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Dissecting cellular biomechanics with a laser[1]

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The biological tissues of a developing organism are built and reshaped by the mechanical behavior of individual cells. We probe the relevant cellular mechanics *in vivo* using laser-microsurgery – both qualitatively, to assess whether removal of specific cells alters the dynamics of tissue reshaping, and quantitatively, to measure sub-cellular mechanical properties and stresses. I will detail two quantitative microsurgical measurements. The first uses a laser to drill a sub-cellular hole in a sheet of cells. The subsequent retraction of surrounding cells allows one to infer the local mechanical stress. The second uses a laser to isolate a single cell from the rest of a cell sheet. Isolation is accomplished on a microsecond time scale by holographically shaping a single laser pulse. The subsequent retraction (or expansion) of the isolated cell allows one to separate and quantify the effects of internal and external stresses in the determination of cell shape. I will discuss application of these techniques to the time-dependent biomechanics of epithelial tissues during early fruit fly embryogenesis – specifically during the processes of germband retraction and dorsal closure.

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