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How correlations between neurons influence the encoding and readout of sensory information

<u>Abstract</u>: The collective activity of a population of neurons is critical for many brain functions. A fundamental question is how activity correlations between neurons affect how neural populations process information. We present a theory, built on the analyses of simultaneous recordings of activity of populations on neurons either in sensory or posterior parietal cortical areas, of how such correlations serve multiple functions performed by neural populations, including shaping the encoding of information in population codes, generating codes across multiple timescales, and facilitating information transmission to and readout by downstream brain areas to guide behavior. Here, we review this theory and we further present ideas on how to combine large-scale simultaneous recordings of neural populations, computational models, analyses of behavior, optogenetics, and anatomy to unravel how the structure of correlations might be optimized to serve multiple functions.

<u>Brief Bio</u>: *Stefano Panzeri is a computational neuroscientist, researching at the interface between theory and experiment. His main research interest is understanding the principles of cortical information processing. He pursues this interest by developing new quantitative data analysis techniques based on the principles of Information Theory and by developing computational models of neural network function.*
Stefano received a Laurea in Physics from the University of Torino, and a PhD in Computational Neuroscience from SISSA, Trieste, Italy. He has held personal research awards in both theoretical physics and computational neuroscience, including an INFN junior Fellowship in Theoretical Physics at Turin University, an EU Marie Curie postdoctoral Fellowship at the University of Oxford, and an MRC-funded Junior Group Leader position at the University of Newcastle. He has held tenured Faculty positions as assistant, associate and full professor at the Universities of Manchester and Glasgow. He has been visiting scientist at the Max Planck Institute for Biological Cybernetics and at Harvard Medical School for several years. He served as Coordinator of the Center for Neuroscience and Cognitive Systems of IIT. He also served as Deputy Chair of the UK Medical Research Council Panel for fellowships in Bioinformatics and Neuroinformatics. He currently works as Full Professor and Director of the Department of Excellence for Neural Information Processing at University Medical Center Hamburg-Eppendorf (UKE), Hamburg, Germany.