The Institute of Neural Engineering at Miami presents Dr. Ioan Opris:

Integration of Perception and Action Signals in the Prefrontal Cortical Microcircuits: Relevance for Technology and Therapy

Bio:

Ioan Opris is an Associate Scientist at the University of Miami, Miami Project to Cure Paralysis. He received his PhD degree in Physics/Biophysics from the University of Bucharest in 1995. His doctoral research was performed during Jan 1992-to-Apr 1993, at the Tokyo Institute of Technology in Japan, where he conducted computational modelling of memory retrieval in neural network models, under a predoctoral Mombusho Scholarship, from the Japanese Ministry of Education. Since 1995, Dr. Opris conducted research at Columbia University and Yale University as a postdoctoral research associate in neuroscience, investigating cognitive function with neurophysiological methods. He studied the decision-making mechanism in the prefrontal cortex of nonhuman primates, with results that brought him a McDonnell Pew award in 2000. Then, in 2004, he moved at Wake Forest University School of Medicine in North Carolina, where in collaboration with Ted Berger, Greg Gerhardt, and Sam Deadwyler demonstrated for the first time the facilitation and restoration of cognitive function by a neuroprosthesis that utilizes minicolumnar neural firing in primate prefrontal cortex. This result was featured by NY Times, in September 2012, highlighting the feasibility of memory prosthesis. He is currently working with Professor Brian Noga at the Miami Project to Cure Paralysis on several projects investigating the neural substrates of locomotion and defensive behavior. Dr. Opris is now pioneering, together with Professor Stewart Barnes from the Physics Department, the developing of noninvasive recording and stimulation tools for brain activity, based on Spintronics (Magnetic Nanotechnology). Amongst recent recognitions, Dr. Opris has received the 2014 ARA Excellence Award for Science, from the American Romanian Academy of Arts and Sciences, the 2015 Innovation in Health Award from Integrative Medicine from Romanian National Academy, the 2015 Innovation in Health Award from Romania. Most recently, he is the recipient of the first Frontiers Spotlight Award 2017, that will organize a prestigious International Conference on Brain Augmentation in September 2018 in Lausanne, Switzerland.

Abstract:

This talk deals with the functional aspects of columnar inter-laminar cortical integration during the executive control of behavior together with their relevance for neural technology and therapy. The integration hypothesis posits that perceptual and behavioral signals are integrated within the prefrontal cortical inter-laminar microcircuits. Inter-laminar minicolumnar activity previously recorded from the dorsolateral prefrontal cortex (dPFC) of nonhuman primates, trained in a visual delay match-to-sample (DMS) task, was re-assessed from an integrative perspective. Biomorphic multielectrode arrays (MEAs) played a unique role in the in vivo recording of columnar cell firing in the dPFC layers 2/3 and 5. Several integrative aspects stem from these experiments: 1. Functional integration of perceptual and behavioral signals across cortical layers during executive control. 2. Causal relations to integration of cognitive signals by the minicolumnar turbo-engines. The inter-laminar integration between the perceptual and executive circuits was facilitated by stimulating the infra-granular layers with firing patterns obtained from supra-granular layers that enhanced spatial preference of percent correct performance on spatial trials. 3. Integration across hierarchical levels of the brain. The integration of intention signals (visuals spatial, direction) with movement preparation (timing, velocity) in striatum and with the motor command and posture in midbrain is also discussed. These findings have profound relevance for the transformative role of prefrontal microcircuits in neural technology and brain disorders therapies.

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