We're All Out Of Africa

By Jane Ellen Blair
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February is Black History Month and an excellent time to reexamine the scientific evidence regarding the amount of genetic diversity among humans and the antiquity of that diversity.

Even in today's modern society, there is continued evolution, migration [illegible] interbreeding which results [illegible] increasingly more diverse human race. To demonstrate how [illegible] linked and variable we are [illegible] species, consider the fact [illegible] is enough variability in a [illegible] size of Drain, Or-[illegible] the entire planet.

[illegible] three possible scientific [illegible] for the timing and patterns of emergence of modern Homo sapiens (*H. sapiens*) from Africa. These are the Out of Africa theory, the Multi-Regional Model and the Partial Replacement theory. Each of these theories has implications regarding the variability in modern human populations. The basic principle of variability is that more variation develops in a population the longer it exists. Within the scientific community, the[illegible] no real consensus regarding [illegible] validity of the different models [illegible] origins.

The **Out of Africa Theory** states that modern humans evolved exclusively within Africa and then replaced [illegible] populations of archaic [illegible] throughout Europe and [illegible] anatomically modern *H. sapiens* evolved from archaic H. sapiens and emerged from Africa around 200,000 years ago. Archaic *Homo sapiens* [illegible] including Cro Magnon [illegible] Neanderthal, existed prior [illegible] spread success of H. sa[illegible] and expressed a mosaic of [illegible] and anatomically modern [illegible] ... [illegible] ns evolv[illegible] places [illegible] pe and As[illegible] ing the exi[illegible] tomically m[illegible] uld have inter[illegible] dy existing gr[illegible] omo sapiens. Th[illegible] ey were not act[illegible] ecies. Some gene[illegible] on) and local selectio[illegible] vented the various lo[illegible] n developing into [illegible] nd ultimately resu[illegible] variable species. [illegible] much higher [illegible] man variabili[illegible] both the longevity of the [illegible] and the interbreeding with va[illegible] archaic populations.

The Multi-Regional Model or **Regional Continuity Model** implies that the variability between populations has very deep roots and that populations transitioned from archaic to modern humans in small groups within both Africa and Asia. In this model, the local populations in Europe, Asia and Africa continued their evolution from archaic to anatomically modern H. sapiens in each area as they developed local and regional adaptations. Critics of this theory question how so many independently evolving populations could develop with such similar physical characteristics.

Partial Replacement or **Recent African Origins Model** is essentially a hybrid between the other two more extreme views. It is based on the idea that there was a significant amount of gene flow or migration between populations of archaic and anatomically modern *H.sapiens*. In th[illegible] theory, there were anatomically modern *H.sapiens* in Africa about [illegible]00,000 years ago which gradua[illegible] dispersed due to changing clim[illegible]c and environmental conditions. There would have been a limited amount of inbreeding or hybridization with resident archaic pop[illegible]s in Europe and Asia, [illegible] to replacement of the [illegible] populations. This [illegible] both a gradual [illegible] process.

[illegible] theories state that anatomically modern humans developed on the African continent and emerged som[illegible] time between 440,000 and 100,000 years ago (or even considerably lo[illegible]er ago by some scientists' estimation). Prior to that, our predecessors, *Homo erectus*, evolved in Africa and then migrated outside of the region approximately 1.8 million years ago. There must have been at least one later time when a more evolved population of *H. sapiens* left the African continent. The evidence is not conclusive regarding the degree to which these anatomically modern *H. sapiens* interbred with populations of archaic *H. sapiens*, how quickly populations of archaic humans were replaced [illegible] anatomically modern humans, [illegible] what the patterns of migration were into other areas.

As is typical with scientific theories, there is little common ground between the supporters of these three theories.

There are several dating techniques used to determine when ancestral populations of *Homo sapiens* actually left the African continent. Molecular time clocks are based on rates of mutation and can potentially assess the age of humans. Fossil specimens, or the rocks they are contained in, can be dated using a variety of techniques applicable to the timescale from 50,000 to 500,000 years ago. Methods for fossil dating include uranium series, thermoluminesence and electron spin resonance techniques. Each of these techniques has different resolutions and ranges of accuracy causing the results to be somewhat ambiguous. Adding to the ambiguity, the fossil specimens themselves are too sparse to be conclusive about what happened during these critical time periods.

Although the results are inconclusive, there is some genetic evidence on the Y chromosome and on chromosome 21 which shows that there is more diversity among African populations than within non-African populations. This would be expected under the Complete Replacement Model due to the cycle of breeding and longevity within Africa, with only subsets of these people populating other areas.

The Complete Replacement Model also relies heavily upon genetic sequencing data from mitochondrial DNA (mtDNA), which is passed intact form mother to daughter. The so called **"Mitochondrial Eve"** theory shows all modern humans stemming from a single African woman. However, it is no longer considered a viable explanation by most scientists. Incorrect estimated rates of mutations, different population sizes, multiple migrations and questionable statistical techniques for identifying population relationships and drawing family trees may all contribute to mtDNA being discredited. In addition, other equally valid results and family trees can be generated using the same set of data.

There are significant implications regarding modern human variability in all of these theories. The phrase human variability refers to how many possibilities there are for people to express different forms of various traits. Since scientists truly don't know how quickly the transition from archaic to anatomically modern species occurred, it is difficult to determine the amount of variability introduced into the population during that transition. However, it is clear from modern research that there is more variability within a single human population than there is between populations. Statistical/mathematical studies have been done which show there is no set of traits which can conclusively separate modern humans into different races. In fact, all dividing lines we currently see are based on social and cultural differences with no real basis in scientific fact.

It is important to understand that human variability does not just refer to outward appearances. Outward appearances are frequently the expression of internal traits. There can be many types of genetic variability based in the human genome that are not externally expressed. When comparing humans to chimpanzees, there is actually only a 1 ½% difference in their genetic code. Additionally, the DNA in human mitochondria is only around 2 ½% as variable as that in chimpanzee mitochondria.

Although we don't know the details of exactly when and how our ancestors populated the world, what we do know is that we are all of one species and there is no such thing as different human races. There are many dangerous social consequences to any sort of racial division and there is no scientific evidence to support or encourage this viewpoint. It is critically important that all people understand the lack of scientific justification for any racial categories or designations based upon anything other than culture and access to resources. In today's culturally diverse society, those cultural differences that do exist between groups should be embraced.

Our Genetic Link As Africans

By Professor Rebecca Cann

In the past, anthropologists explored the history of our species by using either bones preserved as fossils or tools and other artifacts, such as pots, cloth, metals, or wooden implements found in archaeological deposits. In the 1960's, this focus began to change, with the recognition by biologists that we all carry the evidence of evolution in our genetic material, and that modern people can be a key to unlocking that past. The changes in our genetic material, mutations, that have accumulated in our DNA over time, can reveal where we came from, how we spread as a species, and when we began that spread.

By 1980, the idea emerged that all humans alive today can trace at least some of their genes to a woman who probably lived in Africa about 100,000-200,000 years ago. She wasn't the only woman alive at the time, but she represents the only woman who had an unbroken line of female descendants, all the way to the present. Her daughters passed on a unique set of genes, mitochondrial genes, that control the rate at which energy is produced in all the cells of our bodies.

Men and women have these genes but only women transmit them.

Scientists estimate that humans have about 60,000 different genes, and 37 of them fit this pattern. Because they are inherited only through the female line, they are easy to trace and help reveal how humans dispersed around the world.

By comparing the patterns of mutations in these genes, and using a computer to help reconstruct family trees, scientists in 1987 published the data for 142 human female lineages from donors around the world.

The tree had 2 major branches, one that contained only Africans, and the second, that contained Africans and everyone else. The simplest explanation for this pattern is that the ancestor of these people was an African, some people stayed in Africa and gave rise to modern African populations, but others migrated out of Africa and gave rise to other continental populations, including a group that went back into Africa.

Researchers in both fields of anthropology and human genetics were astonished. Many people assumed that earlier groups of archaic people would be directly ancestral to the modern populations found in those same places today. This idea said it wasn't true, all modern people shared a recent common origin, and therefore, the implication was that modern human races were a new phenomenon, and the biological basis of racial differentiation had to be trivial, involving only a few genes. These ideas are still stimulating major research programs on a variety of levels, including a search for the dispersal out of Africa in the archaeological record, the comparison of modern human groups for genetic markers that correlate with racial differences, and the exploration of cultural and linguistic differences that correspond to racial boundaries, however close or changing those boundaries may be.

In 1980, Professor Rebecca Cann of The University of Hawai'i at Manoa found genetic evidence of our African origins. Her work was based on 182 current mitochondrial DNA types which pointed to the existence of a common female ancestor who lived 200,000 years ago in Africa.

Kofi Agorsah from Portland State University is screening dirt with a sieve to look for minute artifacts at an archaeological site.