Wallace H. Coulter Foundation Lecture Series

Probing and Understanding the Dynamics of the Epileptic Brain

Leonidas Iasemidis

Professor and the Rhodes Eminent Scholar Chair of Biomedical Engineering and the Director of the Multidisciplinary Center for Biomedical Engineering and Rehabilitation Science

Lecture: Friday, April 13, 2018
9:00AM-10:00AM
Room EC 2300
10555 West Flagler Street
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Biography

Leon D. Iasemidis received M.S. degrees in Biomedical Engineering and Physics, and the Ph.D. in Biomedical Engineering from the University of Michigan, Ann Arbor. He is currently a Professor and the Rhodes Eminent Scholar Chair of Biomedical Engineering and the Director of the multidisciplinary Center for Biomedical Engineering and Rehabilitation Science at Louisiana Tech University, holds adjunct professorships in Neurology (2013) at the Louisiana State University Health Sciences Center, Shreveport, LA, and Neurosurgery (2015) at the University of Arkansas for Medical Sciences, and is a Professor Emeritus of the Arizona State University. Prof. Iasemidis is a Fellow of AIMBE, the National Academy of Inventors (NAI), and the IEEE. His research interests are in the areas of biomedical signal processing, complex systems theory and neural engineering. He is internationally recognized as an expert in nonlinear dynamics, the detection, prediction and control of crises in complex coupled systems, and is one of the founders of the field of epileptic seizure prediction and control. He has more than 100 peer-reviewed publications, is a reviewer for the National Institutes of Health, the National Science Foundation, and several other national and international funding agencies and foundations. Dr. Iasemidis' research is currently funded by a $6M NSF grant entitled "Probing and Understanding the Brain: Micro and Macro Dynamics of Seizure and Memory Networks".

Abstract

Epileptic seizures are the hallmark of epilepsy. Of the world's 60 million people with epilepsy, fully 1/3 have uncontrollable seizures by current anti-epileptic medication. To capture the essential features underlying the transition of the epileptic brain to seizures, engineering technologies are used to monitor and analyze electromagnetic recordings from the brain, search for precursors of impending epileptic seizures, and intervene in time to avert seizure occurrences. This scheme holds great promise to elucidate the dynamical mechanisms underlying this brain disorder, as well as to improve the effectiveness of new treatments for epilepsy, like neuromodulation of brain networks via intelligent stimulators. Examples of seizure prediction and brain resetting in humans, and closed-loop seizure control via electrical simulation in animal models of epilepsy, will be presented. Preliminary results will also be presented on the investigation of the dynamics of ictogenesis at the molecular and cellular level via long-term in vivo optical cellular imaging and electrochemical probes, identification of the epilepsy and memory networks via multichannel spatiotemporal EEG and MEG analysis, and prediction of memory impairment prior to surgical intervention. The above are specific aims of our ongoing NSF grant on "Probing and Understanding the Brain: Micro and Macro Dynamics of Seizure and Memory Networks". Broader application of these developments to complex systems requiring monitoring, forecasting and control is a natural outgrowth of this field.

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