Brain imaging in neuropsychiatric disorders: innovation and translation

fMRI amygdala neurofeedback for Major Depressive Disorder
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Patients with major depressive disorder (MDD) show hypoactive amygdala responses to positive stimuli, including positive autobiographical memories (Young et al., 2016). By providing real-time fMRI neurofeedback regarding amygdala activity, patients with MDD are able to increase their amygdala response during positive memory recall. This results in significant symptom improvement. Furthermore, training in one direction supports adaptive control of amygdala activity that can be altered in both directions, with increased amygdala responses to positive stimuli and decreased responses to negative/stressful stimuli following training. Dr. Young will present the results of several ongoing randomized clinical trials examining this intervention in patients with MDD.

Young, K.D., Siegle, G.J., Bodurka, J., & Drevets, W.C. (2016) Amygdala activity during autobiographical memory recall in depressed and vulnerable individuals: Association with symptom severity and autobiographical overgenerality. Am. J. Psychiatry, 173, 78–89.

Structural and functional imaging biomarkers of Bipolar Disorder and Schizophrenia
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Differential diagnosis between schizophrenia (SCZ) and bipolar disorder (BPD) is often challenging, especially in early phases, namely when BPD patients present psychotic symptoms. I will present the results of a direct comparison of neuroimaging-derived structural and functional discriminative features of SCZ and BPD. We found opposite changes in gyrification and neural responses underlying social cognitive dysfunction in a core social brain hub subserving theory of mind functions. The joint analysis of different morphometric features and functional features provides a promising strategy for differential diagnosis of BPD and SCZ and may also represent an anatomical target for differentiated neural modulation, that can ameliorate impaired social cognition in two archetypal mental disorders.

Madeira, N., Duarte, J.V., Martins, R., Costa, G.N., Macedo, A., & Castelo-Branco, M. (2020) Morphometry and gyrification in bipolar disorder and schizophrenia: A comparative MRI study. NeuroImage Clin., 26.

Neurofind: Using deep learning to identify abnormal brain structural patterns in neuropsychiatric disorders at the individual level
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In the last decade, many machine learning approaches have been put forward to address the growing demand for translational psychiatric research. Deep learning has shown promise across several disciplines, including in neurologic and psychiatric disorders (Vieira et al., 2017). This talk will introduce Neurofind, a tool to detect brain-based disorders at the individual level based on a normative model of brain morphology, developed using a deep learning approach known as auto- encoders and ~20,000 anatomical brain scans of healthy controls.

Vieira, S., Pinaya, W.H., & Mechelli, A. (2017) Using deep learning to investigate the neuroimaging correlates of psychiatric and neurological disorders: Methods and applications. Neurosci. Biobehav. Rev., 74, 58–75.

Automated analysis of free speech as a marker of neuroimaging findings in individuals with Obsessive-Compulsive Disorder
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No diagnostic biomarkers are available for obsessive-compulsive disorder (OCD). We aimed at identifying how automated speech graph analysis could be related to neuroimaging structural and

functional alterations. OCD patients and HC presented significant differences in speech, bot semantically and in terms of the connectedness of speech. While the resting-state networks (RSN presented no between groups significant differences, speech graph attributes and semantic similarit to symptomatic terms found different correlations in various RSN when comparing both groups Speech analysis is a new useful tool for improving OCD comprehension, related to specifi neuroimaging alterations attributed to the disorder, with potential to develop diagnostic biomarker for OCD.