

Institute of Aerospace Medicine

Institute Seminar, March 7, 2017, *Abstract*

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Functional MRI of autonomic nuclei in the brainstem and hypothalamus

The brainstem and hypothalamus are the most important brain regions for autonomic regulation of bodily homeostasis. Most of our knowledge on the exact function of these nuclei, however, is based on animal studies and has never been confirmed in humans. Functional magnetic resonance imaging (fMRI) is a non-invasive technique with the potential to change this. fMRI can be used to measure brain activity and connectivity in vivo and has revolutionized human neuroscience since its invention in the early 1990s. However, fMRI studies of the brainstem and hypothalamus are scarce since both regions place high demands on data acquisition, preprocessing and statistical analysis. Despite these significant problems, the past few years have seen a number of important advances that bring us closer to routine application of brainstem and hypothalamic fMRI. In this talk I will discuss some of these new methods and their approach to solving problems, like the small size of the structures of interest, physiological noise, lack of contrast, and geometric distortions. I will show that an optimized set of parameters and methods allows to reliably measure the activity and connectivity of brainstem and hypothalamic nuclei in general and autonomic nuclei in particular.