



С И Б И Р С К И Й
Ф Е Д Е Р А Л Ь Н Ы Й
У Н И В Е Р С И Т Е Т

S I B E R I A N
F E D E R A L
U N I V E R S I T Y

Portfolio of scientific supervisors of the participants of the postgraduate track of the International Olympiad of the Global Universities Association

University	Siberian Federal University
Level of English proficiency	C1
Educational program and field of the educational program for which the applicant will be accepted	1.5 Biology 1.5.2 Biophysics
List of research projects of the potential supervisor (participation/leadership)	<p>A new generation of bioluminescent biosensors for environmental monitoring, stress control in biological objects, endotoxigenesis control in the human body for medicine, food quality control, environmental quality control in closed ecosystems for space biotechnology and other applications.</p> <p>Enzymatic tests for measuring total toxicity based on the author's platform technology of bioluminescent biotesting to assess the integral toxicity of water, air and soil using a new biochemical design approach.</p> <p>Mechanisms for stabilizing enzymes and their substrates in viscous and gel-like media.</p> <p>Multicomponent dosed immobilized reagents for bioluminescent analysis.</p> <p>Experimental model of the functioning of enzymes inside a cell by immersing enzymes and their substrates in a viscous microenvironment (molecular crowding).</p>
List of the topics offered for the prospective scientific research	<ul style="list-style-type: none"> • bioluminescent biosensors, • biochemistry of luminous bacteria, • bioluminescence analysis, • enzymatic toxicity biotests, • molecular crowding.
	Biology and biotechnology
	<p>Supervisor's research interests:</p> <ul style="list-style-type: none"> • a new generation of bioluminescent biosensors based on nanotechnology for environmental monitoring, stress control in biological objects, endotoxigenesis control in the human body for medicine, food quality control, environmental quality control in closed ecosystems and other applications. Biochemical design of biotests; • enzymatic bioluminescent biotests for environmental biophysics;



Research supervisor:

Valentina A. Kratasyuk,
Doctor of Science

- mechanisms of inhibitory analysis and patterns of effects of compounds on bioluminescent systems;
- immobilized reagents for bioluminescent analysis;
- evolution of bioluminescent organisms. Antioxidant mechanisms of the occurrence and evolution of bioluminescence;
- experimental modeling of enzymatic processes in cell hyaloplasm;
- comparative analysis of the increasing role of science in education at universities in Russia and the USA, development of a model of scientific and educational structure for universities in Russia;
- bioluminescent biotechnologies for education.

Research highlights:

Research in the Laboratory of Bioluminescent Biotechnologies, founded by Professor Osamu Shimomura, winner of the 2008 Nobel Prize in Chemistry, and in the research laboratories of the Department of Biophysics of the Institute of Fundamental Biology and Biotechnology of the Siberian Federal University uses unique equipment in collaboration with Russian and foreign scientists and research centers. Financial support for a graduate student is possible.

Supervisor's specific requirements:

- Basic education in the field of natural sciences (biology, physics, medicine, ecology, computer science, etc.),
- Knowledge of English or Russian language.

Supervisor's main publications:

1. Esimbekova E.N., Torgashina I.G., Kalyabina V.P., Kratasyuk V.A. Enzymatic Biotesting: Scientific Basis and Application // Contemporary Problems of Ecology, 2021, Vol. 14, No. 3, pp. 290–304. DOI: 10.1134/S1995425521030069
2. Esimbekova Elena N., Kalyabina Valeriya P., Kopylova Kseniya, Torgashina Irina G., Kratasyuk Valentina A. Design of bioluminescent biosensors for assessing contamination of complex matrices, *Talanta*, 2021, 233: 122509.
3. Kratasyuk V. A., Kolosova E.M., Sutormin O.S., Lonshakova-Mukina V.I., Baygin M.M., Rimatskaya N.V., Sukovataya I.E., Shpedt A.A. Software for Matching Standard Activity Enzyme Biosensors for Soil Pollution Analysis // *Sensors*. – 2021. – V. 21. – №. 3. – P. 1017
4. Nemtseva Elena, Gulnov Dmitry, Gerasimova Marina A., Sukovatyi Lev A., Burakova Ludmila P., Karuzina Natalya E., Melnik Bogdan S., Kratasyuk Valentina A. Bacterial luciferases from *vibrio harveyi* and *photobacterium leiognathi* demonstrate different conformational stability as

detected by time-resolved fluorescence spectroscopy// International Journal of Molecular Sciences- 2021, 22(19), 10449.

5. Pande Shubhra, Ranjan Rajeev, Ryazanova Maria, Shuvaev Anton N., Salmina Alla B., Kratasyuk Valentina A. Buckwheat-enriched diet alleviates bisphenol A mediated oxidative stress via modulation of sirtuin 1 and antioxidant status in experimental rats// Food Chemistry. - 2022, -Vol. 373, part B: 131507.

Results of intellectual activity:

A biological part has been developed for a new generation of bioluminescent biosensors for environmental monitoring, stress control in biological objects, endotoxigenesis control in the human body for medicine, food quality control, environmental quality control in closed ecosystems for space biotechnologies and other applications.

A new direction of bioluminescent analysis has been proposed and justified - enzymatic tests for measuring total toxicity. A platform technology for bioluminescent biotesting is proposed. Biotests have been developed to assess the integral toxicity of water and air. A new approach for the biochemical design of enzymatic bioassays is proposed.

The mechanisms of stabilization of enzymes and their substrates in viscous and gel-like media have been studied.

New methods have been proposed for obtaining multicomponent dosed immobilized reagents for bioluminescent analysis.

A new approach is proposed for developing an experimental model of the functioning of enzymes inside a cell by immersing enzymes and their substrates in a viscous microenvironment.