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POSTER PRESENTATION

B524 A hybrid bio-organic interface for neuronal photoactivation

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Interfacing artificial functional materials and living neuronal tissues is at the forefront of bio-nanotechnology. Attempts so far have been based on micro-scale processing of metals, inor-ganic semiconductors as electrodes or photoactive layers in biased devices, and more recently, nano-materials have been investi-gated. However, in spite of extensive research, the communication between biological tissues and artificial sensors is still a challenge. Constraints exist in the complexity of the fabrication processes (that is, metal and semiconductor lithography) and the mechanical prop-erties of the implanted sensing/recording elements (poor flexibility and biocompatibility) that could elicit deleterious tissue reactions such as inflammation and gliosis. In addition, electrodes have fixed geometries that limit the location in space of the stimulus, and elec-trical currents are often detrimental to the overall system.
In this respect, organic soft matter has potential in terms of flex-ibility, favorable mechanical properties and biological affinity. The use of semiconducting polymers has been reported in mechanical actuators for precise delivery of neurotransmitters, and in biosen-sors, such as pH and glucose sensors, in which their ability to support mixed ionic/electronic charge transport was fully exploited. Conversely, organic polymers have been tested as coatings of con-ventional electrodes in direct neuronal interfaces for recording and stimulating neuronal activity, whereas the exploitation of their appealing optoelectronic features has never been considered for neuronal communication and photo manipulation devices.
Here, we report the functional interfacing of an organic semicon-ductor with a network of cultured primary neurons and successfully demonstrate the physiological stimulation of neuronal cells in a network by shaping visible light pulses at the polymer/electrolyte interface. This new approach to the optical stimulation of neurons may stimulate further work towards the development of an artificial retina based on organic materials.

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