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Morphology and cytoskeletal elements of reticulospinal neurons of lampreys in cell culture

Severe spinal cord injury (SCI) disrupts descending axons from reticulospinal (RS) neurons that project to the spinal cord. In most “higher” vertebrates, including humans, recovery is very minimal due to limited regeneration in the central nervous system, and paralysis is usually permanent below the injury site. In several lower vertebrates, including the lamprey, behavioral recovery is almost complete following SCI due to robust axonal regeneration. To study the cellular and molecular mechanisms that regulate axonal regeneration, neurons are often isolated in cell culture so that the factors that influence neurite outgrowth can be studied under controlled conditions. The focus of this project was to determine the morphology and cytoskeletal elements of growth cones of lamprey RS neurons in cell culture. Our research thus far has been focused on determining the molecular and cellular mechanism in which the lamprey uses for neurite regeneration. This research will give more insight into the structural mechanism used during regeneration. It will give some clues as to what structures are useful for the lamprey during the regeneration time by comparing the morphology and cytoskeletal elements of growing neurons versus non-growing neurons. Data was collected for 24 different RS neuron processes and an image analysis program was used to determine the length of the process, the average growth/retraction rate, the soma diameter, the number of filopodia, the number of days in culture, and the number of processes. From our results, we have found that the average growth/retraction rates of RS neurons of lampreys in cell culture are not correlated with the number of filopodia, the number of processes, the length of the processes, the soma diameter, or the age of the neuron. Future studies will be done with a larger number of growth cones of lamprey RS neurons to further confirm our conclusions. Experiments labeling actin, microtubules, and neurofilaments will allow us to determine the effects of intracellular morphology on growth rate.

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