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Preventing neuronal network disruption following brain injuries

Brain injury as a consequence of status epilepticus, trauma, brain tumors or stroke has a high incidence of epilepsy. As of today, there are no effective therapies to prevent epilepsy. One of the reasons is that it is not clear how the fundamental neurobiological mechanisms explain development of epilepsy or epileptogenesis. Also there is not a reliable biomarker to predict patients at risk of epilepsy. These two main factors limit the development of prophylactic therapies in epilepsy. Epileptogenesis is a progressive neural network disorder as a result of a complex biological mechanism that leads to epilepsy, which is a neurological disease characterized by recurrent state of seizure. Neural network dysfunction in epileptogenesis is reflected by high frequency oscillations and microepileptiform activities in a group of neurons, including a neuronal hyperexcitability which facilitates the propagation thorough neuronal circuitry. Dysfunction of specific hubs within a neuronal network are associated with dynamic remodeling of synaptic terminals and formation of aberrant dendritic spines. Therefore, an early detection and analysis of neuronal dysfunction can predict an epileptogenic state. In addition an attenuation of microepileptiform activity using a pharmacological approach after a brain injury can predict a physiological stabilization of the neuronal network. Since the molecular key process that mediates epileptogenesis is characterized by an unregulated and sustained neuroinflammatory state, limiting neuroinflammation after a brain injury could attenuate epileptogenesis and/or disease-modifying effects. The challenge in epilepsy research is to prevent its development. Since there are multiple combinatory factors that contribute to epileptogenesis there is not “a magic bullet” to abort epileptogenesis. Scientific evidence shows that a potential combination of neuro-targets of novel therapies could prevent epilepsy especially after brain injuries. Therefore the current directions in our research laboratory are: a) exploring dysfunctional neuronal network for modeling and automatic detection for in-situ therapeutic interventions; b) activating of endogenous neuroprogenitor cells to repair interneurons; c) identifying regulatory mechanism of cytokine and chemokines in neuronal connectivity, and d) studying neurotoxicity mediated radiation that could contribute to understanding a biological principle of secondary epileptogenesis.

Biography

Alberto Musto is an Assistant Professor of Pathology, Anatomy and Neurology. He is one of the Module Directors of the CareForward Curriculum, School of Medicine and Director of the Neuroanatomy, School of Health Professionals at Eastern Virginia Medical School in Norfolk, Virginia. Dr. Musto integrates an interdisciplinary approach in medical education and mentorship activities in neuroscience research in order to enhance research and diversity in the new medical curricula. Dr. Musto's scientific goal is to identify potential biomarkers and preventive therapies for epilepsy. He has been bestowed with a lifetime professional honor in recognition of his accomplishments and dedication to excellence in epilepsy by the American Epilepsy Society. He has published in major journals in the field of neuroscience and epilepsy and he has been a member of NIH grant review study sections. Prior to joining EVMS, Dr. Musto was at the School of Medicine of Louisiana State University Health Science Center, New Orleans, where he completed his postdoctoral fellowship in neuroprotection and worked as an Assistant Professor of research in Neuroscience and Neurosurgery. Prior to that, Dr. Musto started his career in Buenos Aires, Argentina where he received board certifications in both neurology and radiology, completed postgraduate studies in medical education, management in health systems and a doctoral thesis in neurobiology. Dr. Musto has been involved in academic medicine during his entire career and is a regular speaker at national and international conferences.

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