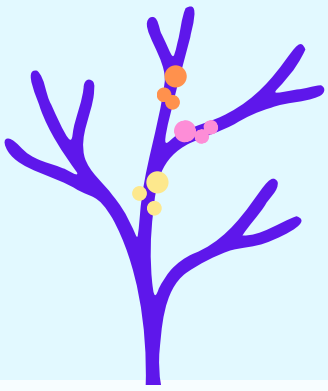
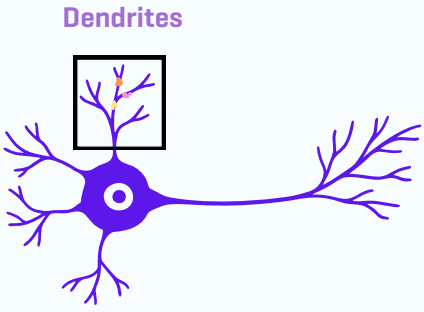
How developing neurons build “mini-computers" for increased computational power

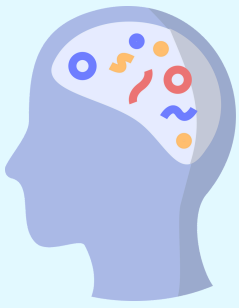
A new mouse study from the Netherlands Institute for Neuroscience (NIN) reveals that neurons establish “mini-computers” very early in life to make the brain computationally powerful.





Building a functional brain requires neuronal circuits to be wired up with high specificity. Key players in this system are branched extensions from neurons called dendrites, which process and integrate the information they receive from other neurons.

Mini computers



Previously, computational neuroscientists proposed that dendrites can compute information locally in many individual segments within one cell. Such “computational subunits” or “mini computers” would increase a neuron’s computational power dramatically. However, how neurons wire up these mini-computers inside the living brain during development is still unknown.

But what if we could observe the development of these subunits in real life?

In a new study from the group of Christian Lohmann, researchers looked into the computational subunits in the intact developing brain of young mice.

They indeed discovered that the communication points in the dendrites, or synapses, are clustered according to the information they are transmitting. In other words, neighboring synapses that transmit similar information are clustered together in dendritic domains.

Why is this important?

This work will help us understand better how our brains develop and why certain errors in development can cause neurodevelopmental disorders.

Secondly, it could potentially give new ideas for designing biologically inspired artificial neuronal networks for high-level information processing as for example AI.

“To me the most fascinating thing is how specifically neurons are connected and how early this is possible without even knowing anything about the outside world.”

Christian Lohmann

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