University	Peter the Great St.Petersburg Polytechnic University
Level of English proficiency	Upper Intermediate
Educational program and field of the educational program for which the applicant will be accepted	PHYSICAL SCIENCE 1.5.2. Biophysics BIOLOGY & BIOTECHNOLOGY 1.5.3. Molecular biology COMPUTER & DATA SCIENCE 1.2.2. Mathematical Modeling, Numerical Methods and Software Tools
List of research projects of the potential supervisor (participation/leadership)	- Endoplasmic reticulum in the functioning of synapses in normal state and in Alzheimer's disease, the role of dynamic tubulin cytoskeleton in the regulation of its calcium signaling - Algorithms for synapse morphology analysis, modeling of neurodegenerative processes and calcium signaling in synapses in normal state and in Alzheimer's disease based on neurobiological data - Analysis of the activity of neural networks using miniature fluorescence microscopy, modeling of processes in the functioning of biological neural networks based on neurobiological data
List of the topics offered for the prospective scientific research	The study of the molecular mechanisms of synapse functioning in normal state and neurodegeneration, the search for connections and approaches to protect synapses from degeneration in Alzheimer's disease, algorithms for synapses morphology, brain neural networks analysis and deconvolution of confocal images using machine learning and artificial intelligence methods
 Research supervisor: Ekaterina Pchitskaya, PhD	*1.6 Biological sciences* Supervisor’s research interests Molecular mechanisms of synapse functioning Alzheimer's disease mechanisms of pathogenesis and the search for therapeutic approaches for its treatment Algorithms and software for the neurobiological data analysis Deconvolution/microscopic image processing Research highlights Research in the field of Friction Stir Welding will be provided on the unique technological and scientific equipment: 5-axis FSW machine with the options for Impulse and High-Speed FSW; thermomechanical simulator Gleeble-3800; supercomputer. Supervisor’s specific requirements: Having a scholarship or grant for training and internships is a significant advantage over competitors. High motivation to solve the tasks, the ability to analyze the literature, propose solutions and analyze the result.

	Knowledge of the basics of programming, data analysis, statistics, modern methods of neuroscience and molecular neurobiology. Knowledge of English is required at a level sufficient to discuss and plan work. Knowledge of the basics of the Russian language is welcome.
	Results of intellectual activity - Demonstrated store-operated calcium entry (SOCE), endoplasmic reticulum (ER) calcium signaling and subsequent dendritic spines morphology abnormalities and in vivo and in vitro models of Alzheimer's disease. Demonstrated neuroprotective effect pharmacological or biological restoration of SOCE in Alzheimer's disease models, determined this pathway as potential target for new AD non-amyloid treatment strategy development - Determine end-binding proteins (EB), attaching to the plus end of growing microtubule, as new binding partner of STIM2, a calcium sensor protein and the key component of SOCE signaling pathway. EB regulates STIM2 translocation and clustering in soma and dendrites of neurons, ER distribution and formation of spine apparatus in neurons – specialized neuronal organelle, formed by stacks of ER, linked to the synaptic plasticity processes - Firstly, SOCE regulation by dynamic tubulin cytoskeleton in neurons was demonstrated - Showed, that EB3 protein participates in neurites and dendritic spines development, potentiates formation of mature synaptic contacts and CaMKII translocation to spines, and demonstrate robust neuroprotective effect in amyloid toxicity conditions, modeling AD, and in neurons with presenilin 1 AD-causing mutation - Demonstrated apoptosis regulator Bcl-2 protein neuroprotective potential in vivo studies on AD mice model. Publications*:* 1. Gerasimov, E.; Mitenev, A.; Pchitskaya, E.; Chukanov, V.; Bezprozvanny, I. NeuroActivityToolkit—Toolbox for Quantitative Analysis of Miniature Fluorescent Microscopy Data // J. Imaging 2023; 9: 243. https://www.mdpi.com/2313-433X/9/11/243 DOI:10.3390/jimaging9110243 Impact Factor: 4.6 Quartile Q2 according to Scopus SJR database 2. Pchitskaya E., Vasiliev P., Smirnova D., Chukanov V., Bezprozvanny I. SpineTool is an open-source software for analysis of morphology of dendritic spines // Sci Rep, 2023; 13: 10561. https://www.nature.com/articles/s41598-023-37406-4 DOI:10.1038/s41598-023-37406-4 Impact Factor: 4.6 Quartile Q1 according to Scopus SJR database

	3. Rakovskaya A., Chigriai M., Bezprozvanny I., Pchitskaya E. Expansion Microscopy Application for Calcium Protein Clustering Imaging in Cells and Brain Tissues // Current Protocols, 2023; 3, e789. https://pubmed.ncbi.nlm.nih.gov/37338219/ DOI:10.1002/cpz1.789 Impact Factor: 0.87 Quartile Q1 according to Scopus SJR database 4. Rakovskaya A., Erofeev A., Vinokurov E., Pchitskaya E., Dahl R., Bezprozvanny I. Positive Allosteric Modulators of SERCA Pump Restore Dendritic Spines and Rescue Long-Term Potentiation Defects in Alzheimer's Disease Mouse Model // International journal of molecular sciences, 2023; 24,18 13973. https://pubmed.ncbi.nlm.nih.gov/37762276/ DOI: 10.3390/ijms241813973. Impact Factor: 6.0 Quartile Q1 according to Scopus SJR database 5. Chernyuk D., Callens M., Polozova M., Gordeev A., Chigriai M., Rakovskaya A. , Ilina A., Pchitskaya E., Van den Haute C. , Vervliet T., Bultynck G., Bezprozvanny I.. Neuroprotective properties of anti-apoptotic Bcl-2 proteins in 5xFAD mouse model of Alzheimer's disease // IBRO Neuroscience Reports, 2023; 14 273-283. https://pubmed.ncbi.nlm.nih.gov/36926591/ DOI:10.1016/j.ibneur.2023.02.005. Impact Factor: 2.7 Quartile Q3 according to Scopus SJR database 6. Gerasimov, E., Pchitskaya, E., Bezprozvanny, I. TREM2 and calcium signaling in microglia – is it relevant for Alzheimer's disease? // Cell Calcium, 2022; 104:102584 https://pubmed.ncbi.nlm.nih.gov/35366517/ DOI: 10.1016/j.ceca.2022.102584 Impact Factor: 4.69 Quartile Q1 according to Scopus SJR database 7. Pchitskaya, E., Rakovskaya, A., Chigray, M., Bezprozvanny, I. Cytoskeleton Protein EB3 Contributes to Dendritic Spines Enlargement and Enhances Their Resilience to Toxic Effects of Beta-Amyloid // International Journal of Molecular Sciences, 2022; 23 (4): 2274 https://pubmed.ncbi.nlm.nih.gov/35216391 DOI: 10.3390/ijms23042274 Impact Factor: 6.2 Quartile Q1 according to Scopus SJR database

	8. Erofeev A.I., Barinov D.S., Gerasimov E.I., Pchitskaya E.I., Bolsunovskaja M.V., Vlasova O.L., Bezprozvanny I.B. NeuroInfoViewer: A Software Package for Analysis of Miniscope Data // Neuroscience and Behavioral Physiology, 2021; 51(8): 1199-1205 https://link.springer.com/article/10.1007/s11055-021-01179-y DOI: 10.1007/s11055-021-01179-y Impact Factor: - Quartile Q4 according to Scopus SJR database 9. Derevtsova K.Z., Pchitskaya E.I., Rakovskaya, A.V., Bezprozvanny I.B. Applying the Expansion Microscopy Method in Neurobiology // J Evol Biochem Phys, 2021; 57:681-693. https://link.springer.com/article/10.1134/S0022093021030157 DOI: 10.1134/S0022093021030157 Impact Factor: 0.44 Quartile Q4 according to Scopus SJR database 10. Pchitskaya E., Bezprozvanny I. Dendritic Spines Shape Analysis—Classification or Clusterization? Perspective. // Frontiers in Synaptic Neuroscience, 2020; 12, 31 https://www.frontiersin.org/articles/10.3389/fnsyn.2020.00031/full DOI: 10.3389/fnsyn.2020.00031 Impact Factor: 4.71 Quartile Q1 according to Scopus SJR database 11. Pchitskaya E., Krylov I., Vlasova O., Bolsunovskaya M., Bezprozvanny I. Analysis of dendritic spines morphology: from classical division to types toward alternative approaches. // St. Petersburg Polytechnical State University Journal. Physics and Mathematics. 2019; 12 (2):86-97. https://physmath.spbstu.ru/userfiles/files/articles/2019/2/07-Pchitskaya-eng.pdf DOI: 10.18721/JPM.12207 Web of Science Core Collection