

# The Long-Term Effects on the Retina Damaged by Optic Nerve Axotomy

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Retinal ganglion cell (RGC) death is the penultimate consequence of optic neuropathies such as glaucoma. Over the last two decades, the molecular pathology associated with this process has been intensively studied, and much of this work has relied on acute models of optic nerve damage in rodents, such as axotomy or controlled optic nerve crush. This research has yielded numerous important findings that have helped piece together what happens in damaged and dying RGCs. The majority of this work, however, has been limited to evaluating early retinal effects over the course of 2 to 4 weeks.

In this report, Nadal-Nicolás and colleagues<sup>1</sup> provide one of the first comprehensive studies of the long-term retinal effects of axotomy, extending a detailed morphometric study out to 15 months. Their findings now provide a greater level of granularity to the characterization of the degenerative process in this model. The authors confirm a long-suspected consequence of optic nerve damage: that only the RGC population is affected by cell loss. Cell death is exponential over the first few weeks after injury, and indiscriminate from RGCs located in the ganglion cell layer or displaced in the inner nuclear layer. Retinal ganglion cells expressing melanopsin (m<sup>+</sup>RGCs) exhibit a different pattern of change after optic nerve damage. Initially, the loss of these cells appears to be equal to or greater than that of other RGCs, but by 1 month, there is an apparent revival of approximately a third of the population of these cells. The authors speculate that not only are these cells probably more resistant to optic nerve damage, but that they also appear to exhibit a recovery of lost melanopsin expression, a phenomenon not observed for gene expression patterns in other RGC classes. This raises the possibility that if m<sup>+</sup>RGCs can recover, perhaps similar molecular pathways, and recoveries, can be activated in other RGC classes.

## Reference

1. Nadal-Nicolás FM, Sobrado-Calvo P, Jiménez-López M, Vidal-Sanz M, Agudo-Barriuso M. Long-term effect of optic nerve axotomy on the retinal ganglion cell layer. *Invest Ophthalmol Vis Sci.* 2015;56:6095–6112.