

Neurobiology of Exercise: What Neuroimaging tells us about the underlying Molecular Mechanisms

Wednesday, Jun 20: 2:45 PM - 4:00 PM

3400

Symposium

Wednesday - Symposia PM

This symposium brings together internationally renowned experts in the field of exercise science and neuroimaging. The symposium targets on molecular mechanisms promoted by exercise. A deeper understanding of the underlying molecular mechanisms of exercise in humans, that promote structural and functional plasticity in mesial temporal lobe structures (and beyond) is an important prerequisite for tailored interventions with either preventative or disease-modifying intentions, for example in the setting of neurodegenerative disease conditions. Equally, advancing the understanding exercise-induced neurotransmitter effects will be important for future preventative and disease modifying interventions, for example in affective disorders, Parkinson's disease, and chronic pain states.

Objective

The first part of the symposium will highlight current MRI exercise research on hippocampal plasticity (with presentations by Michelle Voss and Emrah Duzel), the second part will highlight current PET imaging exercise research on neurotransmission (with presentations by Carl-Johan Boraxbekk and Henning Boecker).

The learning objectives are to foster the

- understanding of the multifaceted molecular mechanisms by which physical exercise impacts on the brain
- understanding of neurotrophic factor effects on structural and functional neuroplasticity induced by exercise
- understanding of dopaminergic and opioidergic neurotransmitter effects in the context of exercise

Target Audience

The symposium will be of interest to researchers working in the various fields subsumed by structural and functional plasticity, but also to a wider audience interested in gaining a deeper understanding on how physical exercise changes the human brain.

Co Organizer

Emrah Duzel, Prof., Institute of Cognitive Neurology and Dementia Research, Otto-von-Guericke University, Organizer

Henning Boecker, Prof., University Hospital Bonn

Presentations

Neurotrophic Factors and Structural and Functional Neuroplasticity in Exercise Science ([index.cfm?do=ev.viewEv&ev=1705](#))

This talk will review what we know from MRI methods about the effects of exercise on structural and functional plasticity of the hippocampus and hippocampal-cortical systems. I will describe whether and how results from human MR imaging correspond to exercise-induced neuroplasticity in animal models, and review the extent to which exercise-induced changes in brain structure and function predict changes in human cognition and performance.

Presenter

Michelle Voss, PhD, Health, Brain, and Cognition Laboratory, Department of Psychological and Brain Sciences

Vascular Neuroplasticity induced by Exercise Interventions ([index.cfm?do=ev.viewEv&ev=1706](#))

Animal studies indicate that the plasticity-related effects of physical exercise also enhance hippocampal perfusion by inducing angiogenesis. This talk will show how physical exercise interventions lasting 3-4 months impact on hippocampal perfusion in humans. Complementary data from gadolinium perfusion, arterial spin labeling, time-of-flight angiography and venous oxygen saturation are presented. The findings are compatible with the possibility that exercise interventions in humans induce vascular plasticity in the hippocampus.

Presenter

Emrah Duzel, Prof., Institute of Cognitive Neurology and Dementia Research, Otto-von-Guericke University,

The Dopaminergic System and Exercise ([index.cfm?do=ev.viewEv&ev=1707](#))

It has been suggested that there is a negative association of increasing age, the neurotransmitter dopamine, and cognitive performance. Studies from patients, animals and healthy humans are suggesting that staying physically active may reduce negative effects of age or disease on dopamine receptor levels. I will in this presentation discuss the possible link between exercise and brain functions via the dopaminergic system.

Presenter

Carl-Johan Boraxbekk, Prof., Danish Research Center for Magnetic Research (DRCMR)

The Opioidergic System and Exercise ([index.cfm?do=ev.viewEv&ev=1708](#))

Acute effects of exercise on mood and pain tolerance have been linked to central opioidergic mechanisms. With the introduction of unspecific (e.g. 18F-Diprenorphine) and μ -opioid subtype-specific (e.g. 11C-Carfentanil) opioidergic PET tracers to human exercise research, it has become possible to study opioidergic release in the context of physical exercise challenges in vivo. This talk will review existing data from human ligand activation studies and associated fMRI work and discuss these findings in relation to preclinical data.

Presenter

Henning Boecker, DZNE Bonn
