APPENDICES TO LESSON 4

Appendix A: "Man and the Neanderthals"

For anthropologists and laypeople alike, controversy and intrigue surrounds the Neanderthals' status and fate. Since this creature's discovery in 1856, people have wondered, Did Neanderthals evolve into modern humans? Did they bury their dead and engage in religious expression? (*Who Was Adam?* p.180)

Though anatomically similar in many ways, Neanderthals and humans exhibit significant morphological differences. …

For a time, anthropologists who saw *an* evolutionary connection between Neanderthals and modern humans didn't consider the differences particularly meaningful. These scientists claimed that (to a large extent) the anatomical distinctives could be explained by the Neanderthals' lifestyle and environmental influences. In other words, the researchers didn't think the Neanderthals' unique characteristics were inherent; rather, they presumed these features resulted from non-genetic factors.

The Neanderthals lived in a cold climate, and many of their facial and bodily attributes allowed them to thrive in harsh conditions. Modern human populations that have historically occupied frigid environments (such as the Inuits) display similar facial and body features. According to Bergmann's rule and Allen's rule, people found in cold environments naturally possess smaller, more barrel-shaped bodies and shorter limbs than do human populations with historical connection to warm climates. Stockier bodies with shorter arms and legs (according to these rules) help retain body heat. In warm climates, long limbs and elongated trunks make heat dissipation more efficient. Therefore, some paleoanthropologists have claimed that Neanderthals' unique anatomy may simply reflect cold adaptation, not fundamental genetic differences. …

Many paleoanthropologists acknowledge that climate effects may account for some anatomical differences between humans and Neanderthals. However, some of these same scientists maintain that Neanderthals' unique features represent a

profound distinction. Not only must Neanderthal be considered a separate species, but it must also be viewed as an evolutionary side branch, a dead end. In other words, the scientists claim that Neanderthals have no evolutionary connection to humanity.

This view gained significant support in 1992 when Yoel Rak discovered the skeleton of a Neanderthal infant in a limestone cave in Israel. The 50,000-year-old specimen manifested the same unique anatomical features as an adult Neanderthal. This similarity convinced Rak (along with the majority of paleoanthropologists) that Neanderthals are inherently distinct from human beings. The infant's morphology establishes that the anatomical differences stem largely from genetics, not exclusively from environmental and lifestyle effects. (*Who Was Adam?* pp.181-182) …

In 1997 researchers from the Max Planck Institute and Pennsylvania State University reported the first genetic comparison of modern humans and Neanderthals. During this groundbreaking study, (which has been described as "science at its very best"), two independent teams isolated, amplified… and sequenced mitochondrial-DNA (mtDNA) fragments from the right humerus of the first-discovered Neanderthal specimen. …

From the DNA fragments, each team pieced together the sequence for what is known as mtDNA's hypervariable I (HVI) region. …The scientists then compared the Neanderthal HVI sequence to the corresponding sequence from 2,051 human and 59 chimpanzee samples. …The research revealed …a 27-base-pair difference, on average, for Neanderthal-to-human comparisons…

Shortly after the 1997 report was published, the team from the Max Planck Institute extended their human-to-Neanderthal genetic comparison by including a second segment of mitochondrial DNA, called the hypervariable II (HVII) region. This DNA sequence consists of about 340 base pairs. As with the first study, the HVII mtDNA fragments were isolated and amplified from the right humerus bone of the first Neanderthal specimen discovered. When examined along side the corresponding HVII region from 663 modern humans, this

segment differed, on average, by 35 base pairs… For this study, human-to-human comparisons yielded an average difference of 10 base pairs…

…Comparisons of Neanderthal DNA with human population groups yielded, on average, a 36-, 34-, and 34-base-pair difference between Neanderthal HVII and the samples from Europeans, Asians, and Africans, respectively.

The extent and nature of the genetic differences make a powerful case that Neanderthals and humans are distinct species. …

Despite the power of the Planck team's case, several paleoanthropologists expressed unease. For them, the conclusions of these two initial studies seemed too far-reaching. The work involved only a single Neanderthal specimen. These scientists also expressed concern about possible contamination. …

Many of these legitimate concerns were laid to rest when teams from the University of Stockholm and the University of Glasgow each independently isolated, amplified, and sequenced the HVI and HVII mtDNA regions from the remains of a second Neanderthal fossil. This infant specimen, dated at 29,000 years old, was recovered from a cave in the northern Caucasus, the easternmost part of the Neanderthals' range. Both teams obtained identical results. As with the first Neanderthal genetic study, these analyses noted a 22-base-pair difference between the northern Caucasus specimen's DNA and a modern human mtDNA reference sequence for the HVI region. They also found close agreement between their Neanderthal DNA sequence and the one obtained by the team from the Max Planck Institute (a mere 3.48 percent difference).

Since these two studies, the Planck team has isolated, amplified, and sequenced mtDNA from seven additional Neanderthal specimens… The mtDNA sequences from these seven additional specimens closely agree with the sequences that were determined from the earlier studies….

The uneasiness that researchers felt about the results of the original study in 1997 has largely dissipated now that

researchers have mtDNA sequences from nine separate Neanderthal specimens. Several independent laboratories, each essentially obtaining the same result on specimens representing different time points in the Neanderthals' existence, make it difficult to dismiss the Neanderthal genetic data as an artifact of contamination or error… The cumulative weight of genetic evidence appears to decisively sever the link between Neanderthals and humans. …The conclusion seems obvious—Neanderthals could not have given rise to modern European populations or to any other human population group. (*Who Was Adam?* pp.183-186.)

As compelling as the evidence seems, a minority of paleoanthropologists remain unconvinced. They consider the genetic data insufficient to rule out a connection between Neanderthals and humans. Some researchers point out that the genetic studies rely exclusively on mtDNA comparisons. They ask whether the results would be the same in a comparison of nuclear DNA.

According to the challenges, while the mtDNA of modern humans and Neanderthals differ, the much more important chromosomal DNA found in the cell's nucleus may be highly similar and reflect a deep evolutionary connection between the two species. …

If the Neanderthals' mitochondrial-DNA sequence was lost, the genetic continuity between them and modern humans would have been disrupted over time. In the distant past, the continuity would be readily evident. The apparent connection would then diminish until it disappears. Comparisons between Neanderthals and currently existing human populations thus might reflect the end of this decay process. In order to test this idea, paleoanthropologists must compare Neanderthal mtDNA sequences with ancient remains of humans that date as close as possible to the time when Neanderthals existed.

A scientific team from Spain and Italy recently performed this type of comparison. They isolated, amplified, and sequenced mtDNA from two human remains recovered in Italy and dating to 25,000 and 23,000 years in age. These people lived within the Neanderthals' range and soon after … The researchers discovered that the mtDNA sequences of these ancient humans

were characteristically identical to those of contemporary humans and yet were distinct from Neanderthal mtDNA.

The two ancient human mitochondrial-DNA sequences differed from four previously published Neanderthal sequences by 22 to 28 base pairs. In other words, as soon as human beings appeared in Europe, sharp genetic differences existed between them and Neanderthals. The DNA from Neanderthals does not appear to be human DNA that became extinct. (*Who Was Adam?* pp.186-187) …

Though the textbook view considers Neanderthals to be a part of humanity's lineage, the preponderance of scientific evidence strongly positions them off to the side… Strauss and Cave argued in 1956 that the public perception of the Neanderthals is incorrect. Instead of being rehabilitated as modern humans, the Neanderthals have been rendered extinct hominids with no bearing on humanity's origin. (*Who Was Adam?* p.191)

The biblical record of origins states that only one creature was made in God's image. That distinction belongs solely to human beings (*Homo sapiens* <u>*sapiens*</u>). As a consequence, … Neanderthal behavior and culture will be qualitatively different from humankind's. Only people should display behavior and a culture that reflect God's image. While biological characteristics are significant in drawing a distinction between humans and hominids, these features are not the most important criteria—behavior is.

Archeological evidence from Neanderthal sites has yielded important insight into their behavior and culture. Claims that Neanderthals used sophisticated tools, possessed language, and engaged in artistic and musical expression abound. …What does the archeological record say? …

…compared to the tools used by the earliest human beings, Neanderthal implements were relatively unsophisticated. According to paleoanthropologist Richard Klein, "The archeological record suggests that they [Neanderthals] were behaviorally far less innovative [than modern humans]." (*Who Was Adam?* pp.191-192) …

When it comes to cognitive ability, no issue is more contentious among paleoanthropologists than the Neanderthals' ability to communicate. The anatomical evidence, while not entirely conclusive, increasingly indicates that Neanderthals lacked the capacity for speech and language. The structure of the Neanderthal skull base was not conducive for speech. …

As Roger Lewin notes in his textbook on human evolution, "The notion that Neanderthals had poorly developed language abilities has become the majority position among anthropologists." (*Who Was Adam?* p.193) …

Neanderthals lacked not only speech but also symbolic thought. Artistic and musical expression reflects this capacity. Richard Klein states, "Unlike Upper Paleolithic Cro-Magnons [modern humans], Middle Paleolithic Neanderthals left little compelling evidence for art or jewelry."

Despite a lack of evidence, some highly publicized claims have been made for Neanderthal artistic expression. One of the most widely known is the so-called Neanderthal flute recovered from a cave in Slovenia in 1995. The paleoanthropologists who made this find interpreted an 11-centemeter bone fragment from a cave bear's femur (leg bone) as a flute. This bone shaft had four evenly spaced circular openings on one side. Subsequent analysis, less publicized, revealed that these openings were more likely perforations to the bone caused by carnivores.

Highly touted claims of Neanderthals' ritual behavior and even religious expression have also appeared in the media. Their chief basis? Graves. Neanderthal remains have been uncovered in close association with tools and other artifacts or in an exaggerated fetal position that seems to have been deliberately arranged at the time of burial.

One of the most widely known Neanderthal burial sites was excavated in Iraq between 1957 and 1961. Researchers there found pollen beneath the Neanderthal specimen. This discovery was taken to indicate that flowers had been placed around the corpse during a ritual burial.

Other paleoanthropologists hesitate to conclude that Neanderthal burials were ritualistic. Natural causes could account for many of the features of Neanderthal "graves." A cave roof's collapse on live occupants (or abandoned bodies) could have buried them. Some scientists have suggested that wind may have blown the pollen in the Neanderthal grave onto the remains, or a rodent may have carried the pollen to the burial site.

Paleoanthropologists struggle to interpret hominid behavior from a sparse archeological record. Conclusions drawn from limited data are speculative and far ranging, often beyond what the evidence can sustain (as in the case with the pollen). Based on the data, it is not outlandish to conclude that Neanderthals buried their dead, at least occasionally, but to interpret these "burials" as deliberate, established rituals appears unwarranted and unsubstantiated. Neanderthal burials likely reflect the fact that these hominids possessed some limited emotional capacity, but this fact does not necessarily imply that they were spiritual beings. …

One of the most fanciful pieces of evidence cited in favor of Neanderthal religious expression came from caves in Switzerland and France that contained large and seemingly orderly collections of bear skeletons. A few paleoanthropologists interpreted the bear skeletons as a type of altar and initially took this evidence to indicate that Neanderthals worshiped as part of a "bear cult." Closer study, however, indicates that the remains had simply accumulated in the caves when bears died there during hibernation (perhaps over a period of years), with natural processes causing the apparent sorting of the bones.

When all archeological evidence is critically considered, it appears as though Neanderthals possessed some capacity of emotional expression and a level of intelligence, similar to that of the great apes today. Yet they clearly lived in nonhuman ways. To say that Neanderthals behaved like spiritual beings made in God's image stretches the evidence beyond reasonable limits. (*Who Was Adam?* pp.194-196) …

Compared to Neanderthals' brains, the human brain has a larger parietal lobe. This brain region plays a vital role in

language, math reasoning, sense of self-identity, and religious experience.

Such a profound biological distinction explains the behavioral difference between Neanderthals and people. The Neanderthals' brain shape and structure provided no capacity for behaving the way human beings behave. Neanderthals lacked the necessary brain structure to think and act in a way that reflects God's image. (*Who Was Adam?* p.197)

Who Was Adam? A Creation Model Approach to the Origins of Man, Fazale Rana and Hugh Ross, NavPress, Colorado Springs CO, 2005.

Appendix B: "Comparing the Genes of Humans and Chimps"

While working at the University of California, Berkeley, in the early 1970s, *Mary-Claire King* compared the amino acid sequences, as well as the immunological and physical properties of several proteins, isolated from both humans and chimpanzees. These three measures indicated to King and her doctoral supervisor, Allan Wilson, that only a small genetic difference separated the two species. …

According to King's results, humans and chimpanzees share a closer genetic relatedness than anyone had anticipated. King uncovered a 99-percent agreement in the amino acid sequences of several proteins. …

The 99-percent genetic similarity has been enshrined as a cultural icon. For many naturalists, this resemblance represents one of the most compelling arguments for humanity's evolutionary origin. Presumably, the 99-percent sequence overlap for proteins and DNA proves that humans and chimps arose from a common ancestor some time in the relatively recent past. According to this view, the small genetic differences arose after the human and chimpanzee lineages split as a consequence of mutational changes within each species' genetic material.

…doesn't the compelling genetic similarity between humans and chimpanzees mean human evolution must be true? An in-depth answer to this question comes from an examination of the recent comparative studies of human and chimp biochemistry and genetics. These studies uncover some unexpected surprises… (*Who Was Adam?* pp. 199-200)

In the early 1980s evolutionary biologists compared the chromosomes of humans, chimpanzees, gorillas, and orangutans using two staining techniques called G-banding and C-banding. These studies revealed an exceptional degree of similarity between human chromosomes and chimp chromosomes. When aligned, the human and corresponding chimpanzee chromosomes appeared virtually identical. They displayed practically the same banding pattern, band locations, band size, and band stain intensity. To evolutionary biologists, this resemblance speaks of human and chimpanzee shared ancestry. …

Human and chimpanzee chromosomes display many structural similarities. Evolutionary biologists interpret these shared features as evidence that humans and chimpanzees evolved from a common ancestor. (*Who Was Adam?* pp.204, 207)

The chromosomal evidence for shared ancestry…fails to offer any insight into the anatomical, physiological, and behavioral differences between human beings and chimpanzees. Evolutionary biologists therefore want a more direct and meaningful comparison at the molecular level.

Steps toward this goal have been taken through application of DNA-DNA hybridization. Begun in the 1970s at the California Institute of Technology, this technique gained importance in the early 1980s when two biologists from Yale University further developed the methodology and then used it to characterize bird origins. This success encouraged biologists to begin using the technique to determine evolutionary relationships among primates.

DNA-DNA hybridization provides the means to make large-scale, though indirect, quantitative comparisons of DNA sequences. …

The DNA double helix is held together by interactions between the nucleotide side groups that extend from each individual chain's backbone. …

When heated above a characteristic temperature (Tm), the two DNA strands of the double helix separate… DNA-DNA hybridization exploits this physical phenomenon. The first step in the process involves heating DNA from two different species to separate each DNA double helix. Once separated, the single DNA strands from each species are mixed and hybrid double helices form. One strand of the hybrid double helix comes from one species; the other strand comes from the other species.

These hybrid DNA molecules form "heteroduplexes." …the more similar the DNA sequences are, the more completely and tightly the two strands pair. The heteroduplexes are then carefully heated in a controlled fashion to determine precisely the temperature at which they separate (Tm).

The difference between the separation temperatures of the heteroduplex and DNA double helix for each species reflects their degree of genetic similarity. …

DNA-DNA hybridization studies show that, among the primates, chimp DNA has the highest degree of similarity to human DNA…. Scientists take these results to signify a deep evolutionary connection between humans and chimpanzees.

While DNA-DNA hybridization studies generally agree with chromosome comparisons, controversy has surrounded them. Both the reliability of the technique and the statistical analysis of DNA-DNA hybridization data have been hotly debated by biologists. Currently, few evolutionists use this technique or consider it informative. DNA-DNA hybridization studies have mostly historical interest. (*Who Was Adam?* pp.207-208)

Most evolutionary biologists see direct comparisons of DNA sequences as the best approach to discern genetic and hence evolutionary relationships among organisms. The technology to conduct DNA sequence analysis became available only in the mid-1980s. …

In the spring of 2003, Morris Goodman (from Wayne State University) and his research team made headlines around the world with one such study. His team took advantage of recently available DNA sequence data from the human and chimpanzee genome projects.

Goodman and his collaborators examined 97 genes collectively comprised of 90,000 base pairs (genetic letters)—perhaps one of the most extensive human-chimp gene-to-gene comparisons ever made. Their work revealed a 99.4 percent sequence similarity for genetic differences that alter the amino acid sequence of the protein coded by the gene (non-synonymous). The research also showed a 98.4 percent sequence similarity for genetic differences that leave the amino acid sequence unchanged (synonymous).

Given this likeness, Goodman maintains that, genetically speaking, chimpanzees and humans belong to the same genus, *Homo*. However, the scientific community has been reluctant to embrace Goodman's proposal because genetic comparisons are not the sole criteria for biological classification. …In spite of the shortcomings with gene-to-gene comparisons, (whether direct or indirect), the high level of genetic similarity suggests to evolutionary biologists that humans and chimpanzees share ancestry. (*Who Was Adam?* pp.209-210)

For the last three decades, the 99-percent genetic similarity between humans and chimpanzees has stood as an unassailable "fact," seemingly confirmed time and time again by evolutionary biologists. However, several recent studies strongly indicate that humans and chimpanzees actually display substantial genetic differences. Biologists are uncovering these differences as they transition from performing individual gene-to-gene comparisons to performing studies that involve significant portions of, if not the entire, human and chimpanzee genomes.

Studies that reveal a 99-percent genetic similarity between humans and chimpanzees have stacked the deck in a way that guarantees a high degree of likeness. Comparisons made between corresponding regions of the human and chimpanzee genomes, which researchers already suspected to be nearly identical, showed striking similarity. But when researchers

made unbiased comparisons of larger regions of these two genomes, differences began to emerge.

One of the first studies to make genome-to-genome comparison between humans and chimpanzees was reported early in 2002 by the International Consortium for the Sequencing of Chimpanzee Chromosome 22. To make this whole-genome comparison, the Chimpanzee Genome Project team cut the chimp genome into fragments, sequenced them; and then compared them to corresponding sequences found in the Human Genome Database. For those chimp DNA fragments that were able to align with sequences in the Human Genome Database, the project team found that the sequences displayed a 98.77-percent agreement. However, the project team found that about 15,000 of the 65,000 DNA fragments did not align with any sequence in the Human Genome Database. They appear to represent unique genetic regions.

A few months later, a team from the Max Planck Institute achieved a similar result when they compared over 10,000 regions (encompassing nearly 3 million nucleotide base pairs). Only two-thirds of the sequences from the chimp genome aligned with the sequences in the human genome. As expected, in those that did align, a 98.76-percent genetic similarity was measured, and yet one-third found no matches. …

Although human and chimpanzee genomes display great similarity, that similarity has been magnified to some extent by research methodology. Researchers are starting to uncover significant differences. Results of large-scale comparisons must be considered preliminary, as it's not yet clear what the genetic differences mean in terms of anatomical and behavioral characteristics. …Already the newly recognized genetic differences between humans and chimpanzees complicate the picture for biologists who view the high degree of genetic similarity between humans and chimpanzees as proof of shared ancestry. (*Who Was Adam?* pp. 212-215)

While advancing research is uncovering what appear to be extensive genetic differences between humans and chimpanzees, it's important to remember that sometimes even single genetic differences can be significant. Separate studies conducted at the University of California, San Diego (UCSD),

the Max Planck Institute, and the University of Chicago supply important examples. This work demonstrates that subtle genetic differences translate into marked disparities in human and Chimpanzee brain biochemistries. Researchers think these discrepancies may explain, at least in part, the unique qualities of the human brain.

One noteworthy biochemical difference between humans and the great apes is the absence in people of a particular cell-surface sugar, N-glycolyl-neuraminic acid (GL-neur). This sugar is found in virtually all mammals, including chimpanzees. Sugars in the cell surface play a critical role in a number of physiological processes. The absence of GL-neur explains the immunological distinction between humans and other mammals, including chimpanzees.

Cell-surface sugars also mediate cell-to-cell communication and may play a role in development. While G-neur occurs at high levels in all body tissues in mammals, including the great apes, its levels are relatively low in brain tissue. This fact has led the UCSD scientists to speculate that the absence of GL-neur in humans may explain, in part, differences in human and chimpanzee brain development, structure, and capacity. Experiments are under way to test this idea. (*Who Was Adam?* p. 215) …

Though humans and chimpanzees share a high degree of genetic similarity, several recent studies demonstrate that even subtle genetic differences can manifest themselves dramatically in terms of an organism's anatomy, physiology and behavior. This finding compels the question…. "What do genetic differences and similarities really mean?"

Anthropologist Jonathan Marks addresses the genetic questions in his book *What It Means to be 98% Chimpanzee*. Marks maintains that comparisons based on the percentage of similarity (or difference) of DNA sequences are largely meaningless. He points out the fact that humans and daffodils possess a 35-percent genetic similarity. According to Marks, "In the context of a 35% similarity to a daffodil, the 99.44% of the DNA of human to chimp doesn't seem so remarkable." …

Comparisons of the mouse genome (reported in December, 2002) with the human genome supports Mark's point. Of the 30,000 genes found in each of the human and mouse genomes, around 99-percent are the same. Only 300 genes are unique either to mice or to humans. Gene-to-gene DNA comparisons for humans and mice reveal roughly an 80-percent sequence similarity. Are humans 80-percent similar to mice? …

Given that humans and mice essentially possess the same genes, something more than genes and genetic similarity must define organisms. Biologists are starting to look at differences in gene expression as a way to account for anatomical, physiological, and behavioral differences among organisms. …(Gene expression describes which genes are turned on and off in a given tissue or at a given point in time.) …

Researchers are just beginning to gain knowledge of gene expression patterns in humans and the great apes. Yet these initial studies already indicate that anatomical, physiological, and behavioral differences between humans and chimpanzees (as well as the other great apes) result much more from differences in gene expression than from DNA sequence disparities. In many instances, it's not the genes present that are important but the way they function. …

…the difference between human biology and behavior and chimp biology and behavior likely depends to a large extent on the difference in gene usage, not the types of genes present. (*Who Was Adam?* pp. 219-220, 222-223)

Emerging genetic data, when viewed from a creation model perspective, provides some understanding of how God may have created humanity. It appears that when the Creator made humanity's physical component, He employed similar design features and the same building blocks (genes) as He used to fashion the great apes and other animals. It also appears that God redesigned certain building blocks or revised their function via genetic changes. He introduced new building blocks (gene duplications followed by genetic changes), cast aside other building blocks (gene deletions), and used the building blocks in radically different ways (gene expression and gene regulation) to produce humanity's unique features. (*Who Was Adam?* pp. 224-225)

APPENDIX C:
ARE THERE TWO CREATION ACCOUNTS?

Genesis 2:5-7 reads as follows:

> *Now no shrub of the field had yet appeared on the earth, and no plant of the field had yet sprung up; for Jehovah God had not caused it to rain upon the earth, and there was no man to till the ground. 6Then there went up rain clouds from the earth, and watered the whole surface of the ground. 7And Jehovah God formed man from the dust of the ground, and breathed into his nostrils the breath of life; and man became a living being.*

Genesis 2:5 is reiterating certain aspects of the creation account initially presented in Genesis 1, and is doing so in a very abbreviated manner.

Genesis 2:5a, *"no shrub of the field* (שִׂיחַ הַשָּׂדֶה) *had yet appeared on the earth, and no plant of the field* (הַשָּׂדֶה) had yet sprung up," is reiterating the initial condition of the creation, which in Genesis 1:2a is stated in these terms: "the earth was formless and empty" (תֹהוּ וָבֹהוּ).

Genesis 2:5b now presents the two "deficiencies" that need to be addressed: 1) no rain to water the ground and 2) no man to till the ground. Genesis 2:6 will reveal how God met the first "deficiency" (no rain,) and Genesis 2:7 will reveal how God met the second "deficiency" (no man.) These opening verses of the passage are intended to set the stage for the fuller discussion of the creation of man and his role in God's creation, the subject that occupies the remainder of chapter two.

Genesis 2:6, *"there went up rain clouds from the earth, and watered the whole surface of the ground,"* is describing the creation of the water cycle, which the LORD brought into being on the second day of creation (Gen. 1:6-8.) We may also take note of Job 36:27-28 (see notes below,) which is describing the same event in terms very similar to those found here in Genesis 2:6.

The Hebrew word אֵד has often been translated as "mist" (KJV, ASV) or "streams" (NIV). "Scholars have proposed numerous meanings for אֵד, but 'streams' seems to have won the day. However, 'streams' cannot possibly be correct for two reasons: 1) The text does not say that the problem was a lack of water in general, a problem that could be solved by water from any one of a variety of sources, for instance, a stream … The text specifically states that the problem was a lack of rain … 2) … If 'streams' is understood to be the correct translation of the Hebrew word אֵד, then the sense is something like 'no wild vegetation had appeared in the land … for the LORD God had not sent rain … but a stream was arising to water the whole surface of the land.' If a stream was present to water the whole surface of the land, then there was ample water for the appearance of wild vegetation, and the reason clause ('for the LORD God had not sent rain') is completely irrelevant and illogical."[1]

The only other recognized occurrence of the Hebrew אֵד is Job 36:27, which the *NIV* translates, *"He draws up the drops of water, which distill as rain to the streams* (אֵד)." The *NIV* translates אֵד here with "streams" in keeping with its rendering in Genesis 2:6. A footnote, however, offers an alternative: *"distill from the mist* (אֵד) *as rain."* The alternative in the footnote is

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[1] Futato, Mark D., *Because It Had Rained: A Study of Genesis 2:5-7 With Implications for Genesis 2:4-25 and Genesis 1:1-2:3;* reprinted from the Westminster Theological Journal; www.Because It Had Rained.com; p. 4.

certainly closer to the true sense. It correctly recognizes the sense "from" for the Hebrew preposition לְ; but "mist" cannot be the sense of אֵד here, since mist does not "distill as rain (מָטָר)," especially as *"abundant rain"* (see Job 36:28) … However, Old Testament scholar Mitchell Dahood translates Job 36:27, *"When he draws up drops from the sea, they distill as rain (מָטָר) from his rain cloud (אֵד)."*

Note how well such a rendering of אֵד fits the context, *"When he draws up drops from the sea, they distill as rain from his rain cloud." "The clouds pour down their moisture and abundant showers fall on mankind"* (*NIV* translation of Job 36:28.) Note how a hinge is formed by vs. 27b (*"rain clouds"*) and vs. 28a (*"clouds".*) This hinge connects the beginning of the cycle (evaporation in vs. 27a) with the end of the cycle (abundant rain on the land in vs. 28b.)

Given that אֵד has the sense "rain cloud" in Job 36:27, where it is collocated with rain (מָטָר), it is certainly plausible that אֵד has the same sense in Genesis 2:6, where it is likewise collocated with rain (מָטָר, Genesis 2:5.) The plausibility of this conclusion is confirmed by the fact that Dahood was not the first to understand אֵד in the sense of "rain cloud;" the ancient Targums consistently render אֵד with the Aramaic word for "cloud."

An immediate objection arises, however, if we translate Genesis 2:6, *"a rain cloud came up* (Qal form of the verb עָלָה) *from the land,"* since rain clouds do not literally come up from the land. But consider a text like Psalm 135:7, *"He makes clouds rise from the ends of the earth; he sends lightning with the rain and brings out the wind from his storehouses."* The verb translated "makes rise" in vs. 7a is the Hiphil form of עָלָה and the word for rain in vs. 7b is מָטָר. Psalm 135:7 thus provides a close parallel for Genesis 2:5-6, showing

that clouds do rise from the land, at least in terms of how things appear to an observer standing on the land. Clouds appear on the horizon, whether the horizon is a plain or a mountain, and thus give the appearance of rising from the land. The seventh time Elijah's servant looked out over the Mediterranean he said a *"cloud as small as a man's hand is rising* (עָלָה) *from the sea"* (1 Kings 18:44.) It was not literally rising from the sea, of course, but rising in terms of appearance, since the cloud was rising in relation to the sea that formed the western horizon. Compare, also, Jeremiah 10:13, *"When he thunders, the waters in the heavens roar; he makes clouds rise* (Hiphil of עָלָה) *from the ends of the earth. He sends lightning with the rain* (מָטָר) *and brings out the wind from his storehouses."*[2]

The Hebrew ו with which verse 6 begins, is translated *"but"* in the ASV and the NIV. This Hebrew particle usually bears the meaning "and," or, at times can even be translated "then" (*The Analytical Hebrew and Chaldee Lexicon*, edited by Benjamin Davidson, published by Samuel Bagster & Sons, reprinted in 1967, p. 233.) An example of ו being used in the sense of "then" is found in Genesis 3:5, *"then your eyes shall be opened"* (וְנִפְקְחוּ עֵינֵיכֶם). It seems preferable to translate the ו as "and," or even better, as "then," here in Genesis 2:6. Thus, verse 6 may be translated, *"then* [referring to God's act of creation on the second day] *there went up rain clouds from the earth, and watered the whole surface of the ground."*

Genesis 2:7 now proceeds to discuss in greater detail than chapter one the creaton of man and his role in God's creation.

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[2] Futato, pp. 5-7.