CHAPTER 11

SCIENTIFIC AND THEOLOGICAL ISSUES ON HUMAN ORIGINS

GENETIC ADAM AND MITOCHONDRIAL EVE

Scientists occasionally talk about a "genetic Adam" and a "mitochondrial Eve." This leads some people to wonder whether these individuals can be connected to the biblical Adam and Eve. A study of human genetics sheds light on this issue.

Humans have two copies of most genes, one from the father and one from the mother. So if you take any one of your genes, it could have come from either of your parents, any one of your four grandparents, any one of your eight great-grandparents, and so on. This makes it difficult to trace the ancestry of most genes. Some genes, however, are easier to track.

Genes on the "Y" chromosome are only passed from father to son. If you are male, your Y-chromosome genes could only have come from your father and his father and his father. Similarly, mitochondrial genes are only passed from mother to child. Whether you are male or female, your mitochondrial genes could only have come from your mother and her mother and her mother. Consequently, it is much easier to deduce the ancestry of Y-chromosome and mitochondrial genes.

Since we find occasional mutations in these genes, population geneticists can use this information to construct family trees of Y-chromosome and mitochondrial genes. They figure out who shared a male ancestor 10 generations ago, who shared a female ancestor 20 generations ago, and so forth. When they do this, taking into account average mutation rates, they conclude that all males today have Y-chromosomes descended from a single male who lived around 60,000 to 100,000 years ago in Africa. They have dubbed him the "genetic Adam."

It is tempting to equate the "genetic Adam" with the Adam of the Bible. But according to population geneticists, this genetic Adam is not the *only* male ancestor of humans today. If you are a male, all of your Y-chromosome genes trace to this individual, but most other genes on your other 45 chromosomes will trace back to other males and females alive at the same time as this genetic Adam.

The following imaginary scenario might be a little difficult to follow, but it illustrates why this can happen. Imagine three couples that move to a remote mountain. Couple One (Abe and Alice) have three sons (Alex, Alan, Albert) and no daughters. Couple Two (Bob and Betty) and Couple Three (Carl and Cathy) together have three daughters (Barbara, Cindy, Candice) and no sons. These children of the original settlers marry, forming three new couples, and produce a new generation of children. The grandchildren of the original settlers will have a mix of genes in 45 of their chromosomes:

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- Half their genes will have come from their fathers (Alex or Alan or Albert), and these genes in turn will have come equally from Abe and Alice.
- Half their genes will have come from their mothers (Barbara or Cindy or Candice), and these genes in turn will have come from Bob, Betty, Carl, and Cathy.

But all male grandchildren will have Y-chromosome genes descended only from Abe (via Alex, Alan, or Albert). Because Bob and Carl had only daughters, their Y-chromosomes are not present in the generation of grandchildren.

This scenario is oversimplified, but it shows that Y-chromosomes from some male ancestors can die out over time even while other genes from these same male ancestors are passed on. More realistic scenarios can be modeled on computers—models with more couples, each with a random number of sons and daughters, and with occasional mutations on Y-chromosome genes. These models show that, after many generations, it is statistically probable that all males will trace their Y-chromosome genes to a single ancestral male, the genetic Adam. But these models also show that other genes on other chromosomes trace their ancestry back to other males alive at the same time as the genetic Adam.

When a similar analysis is done on mitochondrial genes, population geneticists conclude that every human today has mitochondrial genes descended from a single female who lived around 150,000 years ago in Africa, much earlier than the genetic Adam. They have dubbed her "genetic Eve" or "mitochondrial Eve." According to their models, while all of our mitochondrial genes come from her, many of the other genes on our chromosomes come from other females who were alive at the time. Thus we cannot equate the "mitochondrial Eve" with the Eve of Genesis.

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