Neuropeptide regulation of a sleep-like state

Choi, Chatzigeorgiou, Martin, Schafer, and Kaplan (2013), *Neuron*, in press.

Animals undergo periods of behavioral quiescence and arousal in response to environmental, circadian, or developmental cues. During larval molts, *C. elegans* undergoes a period of profound behavioral quiescence termed lethargus. In a collaboration with Bill Schafer's lab (MRC-LMB, Cambridge, UK), we identified neuropeptides that induce quiescence and arousal during the molting cycle. Locomotion quiescence during lethargus is abolished in mutants lacking a neuropeptide receptor (NPR-1), and is reduced in mutants lacking NPR-1 ligands (FLP-18 and -21). Locomotion quiescence and arousal were mediated by decreased and increased secretion of an arousal neuropeptide (PDF-1) from central neurons. PDF receptors (PDFR-1) expressed in peripheral mechanosensory neurons enhanced touch-evoked calcium transients. Thus, a central circuit stimulates arousal from lethargus by enhancing the sensitivity of peripheral mechanosensory neurons in the body. These results define a circuit mechanism controlling a developmentally programmed form of quiescence.

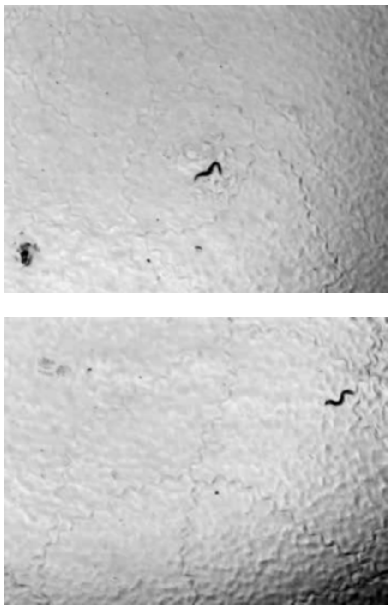

Fig. 1. Mutants lacking NPR-1 are deficient for locomotion quiescence during lethargus. Movies illustrating locomotion behavior during the L4-to-adult molt for wild type (above) and *npr-1* mutants (below).

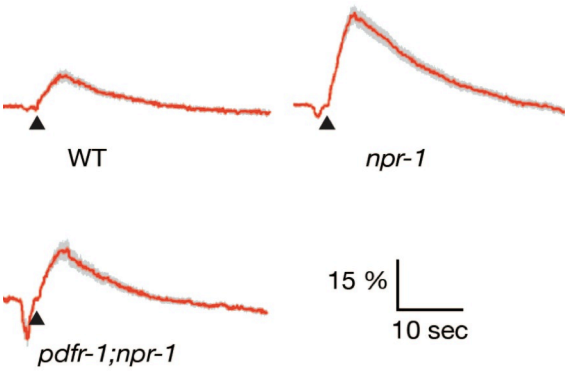

Fig. 2. Locomotion arousal is mediated by increased touch sensitivity. Touch evoked calcium transients in ALM neurons during lethargus are enhanced in *npr-1* mutants and this effect is suppressed in *pdfr-1; npr-1* double mutants.