Society of Engineering Science 51st Annual Technical Meeting

1–3 October 2014

Purdue University, West Lafayette, Indiana, USA

3D traction forces of Schwann cells on compliant substrates

Bar-Kochba, Eyal, eyal_bar-kochba@brown.edu, Brown University

ABSTRACT

Schwann cells (SCs) are specialized glial cells that are critical for the development, regeneration, and maintenance of nerves in the peripheral nervous system. Recent studies have shown that the mechanical properties of the extracellular matrix can significantly affect cell structure and function. Studying the mechanical interactions between SCs and their microenvironment can aid in understanding their physical and morphological changes as well as their native function. Using a recently developed 3D large deformation traction force microscopy technique, we investigate the mechanosensitivity of SCs across a physiologically relevant substrate stiffness range (0.24–4.80 kPa) in vivo. As oppose to other cell types, we find that the SC spreading area and prominent stress fiber formation was relatively insensitive to substrate stiffness. Consistent with these structural findings, the SCs generated large surface tractions on stiff substrates and large material deformations on soft substrates. Across all moduli, we observed a significant contribution from the out-of-plane traction component, locally giving rise to rotational moments similar to those reported for mesenchymal embryonic fibroblasts. These quantitative biophysical measurements are the first to pave the way in understanding how SCs physically interact with their microenvironment. They are anticipated to assist in the development of tissue engineering scaffolds designed to promote functional integration of SCs into postinjury in vivo environments.