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Editorial

Spotlight on Neurotechnology:
Building and Mapping Neuronal Networks

*Neuron* has had a long practice of publishing a themed collection of reviews around this time of the year—when neuroscientists usually convene at the Society for Neuroscience’s annual meeting. While public gatherings and in-person discussions of the latest exciting science have been put on hold during the global COVID-19 pandemic, we hope that this special issue series will offer some semblance of normalcy during these challenging times and prove an informative and inspirational read.

This year, we are highlighting neurotechnology in a three-part series of special issues framed around the concept of the nervous system as a network. Part I looks into methods and approaches for building and mapping a network. The next issues will focus on technologies for reading networks (Part II) and on tools for interacting with networks (Part III).

We are conscious that any selection will not do justice to this burgeoning field. Nevertheless, each article in this varied sample aims to provide a comprehensive and critical resource on the potentials and limitations of current technologies, as well as opportunities for further technological developments that are needed to accelerate the pace of neuroscientific discovery.

In this first issue, we start with pieces that help us define and map neuronal networks—whether networks are created in a dish or *in silico*—thereby interweaving developmental biology and computational neuroscience. In their Perspective, Camp and colleagues showcase the opportunities that organoids offer to study human neurodevelopment and retinal disorders in defined culture conditions by leveraging single-cell genomic profiling and targeted genetic manipulations. Complementing the discussion on organoids, Quadrato and colleagues summarize recent advances in protocols, highlighting strategies to improve reproducibility and physiological relevance in organoid models of human development and disease. A complete picture of the brain necessitates knowledge of detailed anatomy, which can be gained using viral vectors that Xu and colleagues comprehensively review, with practical experimental tips for optimal neural circuit tracing and mapping of anterograde and retrograde connectivity. Switching gears from biological networks to *in silico* models, Yang and Wang present a tutorial on artificial neural networks (ANNs) and consider the benefits afforded by ANNs to build models that capture neural activity, connectivity, and complex behaviors.

To complete this special collection, in our next issues, we will have interviews, opinion pieces, and reviews on innovative recording techniques (optical, electrical, and acoustic), modern electronic interfaces, and tools to analyze neural activity and animal behavior, along with discussions for bringing some of these technologies to the clinic.

Five years ago, we published our first special issue on neurotechnology. Since then, we have seen a flourishing of novel materials, methods, and tools to measure and modulate neural circuits, an expanded integration of advanced machine learning approaches to neuroscience problems, and an increase in clinical and commercial adoption of neurotechnological devices. The key to each of these advances has been collaboration across disciplines, from basic neurobiologists to computer scientists, engineers, physicists, physicians, and more. In the spirit of such a cross-pollination from various fields, we present these pieces from trailblazers who embody this spirit of building bridges across fields to address neuroscientific questions and needs.

We are thankful for the efforts of all the authors and the reviewers who provided feedback on the articles and especially grateful to the numerous contributors to the work collated here, including students, postdocs, primary investigators, project and lab managers, technicians, clinician scientists, and all who make neuroscience more vibrant than ever. We hope you find these spotlighted technologies an exciting reference that might inform your next line of study and that you look forward to the equally enlightening second and third special issues focusing on network recordings and modulation.

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