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One of the key aims of neuroscience research is to elucidate the neural circuits that underlie the many complex functions of the brain. In recent years, a number of exciting methodological advances have brought this goal within reach. To mark this progress, in this issue of *Nature Reviews Neuroscience* we launch an article series on 'Neural circuits'. This series will explore genetic and molecular approaches for the dissection of structural and functional connectivity of neural circuits and show how these various approaches can complement each other to allow for a fuller understanding of how such circuits operate.

A complete profile of any neural circuit should include information on its structural connectivity; that is, which neurons make up the circuit and how they are connected. Until recently, tracing the sometimes vast numbers of neuronal connections that comprise an individual neural circuit presented an enormous technical challenge, meaning that such information was often limited. New and sophisticated tools for the visualization and analysis of neuronal projections make this process increasingly manageable. Furthermore, advances in transcriptomic and proteomic analyses of individual cells — and even individual synapses — promise to provide a comprehensive picture of the molecular make-up of neural circuit components. Thus, the combination of these approaches could soon provide us with an unprecedented level of detailed information on the structural connectivity of a neural circuit.

As well as understanding structural connectivity, it is essential to determine how the various components of a neural circuit interact functionally. Traditional approaches for the measurement and modification of neural activity are limited by the requirement for invasive recording apparatus and the difficulty of observing functional effects in freely moving animals. To this end, a number of advanced genetic and molecular techniques that allow for the detection and manipulation of neural activity in individual neural circuit components in a less invasive manner have now been developed.

We launch the series with a Review that focuses on one of the most promising of these techniques to emerge in the past decade: optogenetics, which allows for the precise manipulation of neuronal activity through the use of a combination of transgenic and optic technology. In this article, Deisseroth and Tye (page 251) provide an update on recent refinements to the optogenetic 'toolbox' and describe how optogenetic approaches have begun to shed light on the brain circuits that are disrupted in particular neurological and psychiatric disorders, including anxiety, depression, addiction and autism.

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