



# Neurotheory Forum

## How dendrites help solve biological and machine learning problems

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**Host: Tim Vogels**

Dendrites are thin processes that extend from the cell body of neurons, the main computing units of the brain. The role of dendrites in complex brain functions has been investigated for several decades, yet their direct involvement in key behaviors such as for example sensory perception has only recently been established. In my presentation I will discuss how computational modelling has helped us illuminate dendritic function [1]. I will present the main findings of a number of projects in lab dealing with dendritic nonlinearities in excitatory and inhibitory and their consequences on neuronal tuning [2] and memory formation [3], the role of dendrites in solving nonlinear problems in human neurons [4] and recent efforts to advance machine learning algorithms by adopting dendritic features.

[1] Panayiota Poirazi & Athanasia Papoutsis. Illuminating dendritic function with computational models. *Nature Reviews Neuroscience*, 11 May 2020 | DOI: 10.1038/s41583-020-0301-7

[2] Tzilivaki A, Kastellakis G, Poirazi P. Challenging the point neuron dogma: FS basket cells as 2-stage nonlinear integrators. *Nat Commun*. 2019 Aug 14;10(1):3664. doi: 10.1038/s41467-019-11537-7.

[3] Park, J., Papoutsis, A., Ash, R. T., Marin, M. A., Poirazi, P., Smirnakis, S. M. Contribution of apical and basal dendrites to orientation encoding in mouse V1 L2/3 pyramidal neurons. *Nat. Commu.*, 26 November 2019. | doi: <https://doi.org/10.1038/s41467-019-13029-0>

[4] Gidon A, Zolnik TA, Fidzinski P, Bolduan F, Papoutsis A, Poirazi P, Holtkamp M, Vida I, Larkum ME. Dendritic action potentials and computation in human layer 2/3 cortical neurons. *Science*. 2020 Jan 3;367(6473):83-87. doi: 10.1126/science.aax6239.

**Friday, April 23, 2021 03:00pm - 04:00pm**

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