Investigating Differences in Regeneration Across Species of Planarian Flatworms

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The remarkable ability of planarian flatworms to heal severe wounds, replenish missing tissue, and recreate missing organs has long captivated biologists, but across the hundreds of planarian species, there is a variety of regenerative capacity. In this study, my goal was to identify potential differences in repatterning between two planarian species whose regenerative abilities vary significantly, but not divergently. Specifically, I compared the planarian species Schmidtea mediterranea and the newly isolated Girardia guanajuatiensis. These animals have very similar overall regenerative success when amputated transversely into head and tail fragments. However, there is more variability in the speed and success of regeneration in the Girardia species (Duncan et al., 2020). To reveal the specific traits underlying differences in Girardia guanajuatiensis regeneration competence, I tested their regenerative abilities in a more challenging context. Specifically, I extracted 1.2-millimeter diameter circles of tissue from the anterior, middle, and posterior edges of the worms, deliberately avoiding significant intersection with the midline. As these fragments regenerate, they must therefore establish (or reorient) a new midline and, subsequently, A-P orientation. I found that in Girardia guanajuatiensis, a significant number of these tissue circles regenerated with poor bilateral symmetry and limited locomotive abilities. Moreover, this effect was stronger in circles extracted from the more posterior positions. My results suggest that Schmidtea mediterranea and Girardia guanajuatiensis have differences in their ability to reestablish geometric landmarks after amputation. For the future, I want to understand the cellular and molecular mechanisms underlying these differences.