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THE FINE STRUCTURE OF SENESCENCE IN THE REGRESSION-REPLACEMENT CYCLE OF Campanularia flexuosa

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Electron microscopic examination was made of the senescence events in the regression-replacement cycle of the colonial hydroid Campanularia flexuosa. The relationship between acid phosphatase activity and the aging cycle was specifically investigated. Individuals of different ages ranging from bud to complete hydranths 1,2,3,4 and senile were fixed with glutaraldehyde or with Karnovsky's fixative and post fixed in 1% osmic acid. The osmotic pressure of the fixative was adjusted for seawater by the addition of sucrose. Prior to post fixation half of the organisms were incubated in a modified Gomori medium for the purpose of localizing acid phosphatase activity. Osmotic conditions were varied with sucrose and sodium chloride both during and prior to incubation.

In the youngest stage (bud) there is very little acid phosphatase. There are a few small acid phosphatase-positive granules around the nuclear membrane. The cells are small, the cytoplasm dense, the nuclear membrane distinct and the cytomembranes prominent. The mitochondria and the Golgi apparatus are small and well structured, the mitochondria having distinct cristae. The endoplasmic reticulum appears to have a normal morphology.

As the individuals age, progressing through the various stages of mature complete hydranths to senile individuals, a rather dramatic series of changes occurs. Prior to the onset of senility mitochondria seem to become larger with distinct cristae. The endoplasmic reticulum becomes vacuolated and the Golgi apparatus increases in number per cell. The acid phosphatase-positive granules increase over the nucleus and the inner surface of the cell membrane. Although some of the acid phosphatase-positive structures remind one of lysosomes, the vast majority of acid phosphatase-positive structures appear as black granules quite unlike lysosomes. The senile hydranths show a marked necrosis. The cytoplasm is highly vacuolated. The organelles and cytomembranes are totally disrupted and the mitochondria have no organized cristae. Secretory and storage vacuoles are gone and there is total cytoplasmic chaos. The acid phosphatase-positive granules are heavily concentrated along the nuclear membrane and the inner surface of the cell membrane. The cytoplasm is relatively free of these granules. The results suggest that immediately before the onset of climactic senescence there is a sudden increase in acid phosphatase-positive granules associated with the nuclear membrane. The possibility that this implies a time dependent informational translation from the nucleus is now being investigated utilizing actinomycin D.

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