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Sommario/riassunto

Cerebral cortex is probably the most complex biological network. Here many millions of individual neurons, the functional units of cortex, are interconnected through a massive yet highly organized pattern of axonal and dendritic wiring. This wiring enables both near and distant cells to coordinate their responses and generate a rich variety of cognitions and behaviours. When the wiring is damaged through disease or trauma it may reorganize but this may lead to characteristic pathological behaviours. While there have been significant advances in mapping cortical connectivity, the organizing principles and function of this connectivity are not well understood. On the one hand, there appears to be general design constraints governing cortical wiring, as first recognised by Ramon y Cajal's in his laws of conduction, material, and volume conservation. Yet on the other hand, particular patterns of cortical wiring exist to serve specific functions. There is a wide gap in understanding how the response and connectivity properties of a single neuron contribute to emergent network functions such as in detecting perceptually relevant features. Unravelling this intimate causal relationship represents one of the major challenges in neuroscience. This Research Topic will examine progress in understanding cortical wiring principles. This Research Topic aims to draw together recent advances in methods and understanding as well as recent challenges to existing ideas about how cerebral cortex is wired. This is particularly timely because new automated techniques may soon yield huge

datasets in need of explanation. Recent studies have, for instance, empirically evaluated Ramon y Cajal's conservation laws for cerebral cortex, while others have shown some unexpected connectivity features that may refine the traditional view of how corticocortical connections are organised with regard to functional representations of auditory, somatosensory and visual cortices. Understanding these data will help improve the fidelity of neural models of cerebral cortical function and take into account the diversity of connections at both micro- and mesoscopic scales not seen at such a depth before.