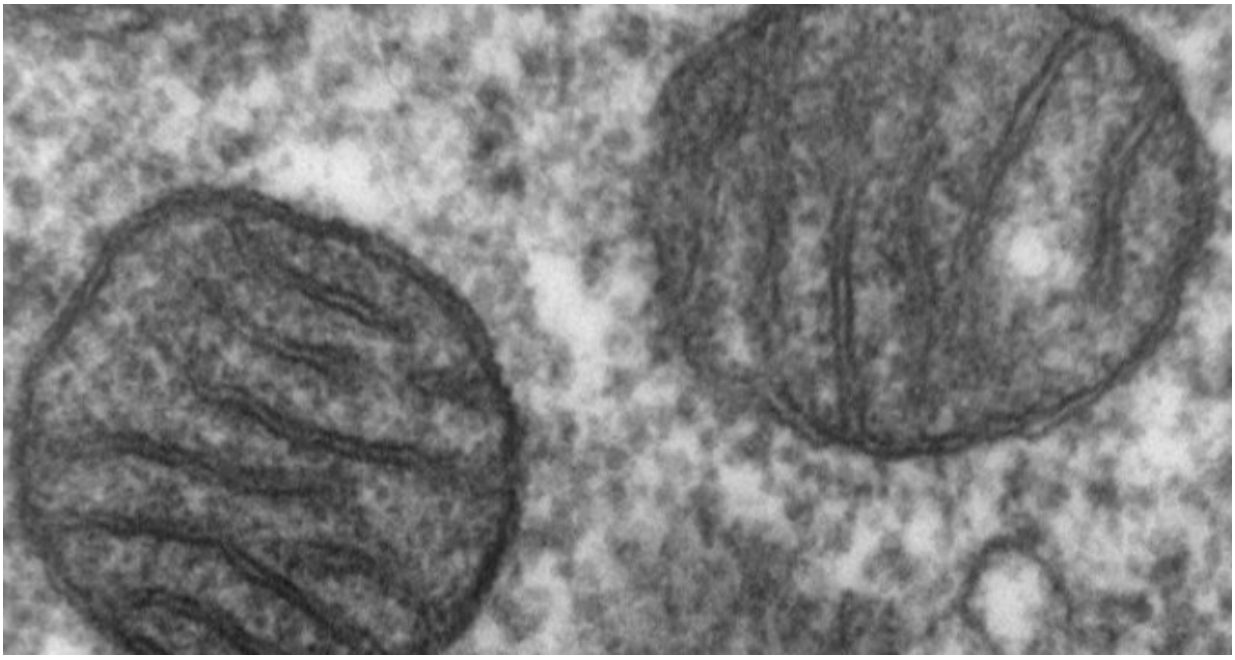
Male mitochondrial DNA found to self-destruct after arrival in embryo

June 24 2016, by Bob Yirka



Credit: University of Colorado at Boulder

A team of researchers with members from Taiwan, the U.S., China and Japan has found that mitochondrial DNA from sperm that makes its way into an embryo begins to self-destruct before autophagosomes in the cytoplasm can reach it. In their paper published in the journal *Science*, the researchers describe their study involving the close monitoring of male mitochondrial DNA activity immediately after an embryo has been

fertilized and as it is subsequently destroyed—they also offer some theories regarding why this occurs.

Over the past half-century, scientists have learned that some amount of DNA exists outside of the cell nucleus and inside mitochondria. They have also found that only the mitochondrial DNA from the mother is passed on to the child during reproduction—the mitochondrial DNA from the father is destroyed before it can have an impact. These discoveries have led to other studies looking to better understand why this occurs.

In this new effort, the researchers used electron microscopy to watch the process in a type of roundworm. In so doing, they discovered that the male mitochondria in sperm actually began to break down before being cut up by autophagosomes in the cytoplasm—an extra guarantee, it seemed, to ensure that the male DNA would not be allowed to become part of the embryo's DNA. Looking more closely, the researchers found that the existence of the cps-6 gene caused expression of an enzyme that initiated the self-destruction process—they also found that the enzyme was able to both break down the membrane protecting the DNA and then to cause the DNA itself to break down.

As part of their experiments, the team altered some of the roundworm genome to prevent it from producing the cps-6 enzyme and found that doing so caused the male DNA to last longer in the embryo development process, which then led to the embryo dying.

It is still not clear exactly why preventing male mitochondrial DNA from making its way into the embryonic genome is so important—the researchers suggest it might be because male DNA has been through so much on its journey to the egg that it has degraded and thus, if it were included, it would lead to birth defects.

More information: "Mitochondrial endonuclease G mediates breakdown of paternal mitochondria upon fertilization," *Science* 23 Jun 2016: DOI: 10.1126/science.aaf4777

Press release