Abstract:

Programmed cell death (PCD) applies to cell death that is part of the normal life of multicellular organisms. PCD is found throughout the animal and plant kingdoms; it is an active process in which a cell suicide pathway is activated resulting in controlled disassembly of the cell. Most cases of PCD described in animal systems take the form of apoptosis, a cell death process characterised by specific features such as cell shrinkage, blebbing of the plasma membrane, condensation and fragmentation of the nucleus and internucleosomal cleavage of DNA. The final stage of apoptosis is the fragmentation of the cell into cellular debris-containing vesicles called "apoptotic bodies" that are being phagocytosed by other cells. A specific class of cell death-associated cystein proteases (caspases) has been identified. Generally, apoptotic cell death involves a sequence of caspase activation events in which initiator caspases activate down-stream executioner caspases that process a variety of target proteins eventually leading to the apoptotic phenotype.

The occurrence of hallmarks of animal apoptosis was studied in tomato cells treated with the anticancer drug and inducer of apoptosis, camptothecin (cpt). It was shown that cpt-induced cell death is accompanied by nuclear condensation, the appearance of TUNEL-positive nuclei, DNA laddering and formation of DNA-containing (apoptotic) bodies and was greatly inhibited by inhibitors of animal caspases. Together the results indicate that cpt induced a cell death pathway with similarities to caspase-mediated (apoptotic) cell death in animal systems. We used cpt-treated cells to study the possible involvement of ethylene in cell death. Treatment of the cells with relatively high concentrations of ethylene did not have any effect on viability of the cells. However, when ethylene was applied in combination with cpt, a significant increase in cell death was observed as compared to cpt treatment alone. Experiments with inhibitors of ethylene production or ethylene action showed that ethylene is an essential factor mediating cpt-induced cell death.

Flower senescence is accompanied by rapid death of large numbers of cells. In situ DNA degradation was studied in gypsophila petals using TUNEL. We showed that TUNEL positive nuclei appear well before the onset of the increase in ethylene production and visible signs of senescence. The role of PCD in flower senescence is discussed.