Research (What is it about?)	**Directional cultivation of neural network *in vitro***
UNN authors	*Gladkov A., Pigareva Y., Kutyina D., Kolpakov V., Mukhina I., Kazantsev V., Pimashkin A.*
We find (The result)	Re-engineering of the heterogeneous network structure in culture with the directed connectivity grown in a microfluidic device has been demonstrated
Abstract	The architecture of neuron connectivity in brain networks is one of the basic mechanisms by which to organize and sustain a particular function of the brain circuitry. There are areas of the brain composed of well-organized layers of neurons connected by unidirectional synaptic connections (e.g., cortex, hippocampus). Re-engineering of the neural circuits with such a heterogeneous network structure in culture can be used to study basic mechanisms of information processing and specific molecular pathways in the brain. Directed synaptic pathways that provide signal transfer are essential in the hippocampus, cortical columns and other brain areas. Similar directed connectivity in artificial neural circuits *in vitro* can be organized by the ***guidance of neurites between isolated groups of cells***. We present the model designed with two subpopulations of primary hippocampal neurons (E18) with directed connectivity grown in a microfluidic device with asymmetric channels. We analysed and compared neurite growth in the microchannels with various shapes that promoted growth dominantly in one direction. We found an optimal geometric shape features of the microchannels in which the axons coupled two chambers with the neurons. The axons grew in the promoted direction and formed predefined connections during the first 6 days *in vitro* (***DIV***). The defined morphological and functional connectivity formed during culture development and was maintained for up to 25 DIV. The microfluidic devices were coupled with microelectrode arrays to confirm unidirectional spiking pattern propagation through the microchannels between two compartments. Bursting activity propagated between two cultures through the microchannels has been registered in the form of signals, separated by a group of neuron spikes.

Representative articles 2017-2018, quartiles	1. *Gladkov A., Pigareva Y., Kutyina D., Kolpakov V., Bukatin A., Mukhina I., Kazantsev V., Pimashkin A.* Design of Cultured Neuron Networks *in vitro* with Predefined Connectivity Using Asymmetric Microfluidic Channels. Sci. Reports. **7:**15625 (2017).	Q1
	Q-index (Qi) for the result	**4**
	high blue	

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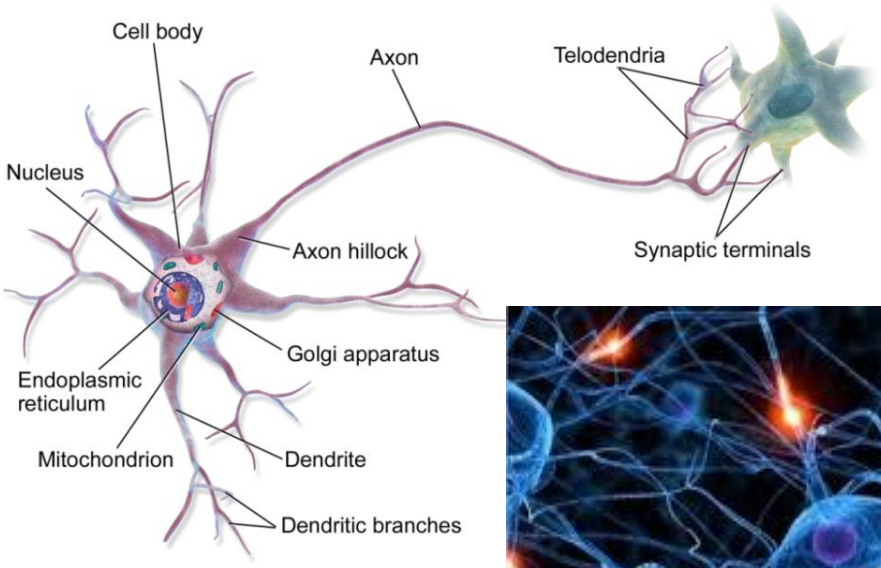
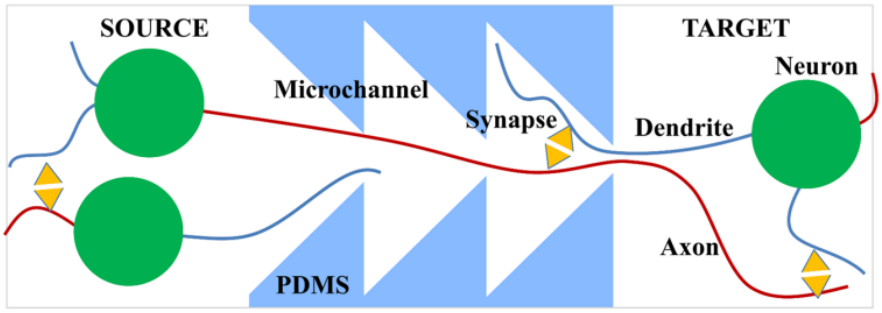


Neuron, neuritis (dendrites, axon) and a neuron network.

The directional cultivation scheme (SOURCE→TARGET) for neurons in the shaped microchannel.

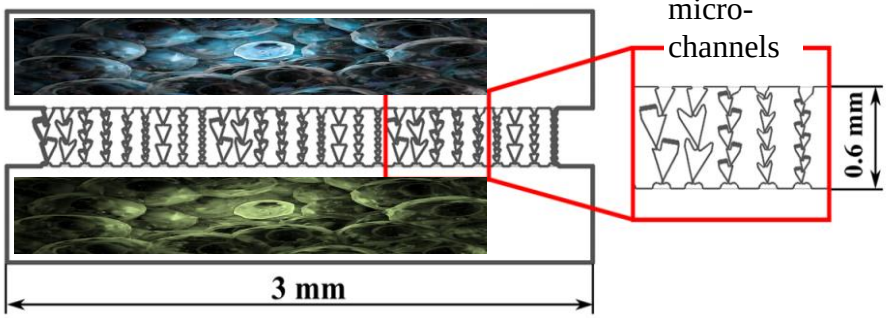


Experimental chamber with the shaped microchannels:

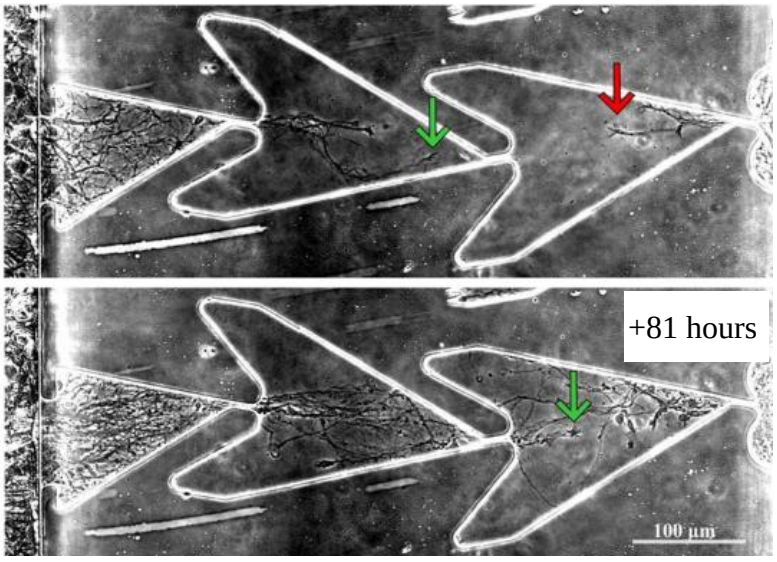
SOURCE

Hippocampal subpopulations of embryonic mice (7,000–9,000 cells/mm^2)

TARGET



The geometric shapes of micro-channels



The neurite dynamics in the shaped microchannels (green arrow – from SOURCE population, red arrow – from TARGET population).