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Manipulating morphogenesis with light using photoactivatable Rac1[1] MONICA LACY, SHANE HUTSON, Vanderbilt Institute for Integrative Biosystem Research & Education, Vanderbilt University, Nashville, TN 37235, USA, ANDREA PAGE-MCCAW, KIMBERLY LAFEVER, Department of Cell and Developmental Biology and Program in Developmental Biology, Vanderbilt University Medical Center, Nashville, TN 37232-8240, USA — One of the major focuses in current Drosophila studies is the morphogenetic process of germ band retraction, which involves two embryonic tissues–the germ band and the amnioserosa–moving in tandem. A challenge of particular interest for biophysicists is defining the specific roles of the proteins that regulate cell motility in these tissues, as well as quantifying the forces exerted as a result of their activity. Among the proteins active in the embryo is the Rho GTPase Rac1, which regulates the formation of lamellipodia at cell edges. My research uses new tools to investigate the role of Rac1 in GBR, with the eventual goal of quantifying the forces involved. Existing work suggests that the crawling of the amnioserosa over the caudal end of the germ band, aided by lamellipodia, is instrumental in the onset of GBR. Using photoactivatable forms of Rac1 incorporated into fly stocks and targeted laser illumination, I will directly control spatial and temporal patterns of Rac1 activation in the amnioserosa to test the hypothesis that increasing and decreasing Rac1 activity in the amnioserosa will affect its crawling over the germ band, and subsequently the process of GBR. This work will explore the possibilities of photoactivatable proteins in biophysical research and add to the body of knowledge on the motions and forces involved in Drosophila morphogenesis.

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