Probing Sensory Nerve Mechanotransduction via Localized Elastomeric Matrix Perturbation

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Although neural cells respond to chemical and electrical stimulations, the effects of mechanics on neural cells are still not understood. I will talk about the method that we have developed, which can be used to understand stretch-activated mechanotransduction on nerve terminals of sensory neurons through a biocompatible elastomeric interface. To apply a mechanical force on a single neurite, we first cultured dorsal root ganglion neurons on an elastic substrate, polydimethylsiloxane, coated with extracellular matrix (ECM). We then implemented a controlled indentation scheme using a glass pipette to mechanically stretch an individual neurite that was adjacent to the pipette. We used whole-cell patch clamping to record the stretch-activated action potential on the soma of the single neurite to determine mechanotransduction-based responses. When we imposed a mechanical force via ECM, we noted a significant neuronal action potential response. Furthermore, because the mechanotransduction cascade is known to be directly affected by the cytoskeleton, we probed the cell structure and its effects as well. When we disrupted microtubules and actin filaments with nocodozale and cytochalasin-D, respectively, the mechanically induced action potential was abrogated. These results could be important in a wide range of fields such as cellular biomechanics, biomaterials, as well as neuroscience.