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A biomechanical device for human sensorimotor function

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The muscle spindle and its associated sensory neurons form the afferent sensorimotor circuit of motor function. In order to better understand the physiology of this circuit so as to use it to address its relevant diseases; this study aims to establish an *in vitro* model of this spindle-sensory unit by integrating the cells comprising this system with microelectromechanical (MEMS) technology. A defined cell culture system has been developed to support the *in vitro* differentiation of human intrafusal muscle fibers (muscle fibers inside the muscle spindle) and human proprioceptive sensory neurons as well as their connections. A BioMEMS chip has been designed and fabricated to allow for the integration and functional analysis of this biological system. Intrafusal muscle fibers have been grown and activated by controlled stretching of the cantilever sensor. This non-invasive test bed will allow for controlled and long-term monitoring, interrogation and high control analysis of the sensorimotor unit of the human neuromuscular reflex arc. It could have use for applications not only for emulation of human health and disease, but also for the construction of relevant robotic systems.

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