Session/Poster#	Presenter
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Bridging the In Silico-Clinical Gap: co-simulation of biophysical circuit and whole-brain network models.

While promising in-silico models of brain activity have been published, the integration between in-silico modeling and clinical science remains sparse. A persistent dilemma is that clinical data tends to observe the activity and structure of the complete brain, rather than isolated slices of individual structures. For instance, we recently developed biophysically-detailed models of auditory, motor and somatosensory cortical circuits in NetPyNE (a multiscale brain circuit modeling tool) which can reproduce local phenomena with accurate detail. However, these in-silico reproductions of single sub-millimeter brain structures necessitate detailed neuronal properties plus connectomic and synaptic definitions. These computationally expensive models are necessary to understand molecular interactions but represent a small fraction of total brain activity. This complexity cannot feasibly scale to whole brain representations. Because of this, many clinical tools and data signals (e.g. EEG, MRI) cannot be easily correlated to in-silico models.
The Virtual Brain (TVB) is a popular reference tool for simulating macroscale whole-brain network models derived from multimodal MRI and EEG data. Currently, TVB parcellates simulations of cortical columns and subcortical nuclei to more detailed simulation tools, which are then integrated as mean-field activity to mesoscopic and macroscopic interactions -- bridging the gap from current detailed in-silico models to clinically observed signal data. We developed a new co-simulation interface between NetPyNE/NEURON and TVB which will allow researchers to link molecular chemical signaling to whole-brain network dynamics for the first time. This will enable scientists to study the effect that occurrences at the molecular scale - for example, drug interactions - have on whole-brain activity, and vice versa. These complex multiscale interactions are essential to understanding and treating brain diseases such as schizophrenia and Alzheimer's.