INTRODUCTION

So You Want to Learn How to Network?

EVER SINCE HUMAN BEINGS BEGAN TO SYSTEMATICALLY INVESTIGATE THE NATURAL world, the introduction of new techniques has pushed the boundaries of our knowledge and revolutionized the way in which we see ourselves and our place in the cosmos. Just think of Galileo and the telescope or Golgi and silver staining for nervous tissue.

With the development and introduction of new techniques coming faster than ever, we highlight in this year’s neuroscience special issue some of the recent advances that have shown to be particularly promising. We invited leading neuroscientists, each of whom investigates a different organizational level of the nervous system, to give an overview of the latest methodological developments in their area of interest, to critically analyze the potential and limitations of the available techniques, and to present their vision of what the future might hold in store.

How and why are specific cells within a neural circuit, and not their neighbors, recruited during learning? Silva et al. (p. 391) review new molecular and cellular methods that allow the tagging and direct study of neurons in vivo, as well as techniques for the activation and inactivation of these neurons in behaving animals. These approaches may have the potential to revolutionize studies of the function of brain circuits, including memory allocation. The technique of optogenetics has been around for less than a decade but, as reviewed by Miesenböck (p. 395), promises to be one of the major developments in the field of systems neuroscience. It will undoubtedly provide novel insights into the organization of neural circuits and the regulation of their interactions. Functional neuroimaging is now without doubt the predominant technique for looking at the brain as a whole. Friston (p. 399) reviews its enormous achievements as well, summarizing the ongoing debates in the field. In a related Perspective, Gerstner and Naud (p. 379) look at the latest advances in computational neuroscience and show how improvements in our approaches to neuronal modeling can help us make more accurate and testable predictions about the behavior of neurons.

In a Q&A, News writer Greg Miller talks to physicist Mark Schnitzer about the future of neuroscience microscopy, particularly his pioneering high-throughput efforts. And Miller also explores whether the Alzheimer’s Disease Neuroimaging Initiative has succeeded at developing better ways of tracking the condition and testing drugs for it.

— PETER STERN

Neuroscience Methods

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Editor's Summary

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