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TOPIC:

Sensing electrical activity of live neuronal networks in a dish- engineering and neurobiological applications

ABSTRACT:

A neuroelectronic hybrid system developed jointly with an interdisciplinary faculty will be described wherein live neuronal networks cultured on a multielectrode array (MEA) obtained by dissociating neurons from the rat brain was used to control an obstacle avoiding robot. Real time signal processing was done by a DSP connected to the MEA. The input from the sensors in the robot was communicated to the neuronal network through Wi-Fi link which stimulated the neuronal network. The output from the neuronal network was communicated to the robot using Wi-Fi link. This required temporally encoding inputs into stimulus patterns using a small set of electrodes such that the neuronal culture's output could be directly decoded by simple linear discriminants using perceptrons.

A neurobiological application will be discussed where we have attempted to understand changes in the neuronal network activity during epileptic seizures using an in vitro model of epilepsy. Analysis of network connections showed that the 'small-world' network topology is lost in 'epileptic' cultures.

PROFILE:

Sikdar did his B.Sc. in Zoology from Loyola College, Madras; M.Sc. in Physiology from the All India Institute of Medical Sciences, New Delhi and Dr. med.sci. from Kyushu University, Japan. He did his post-doc at the Babraham Institute, Cambridge, UK. He pioneered the electrophysiological studies using the patch clamp technique in the country and his lab has expertise in experimental studies related to the electrical activity of neurons from single ion channel molecule level to live neuronal networks cultured on multielectrode arrays. Jointly with an interdisciplinary faculty, he is currently associated with the Neuroelectronics lab at the Centre for Nanoscience and Engineering, IISc; where the technologies associated with sensing the electrical activity of neurons are being developed. He has been a National Science Talent Search Scholar, Lady Tata Memorial Trust scholar, Mon-busho scholar (Japan), Lalor Foundation Fellow (USA), Member of the Physiological Society, UK; and is a Fellow of the Indian Academy of Sciences.