Neurons and astrocytes feel the force: from neuromechanics to inflammation

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SÃ©minaire de Sylvain Gabriele (Interfaces and Complex Fluids Laboratory, UniversitÃ© de Mons, Belgique)

Although pathological changes in axonal morphology have emerged as important features of traumatic brain injury (TBI), the mechanical vulnerability of the axonal microcompartment relative to the cell body is not well understood. In order to answer this question, we combined protein micropatterns with magnetic tweezer rheology to probe the viscoelastic properties of neuronal microcompartments. Creep experiments revealed two opposite rheological behaviors within cortical neurons: the cell body was soft and characterized by a solid-like response, whereas the neurite compartment was stiffer and viscous-like. Despite the interest of understanding the mechanical properties of single cortical neurons, one must consider a network of interconnected neurons for studying TBI mechanisms. Indeed, the complex architecture of the brain is an important limitation for understanding its functioning and the development of brain diseases. To address this challenge, we propose an original approach that combines soft polyacrylamide hydrogels, protein micropatterning and neuronal cell culture to form in vitro well-organized neuronal networks. This platform will serve first to investigate the role of the matrix rigidity on the growth and electrophysiological response of cortical neuronal networks. Interestingly, the neuroinflammatory response following traumatic brain injury (TBI) is known to be a key secondary injury factor that can drive ongoing neuronal injury. In the last part of this seminar, we will show that neuronal networks of controlled architectures can be used for studying the influence of mechanically injured astrocytes on the behavior of neuronal networks.

Sylvain Gabriele est invité par Annie Andrieux.

Infos pratiques

Lieu

Amphi Kampf

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