Anxiety and depression severity in neuropsychiatric SLE are associated with perfusion and functional connectivity changes of the frontolimbic neural circuit: A resting-state f(unctional) MRI study

Despina Antypa1, PhD, Nicholas J Simos2,3, Eleftherios Kavroulakis4, PhD, George Bertsias5,6, MD, PhD, Antonis Fanouriakis5,7, MD, PhD, Prodromos Sidiropoulos5, MD, PhD, Dimitrios T Boumpas5,7,8,9, MD, PhD, Efrosini Papadaki3,4, MD, PhD

1Department of Psychiatry, School of Medicine, University of Crete, University Hospital of Heraklion, Crete, Greece
2Technical University of Crete, Department of Electrical and Computer Engineering, Chania, Crete, Greece
3Computational Bio-Medicine Laboratory, Institute of Computer Science, Foundation for Research and Technology – Hellas, Heraklion, Crete, Greece
4Department of Radiology, School of Medicine, University of Crete, University Hospital of Heraklion, Crete, Greece
5Department of Rheumatology, Clinical Immunology and Allergy, School of Medicine, University of Crete, University Hospital of Heraklion, Crete, Greece
6Institute of Molecular Biology and Biotechnology, Foundation of Research and Technology-Hellas, Heraklion, Crete, Greece
74th Department of Internal Medicine, Attikon University Hospital, Medical School, National and Kapodestrian University of Athens, Athens, Greece
8Laboratory of Autoimmunity and Inflammation, Biomedical Research Foundation of the Academy of Athens, Athens, Greece
9Joint Academic Rheumatology Program, and 4th Department of Medicine, Medical School, National and Kapodestrian University of Athens, Athens, Greece

Corresponding author: Efrosini Papadaki, Department of Radiology, School of Medicine, University of Crete, Heraklion, Crete, Greece, 71003, Tel: 0030-2810392076, Fax: 0030-2810542095, e-mail: fpapada@otenet.gr
**SUPPLEMENTARY MATERIAL**

**Materials and Methods**

**Voxel-wise functional connectivity using ICC**

ICC is based on the graph-theoretical measure of degree. Degree signifies the number of other nodes connected to each node, while the calculation of ICC on a weighted graph, takes into account the connectivity strengths of all connections present for each node. Specifically, a voxel’s ICC value is computed as the mean of that voxel’s time series correlation values with all other voxels’ time series, squared. The explicit calculation of full voxel-to-voxel functional connectivity matrices in fMRI datasets such as the present is computationally prohibitive, mostly due to software RAM usage limitations. MATLAB code for the calculation of ICC maps using Singular Value Decomposition, similar to the implementation found in CONN[1], and is freely available online[2]. ICC maps for all subjects were obtained for all voxels comprised with all 90 AAL regions using a global mask, and ICC values were square rooted so as to retain the same scale as common functional connectivity values. ROI global connectivity metrics (ROI ICC) were also calculated as the square root of the mean of each ROI’s squared correlation values with all other ROIs.

**References**


S.Fig 1.

Significant associations of self-reported depression symptomatology with hemodynamic lead in the right vmPFC \([R^2 = 0.430; A]\) and relatively lower intrinsic connectivity (ICC) in the same region \([R^2 = 0.348; B]\) among NPSLE patients.