Neural Networks of the Mouse Neocortex

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Background

Cognition and behaviour has long been considered as a network level phenomenon since different regions of the brain connect, converge and integrate to express a complex behaviour pattern. Brain wide connectivity matrices may thus reveal some crucial aspects of neuronal integration. Authors describe the crucial role of neuronal integration in mouse as somatosensory subnetwork converges information to prefrontal cortex. Paper describes the communication across entire cortex to study the neuronal inputs and outputs.

Methodology

Double co-injections were made in the entire neocortex, hippocampus, olfactory cortical areas, and amygdale of 8-week-old male C57Bl/6J mice. One anterograde tracer (Phaseolus vulgaris leucoagglutinin [PHAL] or biotinylated dextran amine [BDA]) and one retrograde (cholera toxin subunit b [CTb] or Fluorogold [FG]) tracer were co-injected to simultaneously reveal four pathways. Connectivity matrices were further constructed using iConnectome.

Implications

The paper portrayed one of the most complex integrations present in the nature. Mouse connectome project is an ambitious project to understand the long range networking of the neurons. Authors promise to explore the integration of neuronal networks at the subcortical, synaptic and cell type specific connections. The subnetwork level interaction and communication may also be explored in the normal aging brain to understand and compare a dementic brain at the subcortical, synaptic and cell type specific level. Neuronal integration may also provide information about the pharmacological significance of a substance being used as an intervention for neurological disorders. Moreover, the idea of neural integration may be explored to understand the concept of multiple intelligence in the humans since development of intelligence may be an integration level phenomenon. Understanding this phenomenon to correlate the higher level of consciousness in humans with the genetic and molecular make up also would be of extreme importance. It would be interesting to study the effect of deep meditations and increased neural connectivity.

Tracers based search of connectivity is an important step which can also be utilized in other parts of the body, most importantly retinal neurons as featured by Marx et al.[1] More work may be done to make this study clinically viable in human subjects.

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References

1. Marx V, High-throughput anatomy: Charting the brain's networks. Nature. 2012, 11; 490 (7419): 293–8.