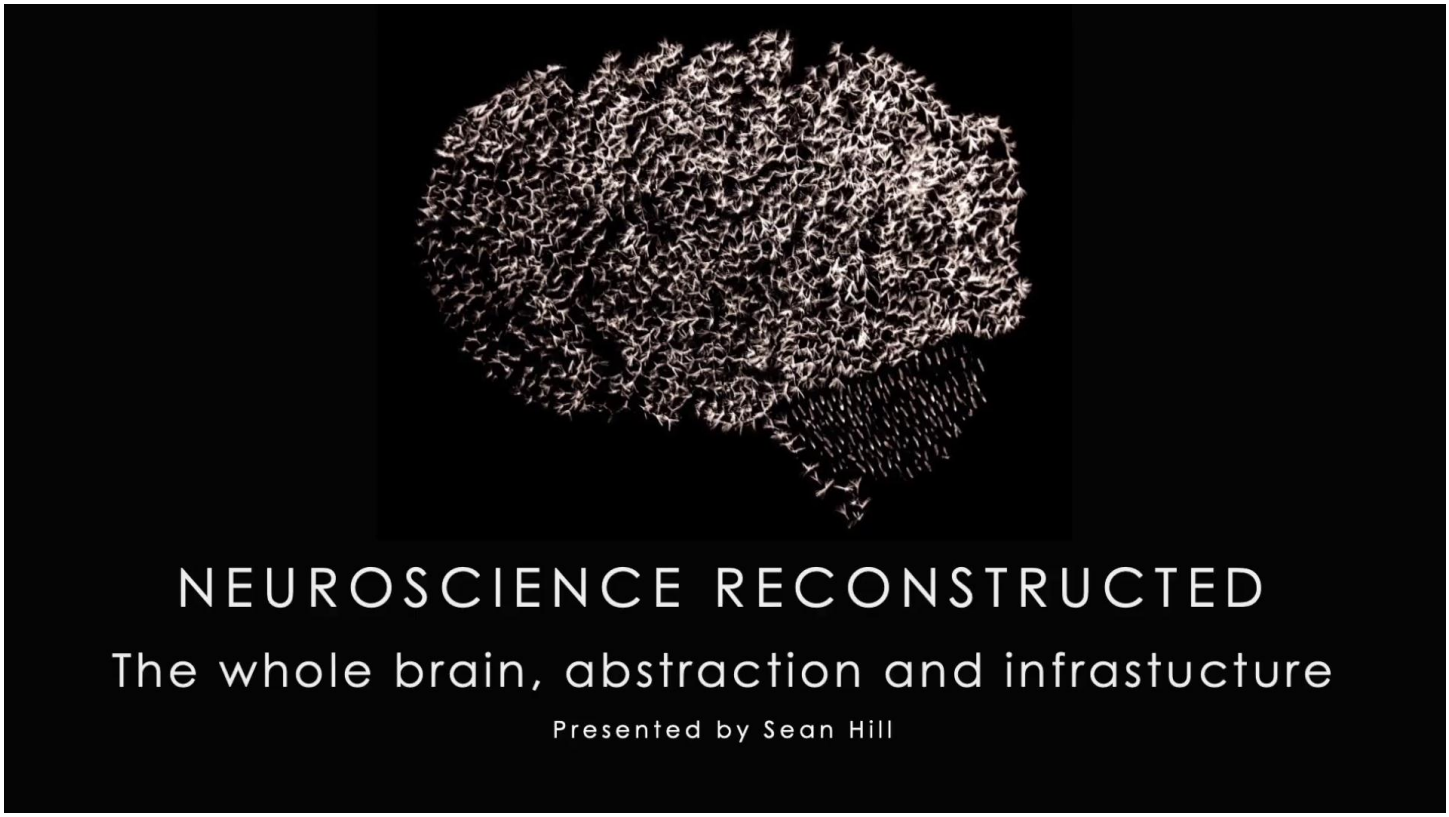
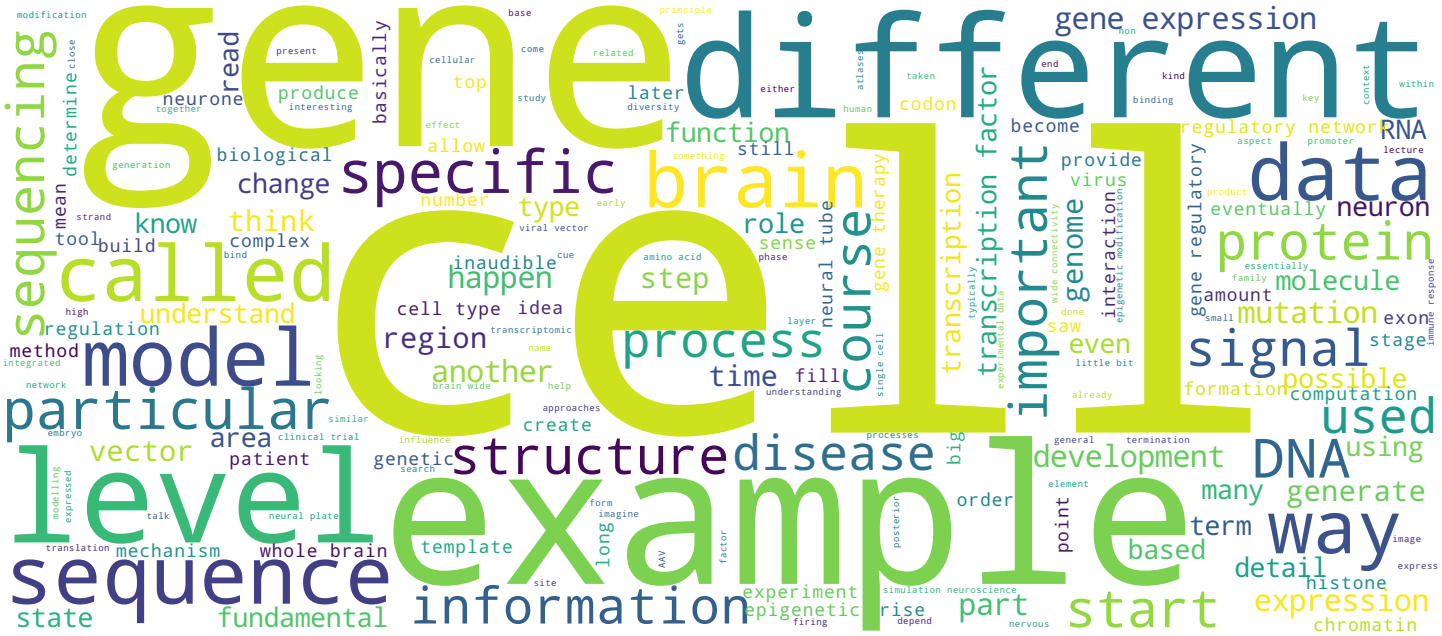




Search MOOC

Video

EPFL

Modeling electrophysiology

Macro-scale
(whole brain)

Meso-scale
(regions and areas)

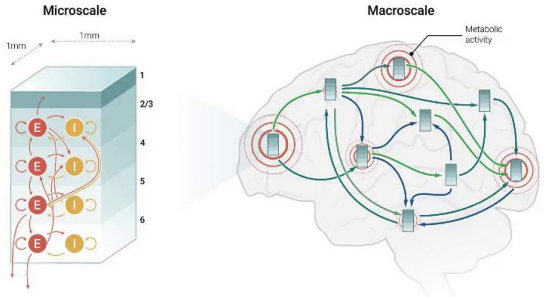
Microcircuit
(unitary network)

Cellular

Sub-cellular

Models of the **whole brain** – linking structure to function:

- **Defining function:** Resting state functional connectivity, dynamic functional connectivity, functional interactions
- **Brain-wide connectivity:** Often taken from diffusion tensor tractography
- **Network of neuron populations**: neuron populations represented as a single unit
- **Temporal scales**: from action potential to cognition
- **Brain energetics**: role of the vasculature in brain metabolism, indicator of function



When you get to the whole brain level, there are many other layers to think about in terms of what's the state, what are the types of functional properties to model, how do you integrate brain wide connectivity often in whole brain models, brain wide connectivity is taken from, for example, diffusion tensor, tactilegraphy or other atlases of of brain connectivity. You can represent networks of neurons as actual single populations, taking into account different temporal scales to fit, for example, EEG or FMRI data, and of course, related to that is the role of the vasculature and brain metabolism in constraining the energetics necessary to produce the firing.

Notes

Summary

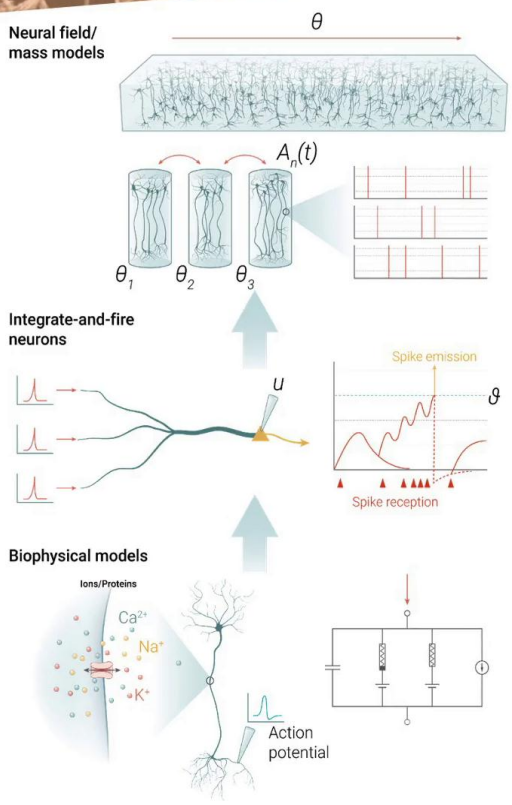
0m 05s

Reductionism & abstraction

Modeling is a trade-off between **generality, realism and precision**.

The level of detail of a model depends on:

- The biological question the model aims to answer



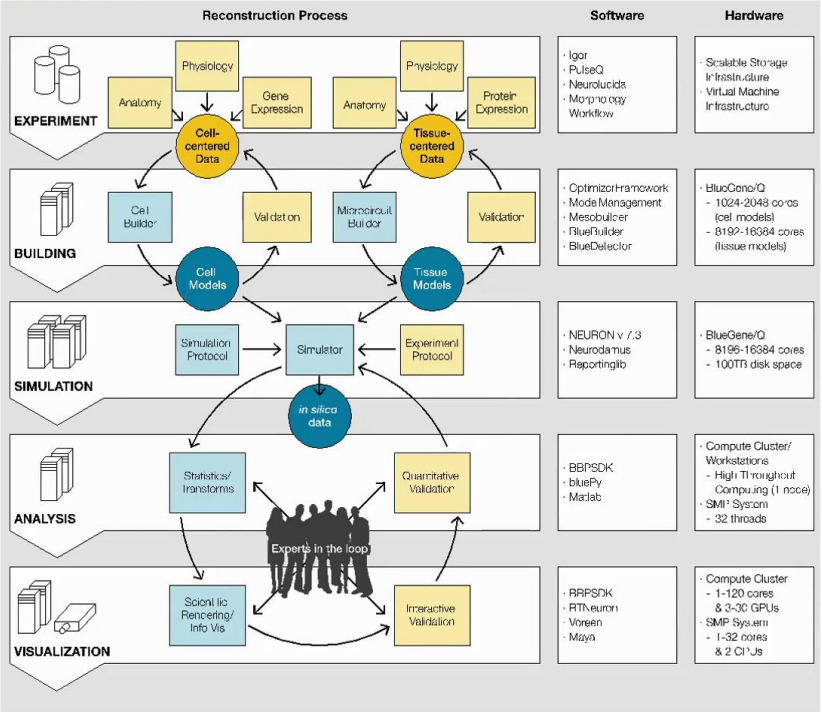
I think that the simulation neuroscience approach really gives us a way to ensure that we're representing the data available explicitly. These other approaches can be used as a essentially a way of reducing the amount of computation or of saying that we don't have sufficient data at this integrated at this point to fill in and construct a model at that level, but the more that we learn principles, we can still create a first version, a first draft biophysical representation to fill in these areas and then use principles that we learned from that to create those reduced representations. So modelling in general, it's a trade-off between the generality, between the realism, the precision, often that corresponds to the amount of computation that is required as well to analyse that model. The level of the detail of the model really depends on the specificbiological question, the model aims to answer the level of the biological data the model is based on and the smallest amount of detail the model needs to accurately reproduce the biological features.

Notes

Summary

1m 04s

Infrastructure



Now, to really pursue simulation neuroscience, we had to build a robust infrastructure that starts from the experimental data, organising the experimental data from the lab, facilitating data driven model building processes with validation, running large scale simulations on supercomputers, visualising that, analysing that and then driving all of that with neuroscientists in the loop to drive new refinement, new data gathering, new experiments, and this iterative process was facilitated by the infrastructure constructed.

Notes

Summary

2m 29s