

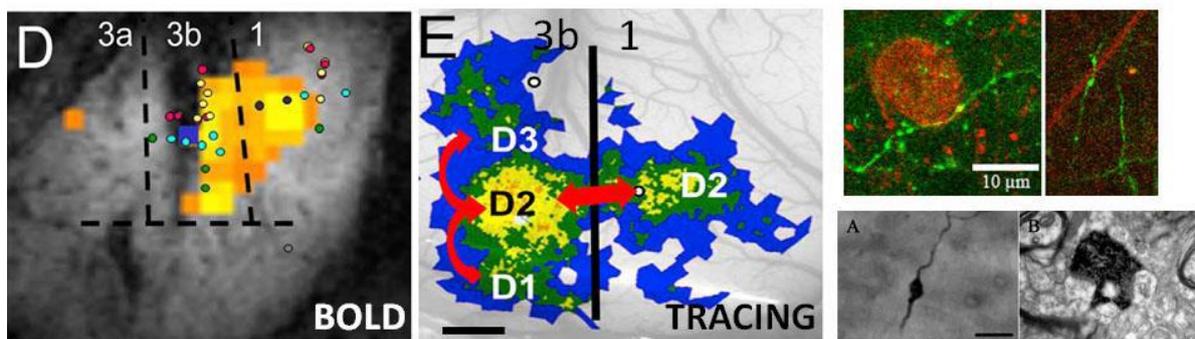
Overview

The continuous sheet of the cerebral cortex, the so called neocortex or isocortex, is in fact a complex network of structurally and functionally heterogeneous areas. The unique characteristic of this network is that it is formed by populations of closely spaced neurons with convergent or overlapping afferents. Thereby connections appear as modular or patch-like pattern both within and between the areas. Similarly, cortical activations are spatiotemporally delineated forming a distributed modular architecture in the functioning brain. As such, modular organization represents the transition from the micro circuits to the large scale network. In some areas the modular connectional architecture corresponds to the known columnar cortical organization, such that certain kinds of columns are selectively connected to each other. However, in most of the cases connectional preferences of the neuronal populations are not known. A major obstacle in understanding the functioning of the cerebral cortex is that the modular connectional architecture is largely unexplored.

Major topics

1. *Connectional organization of the primate sensorimotor cortex*

We study the neuronal connectivity of functionally identified modules of the primate sensorimotor cortex. In this project we use neuroanatomical tracing aided by optical imaging and electrophysiological mapping. The function of such somatosensory and motor cortical modular circuitry is studied by examining the synaptic organization of inhibitory and excitatory connections by way of confocal, and electron microscopy in addition to electrophysiology. This project also aimed at understanding the neural mechanisms of tactile functions and fine finger movements, which, in the future, can help developing bionic devices including prosthetics to disabled persons.



Left: Matching patterns of anatomical connectivity and BOLD signal correlation in the primate somatosensory cortex at the sub-millimeter scale. Scale bar: 1 mm applied for both figures. *Neuron*. 2013, 78(6):1116-26. Right: Synaptic organization of somatosensory cortical connections shown on confocal, light and electron microscopic images.

