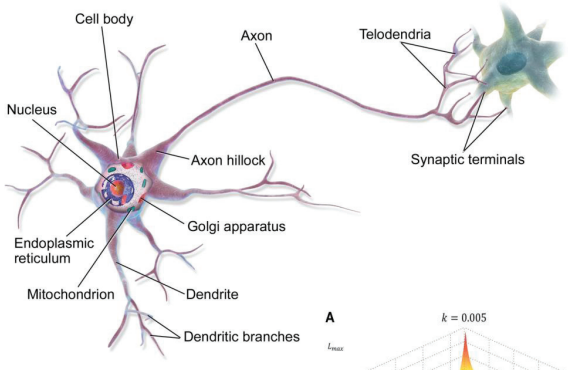
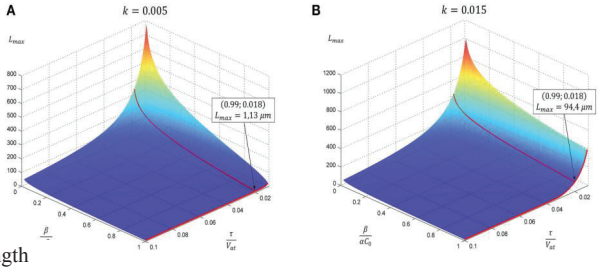
Research (What is it about?)	**Neurite development modeling**
UNN authors	*Mironov V., Semyanov A.V., Kazantsev V.B.*
We find (The result)	On the basis of molecular kinetics we propose a model of neurite growth to explain the differences in dendrite and axon specific neurite development.
Abstract	A neurite or neuronal process refers to any projection from the cell body of a neuron. This projection can be either an ***axon*** or a ***dendrite***. The development of a neurite requires a complex interplay of both extracellular and intracellular signals. At every given point along a developing neurite, there are receptors detecting both positive and negative growth cues from every direction in the surrounding space. The developing neurite sums together all of these growth signals in order to determine which direction the neurite will ultimately grow towards. Neurite growth involves complex molecular machinery responsible for cytoskeleton formation driven by intracellular and extracellular signaling. One of the main building blocks of the cytoskeleton are microtubules. They represent long polymers formed by heterodimers of tubulin. The most active microtubules, which are capable of joining and contracting, are localized in the end of the neurite called the growth cone. Thus, neurite elongation can be considered as elongation of the microtubules located in the distant parts of the neurite. Building proteins (e.g., tubulin) are synthesized in the soma and have to be transported to the growth cone. The key difference of the existing models is in description of building protein delivery to the growth cone. We propose a novel mathematical model of non-branching neurite elongation based on the dynamics of cytoskeleton microtubules reproducing experimental data of dendrite and axon specific development. The main focus is made on the relationship between geometrical characteristics and effective rate of tubulin transport of the neurite. In particular, the balance of these rates predicts a neurite projected over a very long distance, i.e., reproducing the axon specificity. The basic assumption was that the radius of the neurite decreases with length. We found that the neurite dynamics crucially depended on the relationship between the rate of active transport and the rate of morphological changes. If these rates were in the balance, then the neurite displayed axon specific development with a constant elongation speed. For dendrite specific growth, the maximal length was rapidly saturated by degradation of building protein structures or limited by proximal part expansion reaching the characteristic cell size.

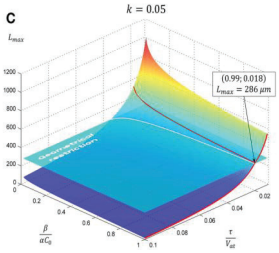
Representative articles 2016-2017, quartiles	1. *Mironov V., Semyanov A.V., Kazantsev V.B.* Dendrite and axon specific geometrical transformation in neurite development. Front. Comput. Neurosci. **9**:156 (2016).	Q2,Q4
	Q-index (Qi) of the result	**2**

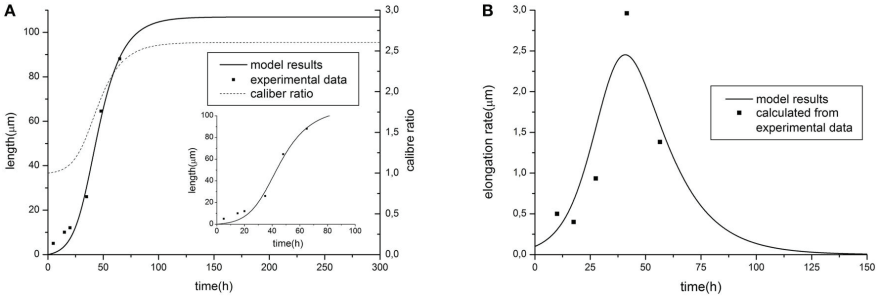
In collaboration	Russian Acad Sci, Inst Appl Phys, Lab Nonlinear Dynam Living Syst, Nizhnii Novgorod, Russia





The evolution of neurite maximal length depending on model parameters. In subsequent panels results for the case of linear tapering are presented. The geometrical restriction represents the case when the proximal segment radius reaches the soma size. Parameter ***k*** characterizing neurite narrowing is varied.





Comparison of model predictions [(A) elongation dynamics and (B) rate for the case of linear tapering] with experimental data of dendrite growth.