# Editorial Note on Focus on neuroscience methods

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## Editorial Note

Neuroscience is rapidly changing, as technology and theoretical methods open up previously inaccessible research questions and techniques, from molecular and cellular levels to systems and behavioral levels. Understanding, as well as their weaknesses, the transformative aspects of new methods is essential to the change that these techniques allow A special emphasis topic is presented by Nature Neuroscience that highlights developments in techniques, analyses and procedures across research scales and subfields of neuroscience.

Detailed profiling of cellular heterogeneity in the brain has been allowed by single-cell transcriptomics, but it is equally necessary to arrive at principled methods to organize and interpret these results. Rafael Yuste, Michael Hawrylycz, Hongkui Zeng, Ed Lein and colleagues discuss the systematic transcriptomics-based classification of cortical cell types and the orthogonal modalities of morphology, physiology and connectivity, and they suggest the introduction of a group platform in a structured manner to aggregate and update taxonomies.

The study of cell types represents the complexity of brain organization. The modeling of human brain growth in stable and disease states has been propelled by three-dimensional tissue culture. In the study of brain development and illness, Ilaria Chiaradia and Madeline Lancaster provide a description of brain organoids as a research tool and explore their application. In addition, the authors highlight technological advancements and developments in the protocols used to manufacture organoids for the brain, as well as potential avenues for organoid modeling.

The development of improved models of brain disorders has led to human-derived induced pluripotent stem cells (iPSC), but functionally characterizing genomic loci associated with disease remains a challenge. Kayla Townsley, Laura Huckins and Kristen Brennand address methods for determining the functional effects of candidate risk variants for psychiatric and neurodevelopmental disorders, including how they can be localized to particular types of cells and how they can affect the expression of genes.

Brain function research also calls for ways to in vivo test neuronal activity. The introduction of emerging technology has required the expansion of the measurement scales and types of questions that can be answered in animal behavior. John Rogers and colleagues are examining developments in the recording and processing of neural signals by electrical, optical and microfluidic instruments and sensors. The authors highlight cutting-edge innovation and innovative technologies that can be wirelessly applied in animals that travel freely.

The study of actions is an invaluable window through which to view the brain. The ways in which behavioral measurement can be accomplished have been influenced by recent innovations. An overview of techniques for automated behavior quantification in animals is given by Talmo Pereira, Joshua Shaevitz and Mala Murthy, Methods and methods for extracting and classifying behavioral dynamics include deep-learning-based pose estimation. The authors explore ways to link neural activity recordings to quantitative behavioral analyses, a method that can provide insights into neural coding.

The noninvasive imaging of spontaneous neural activity has provided insights into the organization of functional brain networks. Janine Bijsterbosch, Eugene Duff and colleagues address analytical approaches and, most importantly, analytical methods to represent functional connectivity results, Consider how the understanding of functional brain organization can be influenced by the choice of representation. The authors provide recommendations to improve the area of generalizability and reproducibility.

Acquisition, review and reporting of data may all affect the reproducibility and replicability of science. In their opinion, Cyril Pernet, Aina Puce and their COBIDAS MEEG committee colleagues address issues related to electroencephalography (EEG) and magneto encephalography (MEG) studies and include guidelines for best practice to encourage the interpretability, sharing and reuse of these studies.

To highlight methods and methodological approaches that promote study across different areas of neuroscience, along with suggestions and guidance for best practices, we assembled this special issue. This topic also includes numerous scientific papers detailing new methods and techniques, including genetic instruments for selective cell labeling and cell manipulation, Imaging for reconstruction of the neural circuit and study of electrophysiological recordings and functional connectivity of the network. With this, we intend to signal our continuing involvement in the publication of transformative neuroscience innovations and methods and our dedication to data improvement and empirical reporting and reproducibility. This collection reflects only a small sampling of the vast variety of methods that allow for new neuroscience discoveries. Exciting developments in genetic techniques for cell population targeting, optical methods for capturing and controlling neuronal ensembles in animal behavior, Among the many forms of technologies that we believe will promote new discoveries in the near future are quantitative and theoretical methods for understanding large-scale brain activity. If they continue to drive neuroscience in exciting new ways, we look forward to reading about these and other innovative developments.

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