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# HUMAN ORIGINS AND HUMAN NATURE: MITOCHONDRIAL EVE AND Y-CHROMOSOMAL ADAM

James A. Marcum

Both religion and science provide powerful images of human origins and human nature. Often these images are seen as incompatible or irreconcilable, with the religious image generally marginalized *vis-à-vis* the scientific image. Recent genetic studies into human origins, especially in terms of common cellular features like the mitochondrion from females and the Y-chromosome from males, provide evidence for common ancestors called mitochondrial Eve and Y-chromosomal Adam. The aim of this paper is to expound upon the Judeo-Christian and western scientific images of humanity with respect to human origins and human nature, especially in terms of possible reconciliation of the two images.

## *1. Introduction*

Throughout history, human nature has been defined in various ways.[1] Traditionally, that nature is often tied to human origins. According to the Judeo-Christian scriptures, for example, humans are creatures formed from the earth but made in the image of God. And so human nature is defined in terms of both the natural and the supernatural. That way of defining human nature in western civilization was common until the middle of the nineteenth century, when Charles Darwin introduced a mechanism—which the scientific community eventually accepted—for explaining species evolution. That mechanism involves descent through (genetic) modification and natural selection. Since then, the scientific image of man as the exclusive product of natural forces has shaped our understanding of human nature. Often, these two images of man—the Judeo-Christian and the scientific—are considered to be irreconcilable. Although there have been a number of efforts to reconcile the two images, recent scientific research on mitochondrial Eve (mtE) and Y-chromosomal Adam (Y-cA) offers a novel way to approach a reconciliation. The aim of this paper is to explore possible reconciliation of these two apparently dissimilar images of man. To that end, I begin with the Judeo-Christian image of man and then examine the scientific image of man, especially in terms of mtE and

[1]See Roger Trigg, *Ideas of Human Nature: An Historical Introduction*, 2nd edition (Oxford: Blackwell, 1999).

Y-cA. I conclude with a brief comment of the importance for reconciling these two images of man or humanity.[2]

### 2. The Judeo-Christian Image of Humanity

The Judeo-Christian scriptures record the origins of mankind in two separate creation stories. In the first story, God speaks: "Let us make man in our image, after our likeness."[3] And so God created man, both male and female, according to his image and likeness. In the second creation story, God forms man from the earth: "the Lord God formed man of dust from the ground, and breathed into his nostrils the breath of life; and man became a living being."[4] Then, God later forms women from one of man's ribs: "the Lord God caused a deep sleep to fall upon the man and while he slept took one of his ribs and closed up its place with flesh; and the rib which the Lord God had taken from the man he made into a woman."[5] With these two stories we have the origins of mankind, which are used to explicate man's nature. Because humanity originates from God and earth, human nature is thus defined in terms of the divine image and likeness, with God and man being intimately connected to each other relationally, and with reference to the earth, with which man is embodied; while woman originates from man in terms of flesh, with whom he has an intimate relationship.

The Judeo-Christian nature of man, as evident from his origins, is both supernatural and natural. On the one hand man is patterned after the divine image, while on the other he is fashioned from the earth. In the first creation story man's divine image as supernatural is stressed, while in the second creation story man's earthly image as natural is stressed. The intent of the writers of Genesis is to place man not only within the larger context of who the creator is but also within the local context of the created world itself. Man by nature is both heavenly or spiritual and earthly or material. At the very heart of what it means to be human is to be both god and animal, to share in the divine plan and yet to be independent of it. The essential tension is that although we share in God's life, we also share in bodily death: we are mortal and immortal, corruptible and incorruptible. This tension is responsible for the paradoxical nature of what it means to be human and for man's existential *Angst*. And some attempts to try to solve that paradox, like the tower of Babel, lead to dysfunctional behavior—i.e., man wants to be *the* creator and not an embodied creature. To a large extent science seeks to legitimize that dysfunction, but it need not.

### 3. The Scientific Image of Humanity

An underlying assumption of the modern natural sciences is naturalism, which claims that all phenomena are the causal result of natural events and

[2]The terms 'man' and 'humanity' are used interchangeably, unless otherwise referring to human males.

[3]*Genesis* 1:26, RSV.

[4]*Genesis* 2:7, RSV.

[5]*Genesis* 2:21–22, RSV.

activities and can be explained as such. Importantly, there is no need to invoke the supernatural. Given this assumption, the scientific image of man then is natural to its very core and, of course, there is no need to invoke the supernatural. Obviously, Darwin's theory of evolution provided the means by which human ancestry could be explained in naturalistic terms, without appeal to a divine creator *per se*. Given that man's ancestry can be explained in naturalistic terms, another assumption is then made that not only can human nature be adequately explained in naturalistic terms but that it can also be completely accounted for in those terms. There have been two prominent means by which human origins have been studied scientifically: fossils and DNA. Recently, the work on mitochondrial DNA (mtDNA) and the Y-chromosome (Y-c) have led to projections of common human ancestors. In the remainder of this section, that work is explored in terms of understanding human origins and human nature.

*3.1 Mitochondrial Eve*

Before exploring the nature of mtE, the nature of mitochondria must be examined first. The mitochondria are cellular organelles that are often called the "powerhouse" of the cell. The reason they are called this is that mitochondria are responsible for the breakdown of sugars to release energy, which is stored in high energy containing molecules. These molecules are then used to power cellular activities. What is most interesting about these organelles is that they resemble bacteria. For example, they have a double cell membrane (found in some bacteria) that covers the organelle. Given these similarities to bacteria, mitochondria are believed to represent symbiotes that were incorporated into eukaryotes during their evolution.[6] But what is most striking about these organelles, especially for studying human origins, is that they contain a circular piece of DNA that constitutes their genome—just like bacteria. Finally, mitochondria are inherited exclusively from the female ovum and not from the male sperm. The mitochondria are used only to power the sperm's flagellum and are destroyed by the female ovum during fertilization. Given the fact that mitochondria contain DNA that is inherited almost exclusively from the female, the matrilineal descent of human origins can be determined.

The analysis of mtDNA within a subset of women from across the world, originally conducted by Allan Wilson and his colleagues at University of California at Berkeley, revealed that the most recent common matrilineal ancestor could be projected from mtDNA sequence differences and a molecular clock for the rate of mtDNA mutation.[7] The projected common ancestor lived somewhere around 150,000 years ago in eastern Africa. This common ancestor was named, to the chagrin of many scientists, after the

[6]See Lynn Margulis, *Symbiosis in Cell Evolution: Life and Its Environment on the Early Earth* (San Francisco: W.H. Freeman, 1981).

[7]Rebecca L. Cann, Mark Stoneking, and Allan C.Wilson, "Mitochondrial DNA and Human Evolution," *Nature* 325 (1987), pp. 31–36.

biblical person Eve. Unfortunately, this name has led to several misconceptions in the public sector of what this research means. First, mtE is not a single person who populated the earth. Rather, she is only a person who is in the lineage of currently existing females. However, there are several problems here. Although the current consensus is that there is only a single origin for humans, multiple origins can never be excluded completely. Moreover, the original study by Wilson and colleagues sampled only 147 females. How well such a small sample reflects the matrilineal descent for billions of females living today *vis-à-vis* mtDNA is unclear, and a larger sampling might produce different results. Second, mtDNA is only one marker for determining human origins. Other markers, such as specific regions of the nuclear chromosomes, might give a better picture of human origins. Moreover, mtDNA studies do not give us any insight into the evolution of the nuclear genome, which holds more information about human descent—especially with other related hominids. Finally, analysis of mtDNA reveals only the matrilineal common ancestor of females and not an unqualified common ancestor of humans.

### *3.2 Y-Chromosomal Adam*

Before examining the origins and nature of Y-cA, the nature of the Y-c must first be discussed. The human genome is made up of 23 pairs of homologous chromosomes found within the cell's nucleus, which are divided into 22 pairs of somatic chromosomes and 1 pair of sex chromosomes. During conception, one of the chromosomal pairs comes from the female, while the other comes from the male. Human sex chromosomes, as is true for many but not all animals, are divided into an X-chromosome (X-c) and a Y-c such that sex is determined as follows: a human female contains two X-c, while the human male one X-c and one Y-c. Thus, only human males contain the Y-c. Moreover, during meiosis—the process by which gametes are produced and the number of chromosomes is reduced to just one copy of each chromosomal pair—both the homologous somatic chromosomes and the X-c undergo exchange of chromosomal material or what is called recombination. The Y-c does not undergo recombination with the X-c, since it shares little if any homology with it. Thus, any mutations occurring in the Y-c are not lost because of recombination and can be used to study the patrilinear descent to the most recent common male ancestor.

The analysis of Y-c sequence differences within a subset of men from around the world revealed that the most recent common patrilinear ancestor could be projected from these differences and a molecular clock of the Y-c mutation rate. The projected common ancestor lived somewhere around 60,000 years ago in eastern Africa. This ancestor was named to match the earlier designation of Eve, and again to the chagrin of many scientists, after the biblical person Adam. Unfortunately, as in the case of Eve, this name has led to several misconceptions of what this research means. As for mtE, Y-cA is not a single person who was responsible in part for populating the earth. Rather, he is only one person in the lineage

of currently existing males. As for the mtE studies, there are several problems here. For example, the original study by Peter Underhill and colleagues at Stanford University sampled only 1062 males.[8] Although this study is certainly larger than the original mtE study, still how well this small sample reflects the patrilinear descent for billions of males living today *vis-à-vis* the Y-c is unclear, and an even larger sampling might produce different results. Next, the Y-c is only one marker for determining human origins, and other markers might give a better picture of human origins. Third, both mtE and Y-cA lived during two separate time periods that were around 90,000 years apart. Finally, as for the mtE studies, analysis of Y-c only reveals the patrilinear common ancestor of males and not an unqualified common ancestor for humans.

### *4. Conclusion*

To transcend the polemical rhetoric fueling the current debate involved in the interactions between natural science and Judeo-Christian theology requires redirecting those interactions away from empirical or logical justification to include an analysis of their metaphysical foundations, such as naturalism and supernaturalism.[9] This redirection is of paramount importance for reconciling what appear to be conflicting images of man—i.e., the scientific mtE/Y-cA and the biblical Eve/Adam. What is required is a much more dynamic view of the interactions between science and theology. "Only a dynamic relationship between theology and science;" according to John Paul II, "can reveal those limits which support the integrity of either discipline, so that theology does not profess a pseudo-science and science does not become an unconscious theology."[10] But such a dynamic interaction must be based on wisdom or *sapientia* rather than knowledge or *scientia* alone. Instead of forcing interactions between their epistemic claims at the expense of one or both of the disciplines' integrity and limits, these claims must be combined or complemented wisely to fashion a world picture that captures both its order and elegance and not only one specific component of that picture thereby distorting the overall picture.[11] Only then can we transcend the *Homo sciens* we find ourselves devolving into, to become the *Homo sapiens* we were created to be.

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[8]Peter A. Underhill et al., "Y Chromosome Sequence Variation and the History of Human Populations," *Nature Genetics* 26 (2000), pp. 358–361.

[9]See James A. Marcum, "Exploring the Rational Boundaries between the Natural Sciences and Christian Theology," *Theology and Science* 1 (2003), pp. 203–220.

[10]Pope John Paul II, "Our Knowledge of God and Nature: Physics, Philosophy and Theology," *L'Osservatore Romano* (Weekly edition in English), 1988, volume XXI (46), pp. 3–5.

[11]See James A. Marcum, "Metaphysical Foundations and the Complementation of Science and Theology," *Journal of Interdisciplinary Studies* 17 (2005), pp. 45–64.