Dr. Olga O. Bochkareva (Dranenko)

Date of Birth: Sept. 10, 1988
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List of all publications: https://orcid.org/0000-0003-1006-6639
Languages: English (fluent), German (A1), Russian (native)

Research interests:

- Architecture and evolution of bacterial chromosomes: genome rearrangements, horizontal gene transfer, homologous recombination, multi-chromosome bacterial species.
- Evolution of protein sequences and operons structure.
- Evolution of bacterial communities: pan-genomics, metagenomics, taxonomy.
- Pathogenicity, resistance, microbe-host interactions.

Work experience:

June 2019 - present postdoctoral researcher, Institute of Science and Technology, Vienna, Austria. Prof. Fyodor Kondrashov group.

2017- 2019 junior research scientist, Department of Life Sciences, Skolkovo Institute of Science and Technology, Moscow, Russia

2012- 2019 junior research scientist, Kharkevich Institute for Information Transmission Problems RAS, Moscow, Russia

Education:

2012–2019 Ph.D., Kharkevich Institute for Information Transmission Problems RAS. PhD thesis: *"Reconstruction of evolutionary history of genome rearrangements in bacteria",* Supervisor: *Prof. Mikhail S. Gelfand.*

2010–2012 Master of Science (applied mathematics and physics), Department of Molecular and Biological Physics, Moscow Institute of Physics and Technology. Master thesis *"Bacterial microevolution and genome rearrangements",* Supervisor: *Prof. Mikhail S. Gelfand.*

2005–2010 Bachelor of Science (applied mathematics and physics), Department of Molecular and Biological Physics, Moscow Institute of Physics and Technology. Bachelor thesis "The convergence of the over-relaxation method depending on the iteration parameter choice for the 2-D Poisson equation", Supervisor: *Prof. Sergey Surzhikov*, Ishlinsky Institute for Problems in Mechanics RAS.

Funding and Awards:

2022-2025 ESPRIT Programme ("Early Stage Programme: Research, Innovation and Training"), funding from **Austrian Science Fund**, total amount – **294.015€**.

2019-2021 ISTplus postdoctoral fellowship. Funding from the European Union's Horizon 2020 research and innovation programme under the **Marie Skłodowska-Curie grant** agreement No 754411

Publications:

8 peer-reviewed publications, 3 first and 3 last authorships, 77 citations (GoogleScholar on 20/11/2022)
(- equal contribution)*

1. Maximilian Baumgartner, Rebecca Zirnbauer, Sabine Schlager, Daniel Mertens, Nikolaus Gasche, Barbara Sladek, Craig Herbold, **Olga Bochkareva**, Vera Emelianenko, Harald Vogelsang, Michaela Lang, Anton Klotz, Birgit Moik, Athanasios Makristathis, David Berry, Stefanie Dabsch, Vineeta Khare, Christoph Gasche Atypical enteropathogenic E. coli are associated with disease activity in ulcerative colitis **Gut Microbes,** 2022, Nov 22; 14(1):2143218 *https://doi.org/10.1080/19490976.2022.2143218*

2. Natalia O Dranenko, Maria Tutukina, Mikhail S. Gelfand, Fyodor Kondrashov, **Olga O Bochkareva** Chromosome-encoded IpaH ubiquitin ligases indicate non-human pathogenic *Escherichia* **SciRep** 2022 Apr 27, 12:6868 doi: 10.1038/s41598-022-10827-3

3. Alexey Zabelkin, Yulia Yakovleva, **Olga Bochkareva**[*], Nikita Alexeev[*] **(last co-authorship)**. PaReBrick: PArallel REarrangements and BReaks identification toolkit. **Bioinformatics** 2021 Oct 03; 38(2):357-363 https://doi.org/10.1093/bioinformatics/btab691

4. Zaira Seferbekova, Alexey Zabelkin, Yulia Yakovleva, Robert Afasizhev, Nikita Alexeev, Mikhail S Gelfand, **Olga O Bochkareva (last authorship)** High rates of genome rearrangements and pathogenicity of *Shigella* spp. **Frontiers Microbiology** 2021 Apr 12; 12:831. doi:10.3389/fmicb.2021.628622

5. Olga Sigalova, Andrei V Chaplin, **Olga O Bochkareva**, Pavel V Shelyakin, Vsevolod A Filaretov, Evgeny E Akkuratov, Valentina Burskaya, Mikhail S Gelfand *Chlamydia* pan-genomic analysis reveals balance between host adaptation and selective pressure to genome reduction. **BMC Genomics.** 2019 Sep 12;20(1):710. doi: 10.1186/s12864-019-6059-5.

6. Pavel V Shelyakin*, **Olga O Bochkareva***, Anna A Karan, Mikhail S Gelfand **(first co-authorship)** Micro-evolution of three *Streptococcus* species: selection, antigenic variation, and horizontal gene inflow. **BMC Evol. Biol.** 2019. Mar 27;19(1):83. doi: 10.1186/s12862-019-1403-6.

7. **Olga O Bochkareva**, Elena V Moroz, Iakov I Davydov, Mikhail S Gelfand Genome rearrangements and selection in multi-chromosome bacteria *Burkholderia* spp. **BMC Genomics**. 2018 Dec 27;19(1):965. doi: 10.1186/s12864-018-5245-1.

8. **Olga O Bochkareva**, Natalia O Dranenko, Elena S Ocheredko, German M Kanevsky, Yaroslav N Lozinsky, Vera A Khalaycheva, Irena I Artamonova, Mikhail S Gelfand Genome rearrangements and phylogeny reconstruction in *Yersinia pestis*. **PeerJ**. 2018 Mar 27;6:e4545. doi: 10.7717/peerj.4545.

Preprints and submitted papers:

Invited Talks

1. Detection of genome rearrangements responsible for bacterial phenotype switching. **2022 Helmholtz Institute for Pharmaceutical Research Saarland (HIPS)** Saarland, Germany
2. How bacteria switch to dark side. 2022 **SMTB'22 University of Tartu,** Tartu, Estonia
3. Microbes: taxonomy, genome structure and molecular evolution **2022** workshop organized by **Institute of Bioinformatics (online)**
4. Role of genome rearrangements in formation of bacterial phenotypes, **2021 EMBL, Heidelberg** Germany
5. Comparative genomics of prokaryotes (cookbook), **2020** Summer School of **Bioinformatics Institute**, **online**
6. Structure and evolution of bacterial chromosomes **2019 Bioinformatics Institute** Open Lectures series, St. Petersburg, Russia

7. Comparative genomics of prokaryotes (cookbook), **2019** workshop organized by **Bioinformatics Institute**, St. Petersburg, Russia

Conference Talks:

1. Detection of genome rearrangements responsible for bacterial phenotype switching. **SASBi'22** Stellenbosch, South Africa
2. Evolutionary benefits of bacterial genomes with chromids **MCCMB'21** Moscow, Russia
3. Genome rearrangements in bacteria. **BiATA'19** St. Petersburg, Russia
4. Evolution of bacterial chromosomes. **Chromosome'18** Novosibirsk, Russia

Supervised students:

2021 *Natalia Dranenko, IITP RAS, Russia*
The Classification of *ipaH* Genes in *Shigella* and Enteroinvasive *Escherichia*, **MCCMB'21** poster presentation
published in SciRep doi: 10.1038/s41598-022-10827-3
2021 *Ariadna Semenova, Moscow State University, Russia*
Insertion sequences in *B. mallei*: adaptation to intracellular lifestyle, **MCCMB'21** poster presentation

2020 *Yulia Yakovleva, Alexey Zabelkin* *Bioinformatics Institute, Russia*
PaReBrick: PArallel REarrangements and BReakpoints identification toolkit
published *in* **Bioinformatics** *doi:10.1101/2021.05.18.444676*

2020 *Kristina Perevoshchikova, Moscow State University, Russia*
Evolutionary benefits of bacterial genomes with chromids, **MCCMB'21** oral presentation

2019 *Zaira Seferbekova, Moscow State University, Russia*
Impact of mobile elements into pathogenicity of *Shigella*
published in *Frontiers Microbiology 10.1186/s12862-019-1403-6*
2019 Moldir Zhiyenbayeva, graduate student at HSE, Moscow, Russia. Co-advising **master project**
"Comparative Genomics of *Bacillus* spp.*"*. PI: Mikhail Gelfand.
2018 Natalia Dranenko, graduate student at MIPT, Moscow, Russia. Co-advising **bachelor project**
"Reconstruction of OxyR ancestor sequence in bacteria". PI: Mikhail Gelfand.

Collaborations:

2021-present Dr. Roderich Kromhild, IST Austria, Klosterneuburg, Austria. Project: Fitness effects of short random peptides.

2020-2022 Dr. Nikina Alexeev, ITMO University, Saint Petersburg, Russia. Project: Development of the bioinformatic toolkit for whole-genome analysis.

2020-present Dr. Michaela Lang, Medical University of Vienna, Vienna, Austria. Project: Genetic factors under biofilms formation in pathogenic *E.coli*.

2016-2018 Prof. Marc Robinson-Rechavi, Evolutionary Bioinformatics Lab, Department of Ecology and Evolution, Université de Lausanne, Lausanne, Switzerland. Project: Positive selection and horizontal gene transfer in prokaryotes.

2010-2014 Prof. Pavel Pevzner, University of California at San Diego, California, USA. Project: Application of the MGRA (Multiple Genome Rearrangements and Ancestors) algorithm to microbial data.

Management experience:

Summer School of Theoretical and Molecular Biology (https://molbioschool.org/en/)

- **2020 – 2022 Vice-director** - recruiting project leaders, lecturers and course instructors; design of lectures and courses; management of courses execution and labs; and moderation of scientific discussions.
- **2020 – 2022 Head of Laboratory** – 4 project leaders and 4-6 students.
- **2016 – 2019 Project Leader** - design and supervision a research-based teaching project.

Teaching experience:

Lecturer/course instructor:

Designed and delivered courses

- **Fall 2020 "Comparative genomics of prokaryotes"**, course for master students (Bioinformatics Institute, St Petersburg, Russia), in Russian. Final evaluation by students: 9.3 out of 10 (the highest evaluation across all courses during the term)

Teacher assistant:

Designed and delivered selected lectures and labs, prepared and supervised course projects and home assignments

- **Spring 2019 "Bioinformatics"**, course for master and PhD students (Skoltech, Moscow, Russia), in English
- **Autumn 2018 "Comparative Genomics",** course for master and PhD students (joint program Skoltech/HSE, Moscow, Russia), in English

Reviewer:

in Microbial Genomics, BMC Genomics, GENE, Journal of Bioinformatics and Computational Biology, PeerJ, Frontiers Microbiology

Professional skills:

Bioinformatics (comparative and evolutionary genomics)

genome assembly and annotation, phylogeny reconstruction, rearrangements reconstruction, sequences alignment, ancestral sequences reconstruction, HGT identification, selection identification, statistics. See also a list of specialized tools I use in my CookBook.

Programming: (Bio-)Python, R

Academic writing *(+LaTeX),* ***data visualization***