The NO-Age and NO-AD Seminar Series 007

'The Impact of Intermittent Bioenergetic Challenges on Brain and Body Health'

by

Prof. Mark P. Mattson

The Johns Hopkins University, Baltimore, USA

at

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Zoom Meeting

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Organizers:

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Speaker: Prof. Mark P. Mattson

Title: The Impact of Intermittent Bioenergetic Challenges on Brain and Body Health

Abstract:
Evolutionary considerations suggest that the brain should function well/optimally during periods of food deprivation/fasting and physical exertion. Brain-intrinsic pathways and peripheral signals by which fasting and exercise promote synaptic plasticity, neurogenesis and resilience under stressful conditions are being elucidated. Our findings suggest that running and fasting can stimulate mitochondrial biogenesis in neurons by mechanisms involving BDNF signaling and PGC-1a, a pathway critical for the formation and maintenance of synapses. The mitochondrial protein deacetylase SIRT3 mediates adaptive responses (stress resistance and modulation of neuronal network activity) of neurons to exercise and fasting. By mechanisms involving deacetylating SOD2 and cyclophilin D, SIRT3 protects neurons in animal models of acute brain injury and neurodegenerative disorders. Interestingly, behavioral adaptations to intermittent fasting (reduced anxiety and preservation of cognitive performance) involve SIRT3-dependent enhancement of GABAergic tone in the hippocampus, which may also protect against excitotoxicity. Regarding peripheral signals generated in response to fasting and vigorous exercise, we found that the ketone b-hydroxybutyrate, which is produced from fatty acids during fasting and vigorous exercise, can stimulate BDNF production, which may mediate beneficial effects of these bioenergetic challenges on neuronal plasticity and stress resistance. Additional data suggest that combining energy restriction with exercise can elicit additive or synergistic beneficial effects on neuroplasticity and performance. Collectively, the emerging picture of bioenergetics and brain health reveals that intermittent energy restriction and exercise promote neuroplasticity and resistance to injury and disease, whereas a ‘couch potato’ lifestyle fosters suboptimal brain function and poor resilience

Biography:
Mark Mattson is the former Chief of the Laboratory of Neurosciences at the National Institute on Aging, and is now a Professor of Neuroscience at Johns Hopkins University School of Medicine. His research has elucidated how the brain responds adaptively to challenges such as fasting and exercise, and he has used that information to develop novel interventions to promote optimal brain function throughout life. Dr. Mattson is among the most highly cited neuroscientists in the world with over 950 published research articles and more than 160,000 citations. He was elected a Fellow of the American Association for the Advancement of Science, and he has received many awards including the Metropolitan Life Foundation Medical Research Award and the Alzheimer’s Association Zenith Award.