Contribution ID: **137** Type: **not specified**

Neuroscience beyond neurons

The human brain displays amazing computing capacities. Unfortunately, it also often goes wrong with dramatic consequences. Diseases of the central nervous system cost each European € 5500 every year and represent one third of the financial burden of European public health systems [1]. For historical and technological reasons, neuroscience has focused mostly on neurons and derives its name as a field from that specific cell type. However, the human cortex consists of numerous cell types, and neurons only represent 20% of that overall population [2]. In recent years, new imaging technologies have allowed us to investigate non-neuronal cell types, collectively called glial cells. Unlike neurons, glial cells are not electrically active but show tremendous activity when monitored via imaging techniques that assess fluctuations of their internal calcium concentration. These studies have revealed that glial cells play a key role in all aspects of brain function, both in health and disease. Because of the relative novelty of this line of inquiry, there is no algorithm to segment and analyse calcium-imaging data in glial cells, and there is no theory to make sense of the data.

Neuroscience is faced today with the challenge of developing new image-processing technologies and a new theoretical framework to go beyond mere neural networks, which we know do not represent the biological reality underlying our computing prowess and diseases [3].

To tackle this challenge, this project will bring together experimental neuroscientists, computer scientists, engineers and computational biologists to collect, store and share the data in an open fashion, to develop the necessary imaging and pattern recognition techniques, and to develop the missing theoretical framework. Through this transformative effort, we expect that neuroscience will mature into brain science. This project will have an impact on our understanding of brain function, paving the way for better machine intelligence algorithms, and it will have an impact on our understanding of the onset and progression of diseases of the central nervous system, opening new therapeutic avenues.

1. Olesen, J., et al., The economic cost of brain disorders in Europe. European Journal of Neurology, 2012. 19(1): p. 155-162.
2. Azevedo, F.A.C., et al., Equal Numbers of Neuronal and Nonneuronal Cells Make the Human Brain an Isometrically Scaled-Up Primate Brain. Journal of Comparative Neurology, 2009. 513(5): p. 532-541.
3. Fields, R.D., Neuroscience: Map the other brain. Nature, 2013. 501(7465): p. 25-7.

Summary

Primary author: Prof. JOLIVET, Renaud Blaise (CERN and University of Geneva)

Co-authors: Dr HOWARTH, Clare (The University of Sheffield); BELTRAMELLO, Olga (CERN); Dr NADKARNI, Suhita (IISER Pune)

Presenter: Prof. JOLIVET, Renaud Blaise (CERN and University of Geneva)