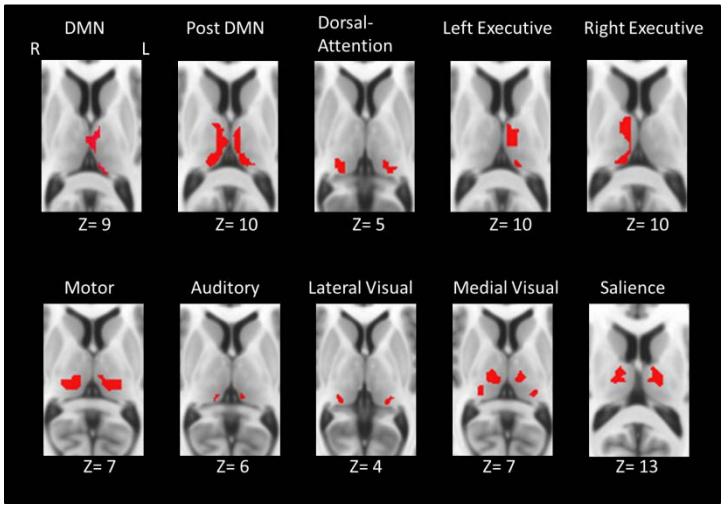
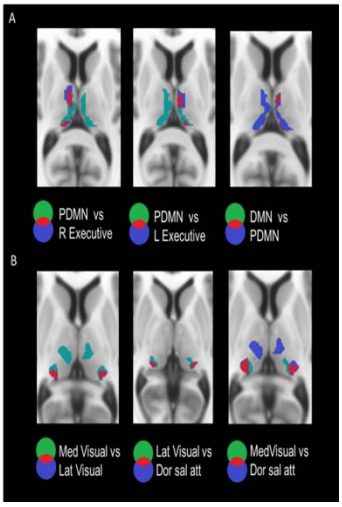
Functional topography of the human thalamocortical system

R.Yuan[1], X. Di[1], P. Taylor[2,3], S. Gohel[1], Y.H. Tsai[1], Bharat B. Biswal[1,]
[1] New Jersey Institute of Technology, Newark, USA, [2] University of Cape Town, South Africa, [3] African Institute for Mathematical Sciences, Muizenberg, Western Cape, South Africa

Background: An increasing number of studies have indicated that the thalamus is involved in controlling corticocortical information and cortical communication with various regions of the brain. More than simply relaying information to cortex [1,2], this thalamocortical system might be much more complex than it has been thought. It is highly possible that the high-order thalamic nuclei might connect to multiple networks. In the current study, we used resting-state fMRI to investigate the human thalamocortical system with respect to brain networks.

Methods: Resting state fMRI datasets with 198 subjects were downloaded from 1000 Functional Connectomes Project [3]. Seed-based analysis was used to map thalamocortical functional connectivity between each voxel of the thalamus and the whole brain. Independent component analysis (ICA), a data driven multivariate technique was then used to determine distinct connectivity maps between the thalamus and functionally independent brain networks. Using these group-level brain network maps in a spatial regression model against each voxel's correlation map, we estimated the subject-specific thalamic maps for every functional network. These maps were then used to statistically model the thalamic subdivisions with regarding the set of brain networks.





Results: We identified sub-regions of the thalamus with each corresponding brain networks as well as functional overlaps between certain networks. The functional overlaps were examined within the context of cortical network relations.
Conclusions: This result indicated that the single thalamic nuclei might connect to multiple brain networks and should no longer been neglected in functional network studies.
References: 1,Behrens, Nature neuroscience 6, no. 7: 750-757, 2003. 2. Zhang, Journal of neurophysiology, no. 4 (2008): 1740. 3,Biswal BB, PNAS 107(10):4734-9, 2010.