Mitochondria are a major executor in nuclear apoptosis of *Tetrahymena thermophila*

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SUMMARY

The ciliated protozoan *Tetrahymena thermophila* undergoes a unique apoptosis-like nuclear event during conjugation, which is called programmed nuclear death (PND) or nuclear apoptosis. The degrading macronucleus is engulfed by a large autophagosome in which many mitochondria are incorporated. These mitochondria have lost their membrane potential, which is a hallmark of apoptosis in multicellular organisms. This implies that mitochondrial apoptosis molecules, such as apoptosis-inducing factor (AIF) and endonuclease G, play a crucial role in PND. Here we show *Tetrahymena* AIF homolog (TtAIF) is usually localized in mitochondria. Gene disruption of TtAIF by homologous recombination resulted in delay of nuclear condensation of parental macronucleus and kb sized DNA fragmentation. Furthermore, TtAIF-deficient mitochondria showed weak DNase activity, while normal mitochondria retained DNase activity similar to that of mammalian endonuclease G. Indirect immnunofluorescence showed that TtAIF was released from mitochondria into the macronucleus before nuclear condensation. These results suggest that TtAIF promotes the first step of PND, and interacts with mitochondrial DNase to cause DNA fragmentation. Thus, a ciliate ancestor may have diverted the mitochondrial apoptosis pathway to PND.