New insight into "apoptosis" from the perspective of programmed nuclear death in *Tetrahymena thermophila*

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SUMMARY

Cell death regulated by the suicide program is generally designated as apoptosis. It is known to play a crucial role in development, stress response, and elimination of deficient mutant individuals from the community in both multicellular and unicellular organisms. However, the narrow sense of the definition of apoptosis used in studies of animals has confused many researchers because the respective means of cell death differ greatly from one death type to another. We reconsider apoptosis because eukaryotic apoptosis would have evolved in the era of ancestral protists when endosymbiotic alliance with mitochondria was formed. The subsequent development of apoptosis from a primitive mechanism would have occurred in highly diversified and specialized ways among different phyla in the course of eukaryotic evolution. Mitochondria play a key role in almost all eukaryotic apoptosis because degradation of genomic DNA begins following the release of mitochondrial apoptotic molecules such as cytochrome C, AIF, and endonuclease. In *Tetrahymena*, AIF-mediated DNA degradation is involved in the macronuclear degradation during conjugation, to ensure the exclusion of the parental genomic information from progeny. Considering the discussion presented above, we assume for this discussion that degradation of a predator's genomic DNA (nucleus) by the prey (mitochondria) is an essential quality of apoptosis, leading to the death of the predator and escape from it.