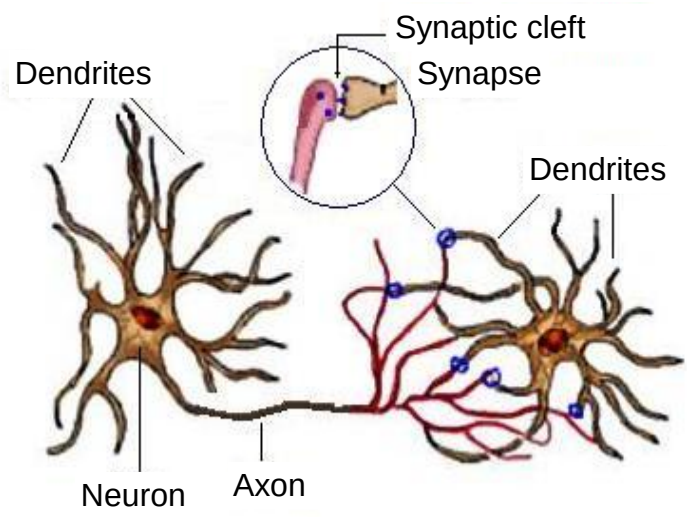
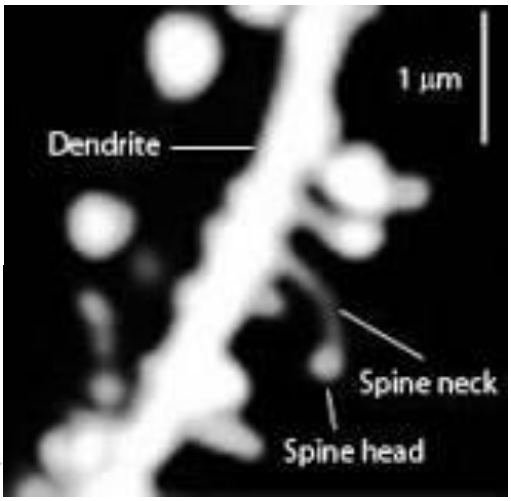
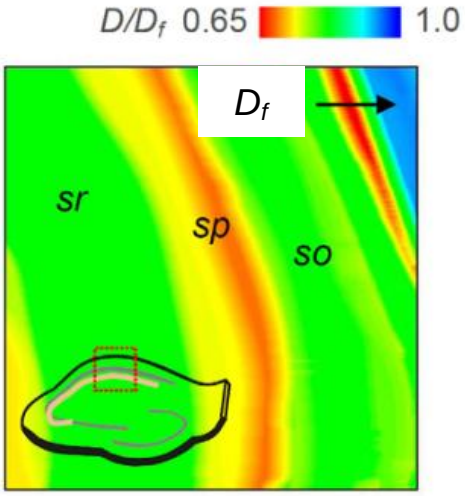
Research (What is it about?)	**Diffusion in elements of neural network *in vitro***
UNN authors	*Savtchenko L.*
We find (The result)	The change in ***mobility of small molecules*** in different elements of neural network compared with free medium has been measured
Abstract	Neural activity relies on molecular diffusion within nanoscopic spaces outside and inside nerve cells, such as synaptic clefts or dendritic spines. How fast the small signalling molecules move on the nanoscale in the brain has remained an enigma. Resolving this issue is nonetheless important, for several demonstrable reasons. First, nanoscale mobility of free-diffusing molecules and ions determines electric conductance of the medium and thus directly guides our knowledge about local electric currents pertinent to neural activity. Second, this mobility sets the maximum rate for local diffusion-limited biochemical reactions. Finally, it determines the extent to which synaptically discharged neurotransmitters or other signalling molecules activate synaptic and extra-synaptic receptors, a long-standing question in neurobiology. Measuring diffusion on these small spatial and temporal scales (***1 μm and 1 ns***) *in situ* has not hitherto been possible, yet this knowledge is critical for understanding the dynamics of molecular events and electric currents. We advance time-resolved fluorescence anisotropy imaging combined with two-photon excitation microscopy to map nanoscale diffusivity in brain slices. We find that in the brain interstitial gaps small molecules move on average ***~30% slower than in a free medium*** whereas inside neuronal dendrites this retardation is ***~70%***. In the synaptic cleft free nanodiffusion is decelerated by ***~46%***. These quantities provide previously unattainable basic constrains for the receptor actions of released neurotransmitters, the electrical conductance of the brain interstitial space and the limiting rate of molecular interactions or conformational changes in the synaptic microenvironment.

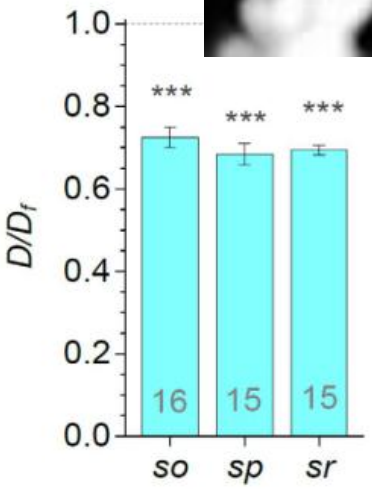
Representative articles 2017-2018, quartiles	1. *Zheng K.Y., Jensen T.P., Savtchenko L.P., Levitt J.A., Suhling K., Rusakov D.A.* Nanoscale diffusion in the synaptic cleft and beyond measured with time-resolved fluorescence anisotropy imaging. Sci. Reports. 7:42022 (2017).	Q1
	Q-index (Qi) for the result	**4**
	high blue	

In collaboration	University College London, London WC1N 3BG, England Kings College London, London WC2R 2LS, England

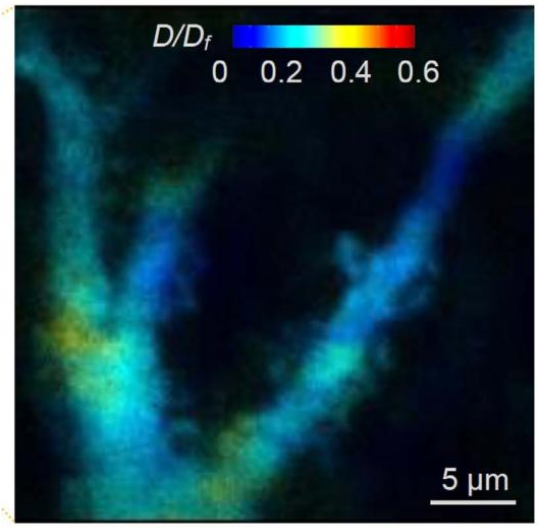


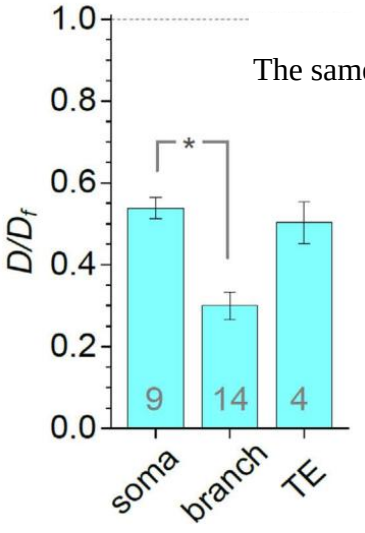






Diffusion coefficient ratio in the hippocampal slice (D_f – in free medium).





The same in neuron.