BIOLOGICAL ADAM AND EVE.

By
William Reville, University College, Cork.

The question of where and when our modern human species *Homo sapiens sapiens* began is not yet finally settled. The preponderance of fossil evidence indicates an African origin for modern humans, but this has been vigorously disputed. In recent years, the 'Out of Africa' hypothesis has been strongly supported by a biochemical investigation of genetic material in living cells. An important biochemical investigation in the 1980s traced an ancestral line from modern humans back to a single woman who lived in Africa about 200,000 years ago. Other evidence recently published, provides evidence for a male ancestor who also lived about 200,000 years ago.

The earliest human ancestor to diverge from apes, seen in the fossil record, is *Australopithecus afarensis*. In the early 1970s a famous female skeleton of this species, nicknamed Lucy, was unearthed in central Ethiopia. Lucy lived three to four million years ago. She was less than four feet tall, walked on two legs, had long arms, massive jaws and a small brain (450cc). About 3 million years ago, Lucy's kind diverged into two lines of descent, one of which, a million years later gave rise to the genus *Homo*. The first hominid, *Homo habilis*, lived between two and one and a half million years ago. *Homo habilis* was still of small physique but had a larger brain case (700cc) than Lucy. About one and a half million years ago, *Homo habilis* evolved into the larger-brained (850cc) *Homo erectus*.

Homo erectus was probably the first hominid to migrate from Africa. Fossils of archaic *Homo sapiens,* the first human subspecies, have been found in Europe, Asia and Africa. It is assumed that these early people descended from *Homo erectus* in various parts of the world simultaneously. The brain of *Homo erectus* is about the same size as ours - 1400cc. *Homo erectus* was eventually succeeded world-wide by the modern sub-species *Homo sapiens sapiens*, whose oldest fossil remains, found in Africa, are about 120,000 years old, 80,000 years older than any found in Europe or Asia. This, together with other archaeological evidence, suggests that modern humans developed from a single isolated population of archaic *Homo sapiens* in Africa, and then spread out all over the world.

Our bodies are composed of cells, and every cell is controlled by its hereditary (genetic) material, which is mainly located in the nucleus of the cell. The genetic material is composed of DNA which contains linear coded information that controls all aspects of the cell's activity, and is also the hereditary material that is passed on to daughters of the cell when the cell divides. The code consists of four letter, and is read in blocks of three successive letters. The most important information in the DNA is divided into chunks called genes.

Over long periods, small changes (mutations) occur in the coded hereditary information. It was realised in the 1950s that it is possible to tell how far apart two species are in evolutionary terms, i.e. how long since they both diverged from a common ancestor, by comparing differences in the coded information in a particular gene between the two species.

Almost all the genetic material in the cell is contained in the cell nucleus. Half of this genetic material was originally donated by the father and half by the mother, when a sperm cell from the father united with an egg cell from the mother. Cells also contain hereditary material other than that contained in the cell nucleus. Cells contain organelles called mitochondria, which generate

most of the cell's energy. Each mitochondrion has its own DNA.

The sperm consists of a head and a tail, and is much smaller than an egg cell. The head of the sperm contains the sperm cell's nucleus, and very little else. The tail propels the sperm cell on its journey to the egg. The tail contains a special locomotion apparatus and some mitochondria to provide energy. When the sperm reaches the egg it is engulfed, thereby fertilising the egg. Mitochondria that enter the egg from the sperm are destroyed by the egg. The fertilised egg now divides and eventually forms the new individual, all of whose mitochondria have been inherited from the mother only.

In the 1980s, a world-wide survey of mitochondrial DNA sequences was carried out. The racial types sampled were African, Asian, European, New Guinean and Australian. The results showed that all groups could trace their ancestry back to a single woman who lived in Africa about 200,000 years ago. This is powerful corrobatory evidence to support the archaeological evidence that modern humans first arose in Africa about 200,000 years ago.

The discovery of the biological African Eve is not a scientific validation of the biblical Adam and Eve story. The existence of the African Eve does not mean that other women were not alive and reproducing at the same time. It merely means that, in the case of the descendents of all the other women from that time to the present day, there was at least one generation without female offspring to pass on the mitochondrial DNA.

In each cell nucleus, except sex cells, the hereditary material is present in the form of twenty three sets of chromosomes. One set comes from the father, and one set from the mother. Sex is determined by the X and Y sex chromosomes. Females contain two X chromosomes, and males contain an X and a Y chromosome. When sex cells (eggs and sperm) are formed, the sets of chromosomes are divided into their individual chromosomes and each sex cell receives twenty three individual chromosomes and not twenty three sets. Each egg cell contains an X chromosome, but half of the sperm cells will contain X chromosomes and half will contain Y chromosomes. If an X sperm fertilises an egg the offspring will be female; if a Y sperm fertilises an egg the offspring will be male. Since maleness is exclusively inherited via the Y chromosome, analysis of codes in this chromosome allows the tracing of ancestry through male inheritance in the same way as ancestry was traced through female descent by analysing mitochondrial DNA. Such a study was recently published, and provides evidence for a biological Adam who also existed approximately 200,000 years ago. The same remarks apply regarding the comparison of biological Adam to biblical Adam as were already made for biological Eve/biblical Eve.

It is very difficult and slow to reconstruct human evolutionary history relying solely on fossil evidence. Indeed, because of the massive difficulties involved here, it is doubtful if these traditional methods could ever unravel the full evolutionary story. In the future, it seems certain that modern techniques of molecular biology, analysing the genetic content of living cells, will play an increasingly important part in this story.

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