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Cell Death and Neuronal Replacement during Formation of the Avian Ciliary Ganglion

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Abstract

Programmed cell death is a prominent feature of embryonic development and is essential in matching the number of neurons to the target tissues that are innervated. Although a decrease in neuronal number which coincides with peripheral synaptogenesis has been well documented in the avian ciliary ganglion, it has not been clear whether cell death also occurs earlier. We observed TUNEL-positive neurons as early as stage 24, with a large peak at stage 29. This cell death at stage 29 was followed by a statistically significant ($P < 0.0001$) decrease in total neuron number at stage 31. The total number of neurons was recovered by stage 33/34. This suggested that dying neurons were replaced by new neurons. This replacement process did not involve proliferation because bromodeoxyuridine applied at stages 29 and 31 was unable to label neurons harvested at stage 33/34. The peak of cell death at stage 29 was increased 2.3-fold by removal of the optic vesicle and was reduced by 50% when chCNTF was overexpressed. Taken together, these results suggest that the regulation of neuron number in the ciliary ganglion is a dynamic process involving both cell death and neural replacement from postmitotic precursors prior to differentiation and innervation of target tissues.

Keywords






parasympathetic; apoptosis; Hu; TUNEL; cranial neural crest; peripheral nervous system; ciliary neurotrophic factor

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