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Editorial

Introduction to the Special Issue on Connectivity

New methods for noninvasive "connectomic mapping" have begun to transform systems neuroscience. For decades, neuroscientists have recognized that the ways we think, feel, and act emerge from complex long-range interactions between locally specialized information processing modules. But ways to explore the human brain's network architecture remained limited, forcing researchers to retreat toward findings from non-human primate axonal tracer studies to talk about human brain networks at all. Things have changed.

The ongoing explosion in network-based neuroscience can be explained by a swirl of fortuitous co-developments. First, network science is booming throughout the broad reaches of science and technology, with its simple, quantitative methods being leveraged to explain phenomena from the cosmic to microscopic scales. Second, neuroscientists can finally see (or estimate anyway) the brain's hard wiring, thanks to the diffusion imaging methods "arms race" that may (if it continues unbridled) soon provide a means for tracing axonal connections between single small nuclei or even individual neurons. Third came the serendipitous discovery that large-scale blood oxygen level-dependent signal covariance could, if properly harnessed, render arresting images of networks that had for years been only presumed to exist in humans based on primate anatomical work. These complementary tools gained momentum just as the trend toward larger-scale,collaborative and data-driven science was converging with an intense push to improve therapies for majorpublic health problems like Alzheimer's disease, schizophrenia, and autism. Suddenly, neuroscientists find themselves with the right tools at the right time to tackle the prevailing challenges of the era.

This issue is about brain connectivity and the breathtaking new methods and findings that have already begun to reshape how we understand human brain organization. We hope that the articles contributed will serve as something of a report card, helping readers gauge how far the new approaches have come, how to understand the underlying physiology, what important frontiers remain, and what the methods have taught or may teach us about disorders of brain connectivity.

We have learned a great deal in putting this special issue together and hope that you find it as educational and inspiring in the reading as we did in the editing.

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