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daf-2 modulates regeneration of mechanosensory neurons II

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Description:

The *daf-2* gene encodes an insulin-like growth factor/IGF-1 receptor that regulates *C. elegans* embryonic and larval development. It has previously been shown that DAF-2 inhibits neurite regeneration of the GABAergic motor neurons and PVD sensory neurons in an age-dependent fashion (Bryne et al., 2014; Kravtsov et al., 2017). Following injury, the posterior lateral microtubule (PLM) neurons are capable of regenerating through axonal fusion, a highly efficient regrowth mechanism in which separated fragments fuse back together (Ghosh-Roy et al., 2010; Neumann et al., 2011; Neumann et al. 2015; Abay et al., 2017). We previously established that a critical event for axonal fusion to occur is the exposure of injury-induced phosphatidylserine (PS) 'save-me' signals (Neumann et al., 2015). The level of PS exposed increases with advancing age (Abay et al., 2017). To determine if *daf-2* is involved in this age-dependent modulation of PS exposure, we visualised and quantified the level of PS exposed after PLM axotomy using a secreted, tagged version of Annexin V (Neumann et al., 2011; Mapes et al., 2012; Neumann et al. 2015). Mutation of *daf-2* had no effect on PS exposure 1 h post-axotomy, with no significant differences observed on either the distal or proximal axon segments (Table 1).

Table 1. Quantification of the relative level of PS exposed 1 h post-axotomy.

Genotype	PS exposed on distal axon (relative to pre-axotomy)	*n*	PS exposed on proximal axon (relative to pre-axotomy)	*n*
wild-type	1.53 ± 0.105	28	1.44 ± 0.0855	28
daf-2(e1370)	1.51 ± 0.167	26	1.57 ± 0.166	26

Reagents

One-day-old adult hermaphrodites were used for all experiments, and were grown under standard conditions at 20°C. The BXN301 [*daf-2(e1370); smIs95(Phsp-16.2::sAnxV::mRFP); zdIs5(Pmec-4::GFP)*] strain was used along with the CU4204 [*smIs95(Phsp-16.2::sAnxV::mRFP); zdIs5(Pmec-4::GFP)*] control strain. The *daf-2(e1370)* allele has been considered temperature sensitive for the dauer phenotype, but not for the long-lived phenotype. At 20°C, *daf-2(e1370)* animals display a greater than 2-fold increase in lifespan compared to the wild-type (Kenyon et al., 1993). Laser axotomy, microscopy and quantification of data was performed as previously described (Abay et al 2017).

References

Abay, Z.C., M.Y. Wong, J.S. Teoh, T. Vijayaraghavan, M.A. Hilliard, and B. Neumann, *Phosphatidylserine save-me signals drive functional recovery of severed axons in Caenorhabditis elegans.* Proc Natl Acad Sci U S A, 2017. **114**(47): p. E10196-E10205.

Byrne, A.B., T. Walradt, K.E. Gardner, A. Hubbert, V. Reinke, and M. Hammarlund, *Insulin/IGF1 signaling inhibits age-dependent axon regeneration.* Neuron, 2014. **81**(3): p. 561-73.

Ghosh-Roy, A., Z. Wu, A. Goncharov, Y. Jin, and A.D. Chisholm, *Calcium and cyclic AMP promote axonal regeneration in Caenorhabditis elegans and require DLK-1 kinase.* J Neurosci, 2010. **30**(9): p. 3175-83.

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Kenyon, C., J. Chang, E. Gensch, A. Rudner, and R. Tabtiang, *A C. elegans mutant that lives twice as long as wild type.* Nature, 1993. **366**(6454): p. 461-4.

Kravtsov, V., M. Oren-Suissa, and B. Podbilewicz, *The fusogen AFF-1 can rejuvenate the regenerative potential of adult dendritic trees by self-fusion.* Development, 2017. **144**(13): p. 2364-2374.

Mapes, J., Y.Z. Chen, A. Kim, S. Mitani, B.H. Kang, and D. Xue, *CED-1, CED-7, and TTR-52 regulate surface phosphatidylserine expression on apoptotic and phagocytic cells.* Curr Biol, 2012. **22**(14): p. 1267-75.

Neumann, B., K.C. Nguyen, D.H. Hall, A. Ben-Yakar, and M.A. Hilliard, *Axonal regeneration proceeds through specific axonal fusion in transected C. elegans neurons.* Dev Dyn, 2011. **240**(6): p. 1365-72.

Neumann, B., S. Coakley, R. Giordano-Santini, C. Linton, E.S. Lee, A. Nakagawa, D. Xue, and M.A. Hilliard, *EFF-1-mediated regenerative axonal fusion requires components of the apoptotic pathway.* Nature, 2015. **517**(7533): p. 219-22.

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