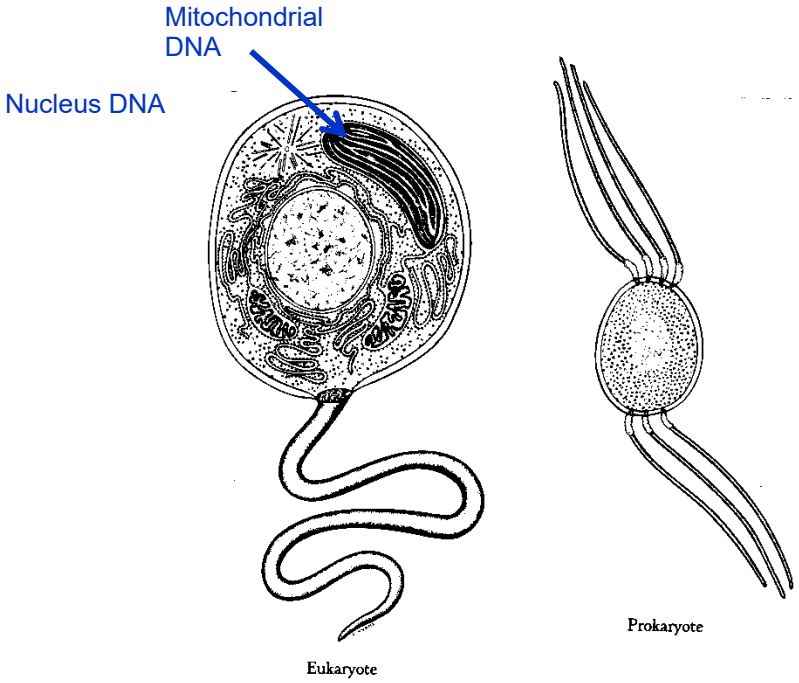
Eve – The Mother of Us All

"And Adam called his wife's name Eve; because she was the mother of all living."
Genesis 3:20

"DNA" is our shorthand for the complex set of inherited instructions used by every living organism on earth. No living cell is without its own unique DNA. For each one of us, our mother and father both contribute DNA that provides instructions for the color of your eyes and hair, how tall or short you are, how athletic your body build is, and of greatest importance – the basic wiring for our exceedingly complex brains. This inherited DNA resides in the cell "nucleus" and nearly all multi-cell organisms such as ourselves and apple trees have a nucleus with DNA. For each man, woman and child, these instructions are carried on 3 billion DNA base pairs. Cells with DNA in a nucleus are called "Eukaryotes." Simple single cell organisms such as bacteria have DNA but do not have a nucleus and are called "Prokaryotes."

Every living cell in our body is hungry for power. Throughout each cell, multiple "organelles" called "mitochondria" provide the chemical power that keeps us alive. The DNA carried by human mitochondria is much, much simpler than the instructions in the nucleus having a mere 16,569 DNA base pairs. These mitochondria also are inherited nearly exclusively from our mothers. Through mistakes, about once in 10,000 births (Tobias, 1999) mitochondrial DNA can come from both the mother and the father (McWilliams, 2019).



In a 1987 *Nature* article, Rebecca Cann and her co-workers, Mark Stoneking and the late Allan Wilson, painstakingly analyzed mitochondrial DNA from women throughout the world of many different ancestral origins. (Cann, 1987) By

comparing the mitochondrial DNA variants to each other, the authors produced a family tree that showed how human mitochondria are all related to each other. What this means is that all of us are descended from a single mother. Today this ground-breaking work is now the accepted consensus in the science community, although they are quick to add the caveat, that strictly this is just proven for women. Constructing the "tree" connections is far from straightforward (see illustration end of article).

The report left a wake, still rippling today, as the female ancestor was quickly dubbed "Mitochondrial Eve." Indeed, the cover of Newsweek one year later depicted an Eden, replete with apple tree and serpent, but with the iconic blonde couple of Dürer now supplanted by an Adam and Eve of African descent. (Gitschier, 2010)

Other human-like -- but *not* human species such as Neanderthals -- have left sufficient DNA to have their mitochondrial DNA analyzed. They do not share our common mother Eve. "The mtDNA [Mitochondrial DNA] of Neanderthals has been shown *not to be present* among contemporary humans." (Hofreiter, 2001)

When did Mitochondrial "Eve" live?

Cann treated two controversial questions. When did Mitochondrial "Eve" live? And Where? A workable, but flawed answer came from the "molecular clock hypothesis."

What is this?

"The molecular clock hypothesis asserts that the rate of amino acid or nucleotide substitution is approximately constant per year over evolutionary time and among different species." (Huang, 2009) This hypothesis builds on some pioneering work looking at a common protein used by every living cell that has mitochondria. (Margoliash, 1963)

Admitting, that much work still needed to be done, the team (Cann, 1987) set forth dates. By looking at the diversity of human populations that had migrated to Australia, New Guinea and the Americas as models, and then using the *accepted dates* in the archeological community of 40,000; 30,000 and 12,000 years ago for these populations to become isolated, they postulated that Mitochondrial Eve lived between 140,000 and 290,000 years ago (while recognizing the data also supported 62,000 years ago).

To set forth a date, based on an assumption for estimating that date predetermines an answer. Logically this is called a tautology. In theory the science community knowingly tries to avoid tautology -- would that other communities took such care. None of the dates Cann was using would be close to the Biblical account dating *by at least a factor of ten or more*. But to the human evolution community the dates Cann set forward were exceedingly recent. She received considerable criticism and soon focused on the older dates. (Cann, 1988) Dr. Allen Wilson, the professor at Berkeley under whom Cann worked promised to keep looking into this timing question so

that Cann's results could align better with the prevailing views in the human evolution, as one of his colleagues reported well after Wilson's death in 1991. (Tobias, 1995)

Science on the Attack -- Science to the Rescue?

Given a challenge, the scientific community was spurred to further research. The results were more disturbing to the human evolution community. Things did not get better. Within a decade, mainline scientific journals were reporting: "Mitochondrial DNA appears to mutate much faster than expected, prompting new DNA forensics procedures and raising troubling questions about the dating of events…mtDNA [mitochondrial DNA] mutates much more often than previously *estimated--as much as 20-fold faster*, according to *two studies* that are causing a stir. Other studies have not found such rapid mutation rates …Regardless of the cause, evolutionists are most concerned about the effect of a faster mutation rate. For example, researchers have calculated that "mitochondrial Eve"—the woman whose mtDNA was ancestral to that in all living people—lived 10,000 to 200,000 years ago in Africa. *Using the new clock, she would be a mere 6,000 years old*" (Gibbons, 1998).

Nor did it help that a separate line of investigators looking at population dynamics led by Douglas Rhode of MIT, with co-investigators from Yale concluded that the "Most recent common ancestor [lived] *only a few thousand years back.*" (Rhode, 2004) By "few' they meant 5,000 years.

Huang starts his critique of the molecular clock hypothesis with this salvo: "Data inconsistent with the molecular clock hypothesis have steadily accumulated in recent years that show no correlation between genetic distance and time of divergence. It has therefore become a challenge to find a testable idea that can reconcile the seemingly conflicting data sets… Although there clearly exists a correlation between genetic distance and time of divergence, such correlation is not universal and is often violated as more data became known in recent years. Numerous studies based on extant organisms have questioned the constancy of mutation rate." (Huang, 2009)

Despite these critiques, portions of the science community move forward on "Eve" and her mate "Y-gene Adam" as though there were no problem, holding to the distant and even more distant dates. (Callaway, 2013). Within the science community, an increasingly insistent chorus of critics opposing Mitochondrial DNA dating are at times philosophical: "So why do researchers persist in trying to solve a…problem that may well be at the limits of, or even beyond, the analytical capabilities of the data and the available methods? The reason is that our own ancestry matters to us." (Wood, 2011)

Indeed, we all may concur – our own ancestry matters to us.

Richard D. Doctor, February 20, 2020

REFERENCES

Callaway, Ewan (2013 August 6) *Genetic Adam and Eve did not live too far apart in time — Studies re-date 'Y-chromosome Adam' and 'mitochondrial Eve'*, Nature 500.

Cann, Rebecca L., Mark Stoneking and Allan C. Wilson (1987 January 1), *Mitochondrial DNA and human evolution*, Nature, 325:31–36. https://doi.org/10.1038/329111c0 "One way of estimating this rate is to consider the extent of differentiation within clusters specific to New Guinea, Australia, and the New World. People colonised these regions relatively recently: a minimum of 30,000 years ago for New Guinea, 40,000 years ago for Australia, and 12,000 years ago for the New World. These times enable us to calculate that the mean rate of mtDNA divergence within humans."

Cann, Rebecca L. (1988), *DNA and Human Origins*, Annual Review of Anthropology 17: 127-43. Accessed February 20, 2020. www.jstor.org/stable/2155908.

Gibbons, Ann (1998 January 2), *Research News — Calibrating the Mitochondrial Clock*, Science, 279:28-29.

Gitschier, Jane (Published online 2010 May 27) *All About Mitochondrial Eve: An Interview with Rebecca Cann*, PLoS Genet. 2010 May; 6(5): e1000959. doi: 10.1371/journal.pgen.1000959

Hofreiter, Michael; David Serre, Hendrik N. Poinar, Melanie Kuch & Svante Pääbo (2001 May 1) *Ancient DNA*, Nature Reviews Genetics, volume 2, pages 353–359

Huang, Shi (2009 January 13), *Inverse relationship between genetic diversity and epigenetic complexity*, Nature Precedings : doi:10.1038/npre.2009.1751.2

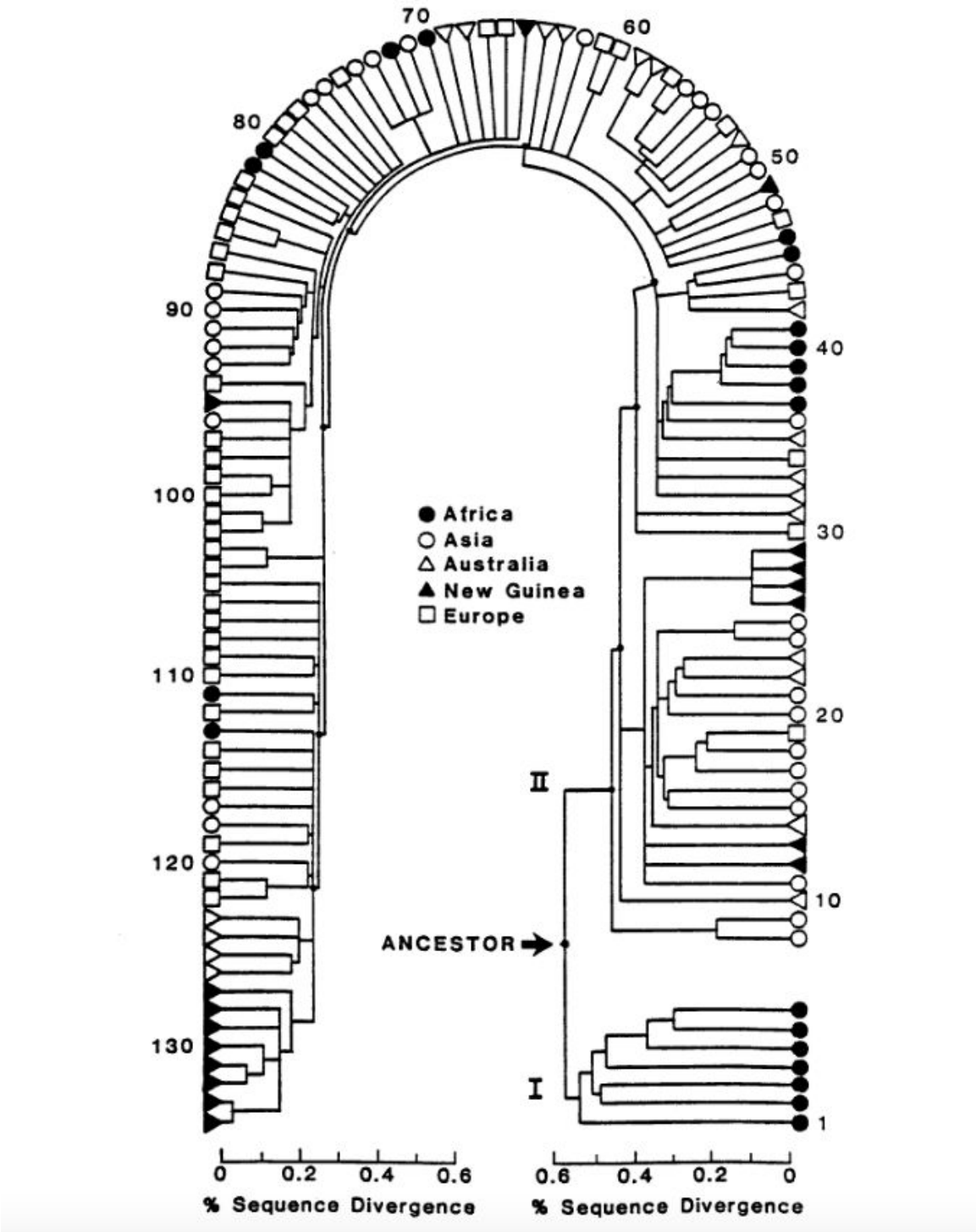
Margoliash, E., *Primary structure and evolution of cytochrome c.* (1963), Proc. National Academy of Science, 50:672-679.

McWilliams, Thomas and Suomalainen, Anu (2019 January 17), *Fate of a father's mitochondria*, Nature, 565:296-297.

Rohde, D.L.; Olson, S.; Chang, J.T. (2004 September 30), *Modelling the recent common ancestry of all living humans,* Nature, 431: 562–566.

Tobias, Phillip V. (1995), *The Bearing of Fossils and Mitochondrial DNA on the Evolution of Modern Humans, with a Critique of the 'Mitochondrial Eve' Hypothesis.* The South African Archaeological Bulletin 50, no. 162:155-67. doi:10.2307/3889064

Wood, Bernard, and Harrison, T. (2011 February 17) *The evolutionary context of the first hominins*, Nature, 470: 347–352.



Mitochondrial Eve from Cann et al. 1987