EPSTEIN INSTITUTE SEMINAR ▪ ISE 651

Data and the Brain

ABSTRACT - In 1894, Santiago Ramón y Cajal first suggested that memories are formed by changes in synaptic connections, a view that is widely held by neuroscientists. Countless studies have examined and characterized synaptic changes that can occur in culture and ex vivo (i.e. dead) brain slices, but how synapses change in a living animal when a memory is formed is poorly understood. This synaptic theory of learning is pervasive not only in neuroscience, but has impacted computer science as well, forming the foundation for neural network models of learning.

A multidisciplinary collaboration between ISI and Dornsife School at USC has developed and applied a set of tools that enables direct observation and spatial mapping of synapses using high-contrast selective plane illumination imaging of an endogenous postsynaptic density protein labeled with a recombinant GFP-coupled probe to study the synaptic structure of a larval zerbarfish brain before and after learning. Surprisingly, we found that memory formation due to classical conditioning is associated with generation of new synapses, but not with systematic changes in the strengths of existing synapses. Understanding how synapses change during learning could have broad implications. For example, better understanding of aberrant memory formation that can lead to post-traumatic stress disorder or addiction may one day lead to novel approaches for treatment of these conditions.

A unique aspect of our study is that all data, from the first experiment to published results, was Findable, Accessible, Interoperable, and Reusable (FAIR data principles). We were able to accomplish this by integrating the Deriva platform for scientific data management and developed by the Informatics Systems Research Division into our daily research activities. This approach enables an uncommonly high degree of transparency and reproducibility — which as demonstrated by todays COVID environment is of increasing importance.

In this talk, I will describe our fundamental new results in neuroscience and describe how we constructed a socio-technical ecosystem leveraging Deriva that fundamentally altered the way that we conducted our experiments, analysis and publication in this high-dimensional uncertain environment.

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SPEAKER BIO – Carl Kesselman is a Dean's Professor of Industrial and Systems Engineering and Professor of Computer Science, and Professor in the Keck School of Medicine and Ostrow School of Dentistry and the Director of the Informatics Systems Research Division at the Information Sciences Institute. His work in large-scale distributed informatics systems has been widely recognized with over 74,000 citations. He is a fellow of the British Computing Society and the Association for Computing Machinery. His awards include the Ada Lovelace Medal from the British Computing Society and the Harry H. Goode Memorial Award from the IEEE Computer Society.

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TUESDAY, SEPTEMBER 29, 2020
3:30 PM – 4:50 PM
ZOOM/ONLINE *PLEASE EMAIL OWH@USC.EDU FOR PASSWORD*