human Genome Project. Perhaps that is why the year following *The Language of God* Collins started to pull back on his public promotion of the idea of junk DNA, even telling one reporter that he had “stopped using the term.”⁴¹ [Collins, quoted in Catherine Shaffer, “One Scientist’s Junk Is a Creationist’s Treasure,” *Wired Magazine Blog* (June 13, 2007), accessed March 6, 2012.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p91, 92.]

- The second main argument for human/ape common ancestry made by Francis Collins is his claim that human chromosome #2 has a structure similar to what one would expect if two chimpanzee chromosomes became fused, end to end. Humans have 23 pairs of chromosomes, but chimps and other great apes have 24. In *The Language of God*, Collins argues that this chromosomal fusion explains why humans have one less pair of chromosomes than apes, claiming “it is very difficult to understand this observation without postulating a common ancestor.”⁴³ [Collins, *The Language of God*, 138.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p92.]
- To the contrary, it is very easy to understand this evidence without postulating a common ancestor. Assuming that human chromosome 2 is fused as Collins claims it is, human chromosomal fusion merely shows that at some point within our lineage, two chromosomes became fused. Logically speaking, this evidence tells us nothing about whether our human lineage leads back to a common ancestor with apes. Nor does it tell us whether the earliest humans were somehow ape-like. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p92.]
- Even if our ancestors did once have 24 pairs of chromosomes, they still could have been essentially just like fully modern humans. As University of North Carolina, Charlotte anthropologist Jonathan Marks observes, “the fusion isn’t what gives us language, or bipedalism, or a big brain, or art, or sugarless bubble gum. It’s just one of those neutral changes, lacking outward expression and neither good nor bad.”⁴⁴ [Jonathan Marks, *What it means to be 98% Chimpanzee: Apes, People, and their Genes* (Los Angeles: University of California Press, 2003), 39.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p92, 93.]
- At best, the evidence for human chromosomal fusion implies that one of our ancestors experienced a chromosomal fusion event which then got fixed into the human population; but this evidence tells us nothing about whether we share a common ancestor with apes. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p93.]

- If we step outside of the Darwinian box, the following scenario becomes equally possible with common ancestry: 1. The human lineage was designed separately from apes. 2. A chromosomal fusion event occurred in our lineage. 3. The trait spread throughout the human population during a genetic bottleneck (when the human population size suddenly became quite small). [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p93.]
- The Darwinian might respond by saying: “The fusion evidence shows our ancestors once had 48 chromosomes, like chimpanzees and other great apes do today. Moreover, our fused chromosome #2 even contains segments resembling ape chromosomes 2a and 2b. Common ancestry would have predicted all this evidence.” But the Darwinian rejoinder merely restates the fact that humans and apes share a highly similar genetic structure. This high level of human/chimp functional genetic similarity does not demonstrate common ancestry. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p95.]
- Telomeric DNA at the ends of our chromosomes normally consists of thousands of repeats of the 6-base-pair sequence TTAGGG. But the alleged fusion point in human chromosome 2 contains far less telomeric DNA than it should if two chromosomes were fused end-to-end: As evolutionary biologist Daniel Fairbanks admits, the location only has 158 repeats, and only “44 are perfect copies” of the sequence.⁴⁶ [Daniel Fairbanks, *Relics of Eden: The Powerful Evidence of Evolution in Human DNA* (Amherst, NY: Prometheus, 2007), 27.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p96.]
- Additionally, a paper in *Genome Research* found that the alleged telomeric sequences we do have are “degenerated significantly” and “highly diverged from the prototypic telomeric repeats.” The paper is surprised at this finding, because the fusion event supposedly happened recently—much too recent for such dramatic divergence of sequence. Thus, the paper asks: “If the fusion occurred within the telomeric repeat arrays less than ~6 mya [million years ago], why are the arrays at the fusion site so degenerate?”⁴⁷ The conclusion is this: If two chromosomes were fused end-to-end in humans, then a huge amount of alleged telomeric DNA is missing or garbled. [Yuxin Fan, Elena

Linardopoulou, Cynthia Friedman, Eleanor Williams, and Barbara J. Trask, “Genomic Structure and Evolution of the Ancestral Chromosome Fusion Site in 2q13-2q14.1 and Paralogous Regions on Other Human Chromosomes,” *Genome Research*, 12 (2002): 1651–62.] [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p96.]

- Thus, there are at least three reasons why the evidence isn’t exactly what the fusion story predicts: • The alleged fusion point in chromosome 2 contains much less telomeric DNA than it should • The supposed telomeric sequences we do have are highly “degenerate” and “highly diverged” from what we would expect if there were a relatively recent fusion event • Finding interstitial telomeric DNA in mammals isn’t all that remarkable, and doesn’t necessarily indicate a fusion event. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p97.]
- But—and this is the key point—even if human chromosome #2 is the result of two other chromosomes which became fused, this is not evidence for human/ape common ancestry. At most, it shows our human lineage experienced a chromosomal fusion event, but it does not tell us whether our lineage leads back to a common ancestor with apes. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p97.]
- As a supporter of the idea that many aspects of nature are best explained by intelligent design rather than unguided processes, I want to note that intelligent design is not incompatible in principle with humans sharing ancestry with other species. At its core, intelligent design challenges not common ancestry, but the claim that life’s complexity arose via unguided processes like random mutation and natural selection. Thus, a guided form of common ancestry would be compatible with intelligent design. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p98.]

5 The Science of Adam and Eve (Ann Gauger)

- Now that DNA sequencing has become relatively simple and cheap, researchers are gathering vast amounts of human sequence data. They use

the genetic variation they find to reconstruct past events in our genetic history. They derive evolutionary trees, estimate ancestral population sizes, and even calculate when and where our ancestors migrated out of Africa. Based on this kind of work, some have argued that we cannot have come from just two first parents. This argument directly contradicts the traditional belief of many Christians that humanity started with an original couple, Adam and Eve. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p105.]

- Note that for neo-Darwinism, there is no room for direction or guidance in evolution. Random genetic variation occurs by chance, without any provision for the organism's needs. Natural selection does the winnowing, and genetic drift throws in a dash of additional randomness as to which variants actually survive and spread through the population. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p108.]
- Currently, neo-Darwinism is the accepted explanation for our origin. It may be, though, that as we continue to investigate our own genomes, the Darwinian explanation for our similarity with chimps—namely, common descent—will evaporate. We may discover additional features in our genome that defy explanation based on common ancestry. As evidence of common descent's insufficiency as a theory grows, alternate theories will need to be tested. But one thing is clear right now: Adam and Eve have not been disproven by science, and those who claim otherwise are misrepresenting the scientific evidence. [Ann Gauger, Douglas Axe & Casey Luskin: *Science and Human Origins*, Discovery Institute Press, Seattle 2012, p120, 121.]

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