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Neuromechanics of crawling in *D. melanogaster* larvae CENGIZ PEHLEVAN, HHMI Janelia Research Campus, PAOLO PAOLETTI, University of Liverpool, L. MAHADEVAN, Harvard University — Nervous system, body and environment interact in non-trivial ways to generate locomotion and thence behavior in an organism. Here we present a minimal integrative mathematical model to describe the simple behavior of forward crawling in *Drosophila* larvae. Our model couples the excitation-inhibition circuits in the nervous system to force production in the muscles and body movement in a frictional environment, which in turn leads to a proprioceptive signal that feeds back to the nervous system. Our results explain the basic observed phenomenology of crawling with or without proprioception, and elucidate the stabilizing role of proprioception in crawling with respect to external and internal perturbations. Our integrated approach allows us to make testable predictions on the effect of changing body-environment interactions on crawling, and serves as a substrate for the development of hierarchical models linking cellular processes to behavior.

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