Project 1.9. Re-engineering the neuronal synapse: towards direct manipulation of synaptic structure

Supervisor: Dr. Oleg Glebov

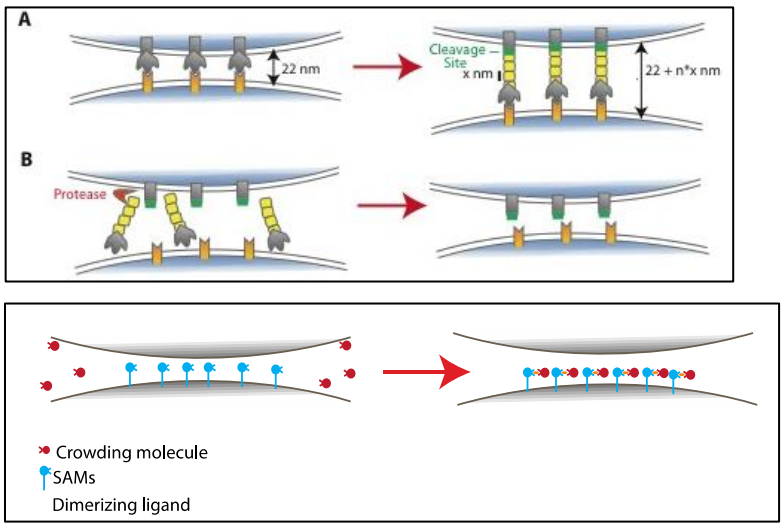
Laboratory: Synaptic Plasticity and Disease

Background:

The neuronal synapse operates much like a complex cell biological machine, consisting of many dynamic elements coupled to each other. The activity of neurons and structure of the synapse are linked through synaptic plasticity, the key phenomenon enabling the functionality of the central nervous system. Up until recently, most of the research has been focused on picking apart the key components of the synaptic machinery to understand their function. A major conceptual challenge now is to put them back in order to manipulate specific properties of the synapse – in other words, to re-engineer the synapse.

Aim:

Our recent findings highlight particular structural properties of the synapse that are linked to neuronal activity, namely the distance between presynaptic and postsynaptic sides1 and molecular crowding in the presynaptic active zone2. What roles do they play at the synapse? The main aim of the project is to address this question by developing tools to directly manipulate the structural properties of the synapse, and to test their effect on synaptic function in neuronal cell cultures.



Requirements:

Essential:
- fluent English,
- ability to work independently,
- general laboratory skills, Cell culture, Molecular biology,
- previous experience with light microscopy and image analysis.

Desirable:

- good grasp of statistical methods, Programming skills.

References

1. Glebov, O. O., Cox, S., Humphreys, L. & Burrone, J. Neuronal activity controls transsynaptic geometry. Sci. Rep. 6, 22703 (2016).
2. Glebov, O. O. et al. Nanoscale Structural Plasticity of the Active Zone Matrix Modulates Presynaptic Function. Cell Rep. 18, 2715–2728 (2017).