

# MITOCHONDRIAL EVE

49

made possible because mitochondria replicate asexually. Unlike genomic DNA which is recombined in every generation through sexual reproduction (i.e. every offspring is genetically different from their parents), mtDNA is merely cloned when new mitochondria is made. Thus everyone in your family has different genomic DNA, but you, all of your siblings and your mother will share the same exact mtDNA (though your father's mtDNA is not represented in his offspring).

(6) Mitochondrial DNA only changes if a genetic mutation occurs in the mtDNA of the egg cells resulting in offspring. Thus mutations are rare and only show up once in every 1000 generations. Hence, you most likely have the same mtDNA as your mother's mother 1000 generations back. However, when mutations

do occur, the result is that every generation going forward will contain mitochondria with changed mtDNA. These changes give clues to how different human populations have evolved over time. If population A and population B have similar mtDNA, this means that few mutations have occurred between them and that not long ago, the two separate populations were most likely one population. However, if population A and population B have many more mutations between their mtDNA, this indicates they diverged from one another further in the past. Comparing differences in the mtDNA of populations allows researchers to trace backwards to the origins of the first humans. Not surprisingly, within themselves, African populations have the greatest differences in their mtDNA because they have the oldest genetic lineage.

## Article Questions

- 1) What two factors make it unlikely that paternal mitochondrial DNA will be found in the zygote?
  - 1) There is so much more maternal mtDNA in an egg (10 000 000 copies) versus in a sperm cell (100 copies). (2)
  - 2) Enzymes in the egg destroy the mitochondria found in the sperm when the sperm enters the egg. (2)
- 2) In the diagram in paragraph 4, why is each human generation represented only by female symbols and not by both female and male symbols?
 

This diagram represents the connection of several human generations based on their mtDNA relationships. Since mtDNA is only passed through the maternal line, only females are used to represent the human generations. (4)
- 3) Who was Mitochondrial Eve?
 

She is the most recent common female ancestor of modern day humans as determined by research into mtDNA. (4)
- 4) What is the Out of Africa Theory?
 

This theory proposes that all humans originated in Africa after which they migrated to different areas of the Earth. (4)
- 5) How did studying the mtDNA of various races help trace them all back to Mitochondrial Eve?
 

Since mtDNA changes very little over many generations, comparing the small changes in mtDNA in various races helped form a picture of how races related to one another genetically which has ultimately led to the conclusion that they all came from a common ancestor. (5)
- 6) Though there are differences in mtDNA amongst modern humans, modern chimpanzees show much more diversity (many more differences) in their mtDNA. What does this suggest about chimpanzee evolution?
 

This suggests that, unlike humans, chimpanzees did not experience a genetic bottleneck as recently (if at all) as humans did during their evolution. (4)