



Maxim Miroshnichenko

Mathematical modeling | Systems biology | Bioinformatics

Sirius University of Science and Technology, Sirius, Russia

Research interests

My research focuses on mechanistic modeling of biological systems, particularly immune response dynamics and regulated cell death. I am interested in how intracellular signaling mechanisms, such as TNF-mediated necroptosis, can be connected to population-level and tissue-level inflammatory processes.

Current research directions:

- intracellular models of cell death signaling
- within-host models of viral infection and immune response
- multiscale modeling of cell death-driven inflammation
- differential-equation and agent-based models of biological systems
- Julia and Python-based computational workflows

Education

PhD Student in Computational Biology

2023-present

Sirius University of Science and Technology

Computational Biology track

MSc in Information Biology and Bioinformatics

2021-2023

Novosibirsk State University

Faculty of Natural Sciences, Department of Information Biology. GPA: 4.88 / 5

BSc in Biology

2017-2021

Tomsk State University

Biological Institute, Department of Plant Physiology, Biotechnology and Bioinformatics. GPA: 4.875 / 5

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Publications

A modular mathematical model of the immune response for investigating the pathogenesis of infectious diseases

Viruses, 17(5), 589. Published in 2025

Miroshnichenko M. I., Kolpakov F. A., Akberdin I. R. DOI: 10.3390/v17050589.

Citations: 3. Q1 (SCImago). Updated 2026-05-02.

Conference presentations

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| 2026 | Mathematical model of TNF-induced necroptosis with blocked alternative cell death pathways
15th International Multiconference "Bioinformatics of Genome Regulation and Structure/Systems Biology", Novosibirsk, Russia, July 6-11, 2026. Oral presentation in English. |
| 2025 | A modular mathematical model of the immune response for investigating the pathogenesis of infectious diseases
Modern Models and Methods in Mathematical Immunology, Sirius, Russia, November 3-7, 2025. Oral presentation. |
| 2025 | Mathematical model of TNF-induced necroptosis with blocked alternative death pathways
Modern Models and Methods in Mathematical Immunology, Sirius, Russia, November 3-7, 2025. Oral presentation. |
| 2024 | 14th International Multiconference "Bioinformatics of Genome Regulation and Structure/Systems Biology"
Mathematical Immunology section, Novosibirsk, Russia, August 5-10, 2024. Oral presentation in English. |
| 2022 | Applied Mathematics of Immunology and Virology
Sochi, Russia, November 14-18, 2022. Oral presentation. |
| 2022 | 13th International Multiconference "Bioinformatics of Genome Regulation and Structure/Systems Biology"
Mathematical Immunology section, Novosibirsk, Russia, July 4-8, 2022. Oral presentation in English. |

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| 2022 | 60th International Scientific Student Conference
Bioinformatics section, Novosibirsk, Russia, April 10-20, 2022. Oral presentation. |
| 2020 | International Forum "Biotechnology: State and Prospects of Development"
Moscow, Russia, October 28-30, 2020. Conference abstract. |
| 2020 | LXIX Scientific Student Conference of the Biological Institute "Start in Science"
Tomsk, Russia, April 20–24, 2020. Oral presentation. |

Research projects

Clonal hematopoiesis and solid tumor treatment

Hybrid ODE/SDE and agent-based modeling

Development of a hybrid mathematical model combining ODE/SDE systems with an agent-based approach to study how mutations in hematopoietic stem cells shape clonal hematopoiesis and influence treatment response in solid tumors.

Within-host SARS-CoV-2 infection and immune response

Multiscale within-host dynamics

Development of a multiscale within-host model of SARS-CoV-2 infection in the respiratory tract, combining ODE/SDE dynamics, agent-based modeling, spatial viral spread, inflammation, intracellular cell death processes, and fibrosis development.

TNF-mediated necroptosis

Mechanistic intracellular signaling model

Development of a mechanistic ODE model of TNF-mediated necroptosis that extends classical cytoplasmic signaling descriptions by explicitly incorporating nuclear translocation and compartment-specific protein dynamics.

Additional academic activities

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| 2023 | Mathematical Modeling in Drug Development
Sirius University, Sochi, Russia, April 24-29, 2023. Scientific school and workshop. |
| 2021 | SBB-2021 & PlantGen School 2021 Young Scientists Multischool
Novosibirsk State University, Novosibirsk, Russia, October 4-9, 2021. Scientific school. |

2022-2023 Vladimir Potanin Scholarship

Scholarship recipient.

2020/2021 I Am a Professional Olympiad, 4th season

Winner, Biology track, Bachelor's category.

Technical skills

Programming

Julia, Python, R, JavaScript

Bioinformatics

Genomic, transcriptomic and metagenomic data analysis; functional enrichment analysis

Languages

Russian (native), English (B2/C1)

Mathematical modeling

ODEs, DDEs, SDEs, agent-based models, dynamical systems, optimization

Computational tools

Git, GitHub, Bash, Linux, Docker, Conda, LaTeX, Quarto