Electrochemical Nanowires For Characterizing the Cellular Force of Leukocytes, Cancer Cells, et al

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Technology description

Pseudopods are temporary, exploratory appendages that certain cells, like leukocytes, certain kinds of cancer cells, and more extend to probe the surrounding substrate surface or other cells. A cell both senses the environment and establishes the new adhesive contacts to the substrate at the tips of these structures, influencing whether the cell continues migrating in the same direction, halts migration entirely, or moves on. Despite the importance of such adhesive sites, there has been little characterization of adhesion at the single adhesive contact level.

Current methodologies include the deformable substrate method where cell-induced wrinkling or marker-displacement of the elastic substrate is observed. This substrate displacement method allows for direct visualization, but no direct measurement of the forces, thereby requiring a nontrivial modeling effort to correlate displacement with inferred force at discrete sites. Alternatively, an atomic force microscope can measure force with exquisite precision, but does not allow for the simultaneous visualization of the cell-probe contact.

Researchers at Kansas State University have developed a sensor to directly visualize and measure the force that a cell exerts. Specifically, K-State has fabricated cellular force sensors from cantilever polymer (PEDOT) filaments that visibly deflect under forces exerted at individual pseudopod-filament adhesive contacts. The shape of the deflected filaments provides information on the force exerted by the cell or applied by the user at the contact site.

Application area

On-chip and off-chip sensors are both described

Useful in researching fundamental cell behavior and in developing new therapeutics

Advantages

Simultaneous visualization and measurement of the forces at a single pseudopod-filament adhesive contact

Production of biocompatible filaments, utilizing a simple polymerization technique

Filaments are flexible enough to deflect visibly upon contact by a foraging cell, yet stiff enough to resist visible thermal motion

Institution

Kansas State University

Inventors

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