

# MOLECULAR NEUROBIOLOGY OF MEMORY

## Moscow Institute of Physics and Technology (National Research University)

Degree or qualification is awarded: **PhD (Candidate of Science)**

Language of study: **English**

Mode of study: **full-time**

Duration: **4 years**

Availability of free education: **yes**

Price: **375 000 RUB**

Programme webpage at the university website:

<https://eng.mipt.ru/programs/molecular-neurobiology-of-memory/>

Programme curator: **Denis Ustyuzhaninov**

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### Research supervisor:

[Pavel Balaban](#)

PhD, DSc, Corr. member of RAS

### Supervisor's research interests:

Neurobiological investigation of learning and memory with the aim to understand molecular mechanisms of epigenetic regulation of neuronal functioning. Synaptic plasticity mechanisms, optogenetics, thermogenetics and chemogenetics as innovative instruments for neurobiological research. Maintenance and modification of the long-term memory, invertebrate models for neurophysiological research.

### Research highlights:

Unique complex of behavioral, electrophysiological and molecular biological approaches in one lab. Biological subjects from cultured cells, invertebrate animals, mammals. Optical recording of electrical and molecular events in one cell or in a network, including in vivo optical recording of 30-40 neurons in free behaving animals.

### Supervisor's specific requirements:

- Devotion to Science.
- Good English.
- Knowledge of Biophysics.
- Knowledge of Matlab programming.

### Main publications:

- Xu C, Li Q, Efimova O, Jiang X, Petrova M, K Vinarskaya A, et al. Identification of Immediate Early Genes in the Nervous System of Snail *Helix lucorum*. *ENeuro* 2019;6(3).  
<https://doi.org/10.1523/ENEURO.0416-18.2019>
- Romanova DY, Smirnov IV, Nikitin MA, Kohn AB, Borman AI, Malyshev AY, Balaban PM, Moroz LL. Sodium action potentials in placozoa: Insights into behavioral integration and evolution of nerveless animals. *Biochem Biophys Res Commun* 2020;19:S0006-291X(20)31565-5.

<http://doi.org/10.1016/j.bbrc.2020.08.020>

- Balaban PM. Molecular Mechanism of Memory Modification. *Neurosci Behav Physi* 2018;48:734-40. <https://doi.org/10.1007/s11055-018-0624-2>
- Ermakova YG, Lanin AA, Fedotov IV, Roshchin M, Kelmanson IV, Kulik D, et al. Thermogenetic neurostimulation with single-cell resolution. *Nat Commun* 2017;22(8):15362. <http://doi.org/10.1038/ncomms15362>
- Borodina AA, Kuznetsova MA, Alekseeva VS, Balaban PM. Histone acetylation determines transcription of atypical protein kinases in rat neurons. *Scientific Reports* 2019;9:4332. <https://doi.org/10.1038/s41598-019-40823-z>
- Roshchin MV, Matlashov ME, Ierusalimsky VN, Balaban PM, Belousov VV, et al. A BK channel-mediated feedback pathway links single-synapse activity with action potential sharpening in repetitive firing. *Sci Adv* 2018;4(7):eaat1357. <http://doi.org/10.1126/sciadv.aat1357>

## **Specializations within this programme**