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Brain diseases: a network story?

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Neurological diseases such as neurodegeneration, stroke, and brain tumors are often studied as separate conditions, yet they share common neuroimaging features and biological mechanisms. This talk introduces the human brain connectome as a unifying framework to explain how molecular pathology, focal lesions, and structural damage spread across large-scale brain networks. Alterations in brain connectivity provide a direct link between underlying pathology and clinical symptoms across neurological disorders, including Alzheimer's and Huntington's disease, stroke, and glioblastoma. Evidence shows that network vulnerability, disconnection patterns, and both increased and decreased connectivity represent shared, transdiagnostic features of neurological diseases. These insights support a shift from region-based to network-based models and may inform the development of new tools for patient stratification, prognosis, outcome prediction, and clinical decision-making.

Lorenzo Pini is an Assistant Professor (RTD-A) at the Department of Neuroscience, University of Padova, focusing on clinical and computational neuroscience. His work investigates brain connectivity in neurological disorders using multimodal neuroimaging and non-invasive brain stimulation.
He completed his PhD in Biomedical and Translational Sciences at the University of Brescia (2019) and conducted postdoctoral research on structural and functional connectivity in neurological and neurodegenerative patients. He has collaborated with the Vrije Universiteit Amsterdam, CHUV Lausanne, and maintains partnerships with the University of Verona, University of Brescia, and Karolinska Institutet. Author of 70 peer-reviewed publications, he is also co-inventor of a diffusion-based method for predicting survival in brain tumor patients.

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