

## Matthew Larkum

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Born in 1967, married with 2 children.

### Curriculum vitae

since 2011 Professor "Neuronal Plasticity" (W3), Department of Biology, Humboldt University of Berlin  
2004 – 2011 SNSF Professor, Institute of Physiology, University of Bern  
1997 – 2003 Postdoctoral fellow (Advisor: Bert Sakmann), Max Planck Institute for Medical Research, Heidelberg  
1992 – 1996 PhD (supervisor: Hans-Rudolf Lüscher), Institute of Physiology, University of Bern  
1991 First class honours in Physiology (supervisor: Max Bennett), University of Sydney  
1987 – 1990 Bachelor of Science, University of Sydney

### Short biography

I graduated from Sydney University with a thirst for solving the brain and was lucky to be a post-doc in the laboratory of Nobel prize-winner Bert Sakmann for 6 years. It was here that I cut my teeth on hard-core electrophysiological and imaging techniques for understanding the computational properties of cortical neurons. I continued this focus upon starting up my own laboratory in Switzerland and more recently in Berlin where the laboratory has grown to accommodate a more comprehensive investigation of the contribution of single-cell computation to the process of cognition, learning and memory. The aims of the lab are based on a unifying hypothesis that the incredible cognitive power of the cortex derives from an associative mechanism built in at the cellular level such that the architecture of the cortex is tightly coupled with the computational capabilities of single cells. In essence, this hypothesis places new importance on the computational power of neurons that has ramifications for our understanding of cognition and for neurodegenerative diseases that disturb neuronal properties.

### Research fields

Our group focuses on the processing of feedforward and feedback information in the cortex, and particularly, on the contribution of active dendritic properties to the computational power of neocortical pyramidal neurons. Recent topics include:

- Dendritic spikes in the tuft and basal dendrites of neocortical pyramidal neurons
- Inhibitory control of cortical microcircuits
- Memory consolidation with active dendritic mechanisms
- Cellular basis for interhemispheric inhibition in the cerebral cortex
- Effect of fetal alcohol syndrome on dendritic processing
- Effects of common anesthetics on single-cell computation in the cortex
- Development of state-of-the-art optical approaches for studying cortical dendritic activity

### Activities in the scientific community, honors, awards

2010 Robert Bing Prize, Swiss Academy of Medical Sciences  
2007 Pfizer Prize for the best neuroscience paper published by a Swiss group  
2006 Theodor Kocher Prize  
2004 Professorship, Swiss National Science Foundation (SNSF)  
2003 Nikon Research Fellowship, Woods Hole Research Laboratories  
2002 Woods Hole Research Fellowship  
1999 – 2001 Max Planck Society Scholarship  
1997 – 1998 Alexander von Humboldt Scholarship  
1992 – 1995 Australian Postgraduate Research Award

## Selected publications

- Palmer LM, Shai AS, Reeve JE, Anderson HL, Paulsen O, Larkum ME (2014) NMDA spikes enhance action potential generation during sensory input. *Nature Neuroscience* 17: 383-390.
- Larkum ME. A cellular mechanism for cortical associations: an organizing principle for the cerebral cortex. *Trends in Neurosciences*. 2013 36: 141-151.
- Larkum ME. The yin and yang of cortical layer 1. *Nature Neuroscience*. 2013; 16, 114-15.
- Palmer LM, Schulz JM, Murphy SC, Ledergerber D, Murayama M, Larkum ME. The cellular basis of GABA<sub>B</sub>-mediated interhemispheric inhibition. *Science*. 2012; 335, 989-93.
- Murayama, M, Perez-Garci E, Nevian T, Bock T, Senn W, Larkum ME. Dendritic encoding of sensory stimuli controlled by deep cortical interneurons. *Nature*. 2009; 457, 1137-41.
- Murayama M, Larkum ME. In vivo dendritic calcium imaging with a fiberoptic periscope system. *Nature Protocols*. 2009; 4, 1551-9.
- Murayama M, Larkum ME. Enhanced dendritic activity in awake rats. *PNAS*. 2009; 106, 20482-6.
- Larkum ME, Nevian T, Sandler M, Polsky A, Schiller J. Synaptic integration in tuft dendrites of layer 5 pyramidal neurons: a new unifying principle. *Science*. 2009; 325, 756-60.
- Larkum, M.E. & Nevian, T. (2008) Synaptic clustering by dendritic signaling mechanisms. *Current Opinion in Neurobiology*. 18: 1-11.
- Nevian, T.\*, Larkum, M.E.\*, Polsky, A., Schiller, J. (2007) Properties of basal dendrites of layer 5 pyramidal neurons: a direct patch-clamp recording study. *Nature Neuroscience*, 10: 206-214. \* equal contribution
- Perez-Garci E, Gassmann M, Bettler B, Larkum ME. The GABAB1b isoform mediates long-lasting inhibition of dendritic Ca<sup>2+</sup> spikes in layer 5 somatosensory pyramidal neurons. *Neuron*. 2006; 50, 603-16.
- Larkum, M.E., Senn, W, and Lüscher, H.-R. (2004). Top-down dendritic input increases the gain of layer 5 pyramidal neurons. *Cerebral Cortex*, 10: 1059-70.
- Larkum, M.E., Kaiser, K.M.M., Sakmann, B. (1999b) Calcium electrogenesis in distal apical dendrites of layer 5 pyramidal cells at a critical frequency of back-propagating action potentials. *PNAS*. 96: 14600-14604.
- Larkum ME, Zhu JJ, Sakmann B. (1999) A new mechanism for coupling inputs arriving at different cortical layers. *Nature*. 398, 338-41.