PhD Studentship in Microbial Biology and Evolution

Position: PhD student, starting from 1st January 2027

Scientific disciplines: Life Sciences, Microbiology, Microbial Genomics, Evolutionary Biology, Infection Biology

Stipend amount/month: Up to 5,000 PLN net per month; increased to 8,600 PLN net per month upon admission to the doctoral school, and to 9,700 PLN net per month after a positive midterm evaluation in the third and fourth years.

Period of stipend agreement: 48 months

Institution: University of Warsaw

Laboratory: Laboratory of Microbial Evolution and Mutagenesis, Centre of Biological and Chemical Research

Projects leader: Dr Chris Ruis (cr628@cam.ac.uk)

Application deadline: 29/04/2026

Candidates are encouraged to first contact the project leader via the email above to discuss the position, projects and ask any questions they may have.

Potential project titles (see project abstracts below)**:**

1. **Identifying bacterial transmission routes and host species through mutational signatures.** Computational analysis of genetic sequences from a broad diversity of bacteria to identify and apply mutational signatures.
2. **Experimental measurement of microbial mutational signatures.** Measurement of ground truth mutational signatures for mutagens, DNA repair genes, bacterial polymerases and other factors through experimental methods and high throughput sequencing.

Key responsibilities:

1. Drive forwards a research program on computational or laboratory analysis of microbial mutational signatures.
2. Co-development of research directions; execution of experiments and data analysis; interpretation and presentation of results; discussion of next steps.
3. Literature review where needed.
4. Prioritisation of research activities.
5. Problem solving to enable new research directions and overcome challenges.
6. Active participation in lab meetings (presentation and discussion), seminars and scientific conferences.

7. Collaborative discussions with team members and broader research networks; assistance in other projects where appropriate.
8. Preparation of manuscripts for publication of results in scientific journals.
9. Focus on personal development and gaining new skills.
10. (Optional) Readiness to conduct research visit in a partner institution if appropriate (e.g. University of Cambridge, University of Melbourne).
11. The successful candidate is expected to enroll in one of the Doctoral Schools of the University of Warsaw https://szkolydoktorskie.uw.edu.pl/en/

Candidate competencies and skills:

- Ability to collaborate with others in the Team and broader research environment
- Desire to consistently learn, improve, expand knowledge and push their work forwards
- Strong interest in microbial biology, evolution and/or genomics
- Ability to effectively communicate ideas and results and present orally to groups
- Strong attention to detail
- Ability to take initiative, prioritise, work independently and solve problems
- Motivation and commitment to execute a comprehensive research program
- Very good level of spoken and written English (interview and meetings will be carried out in English)
- Master's degree (completed or to be completed by mid-September 2026) in microbiology, computational biology, virology, bioinformatics or a related discipline

For computational project:

- Basic programming skills, for example in bash, python or R
- Experience in analysis of genetic sequence data and phylogenetics is desirable

For wet lab project:

- Laboratory experience in microbiology, molecular biology or genetics

Required documents

1. Short motivation letter including (1) which project(s) you are applying for, (2) your research interests, (3) your research experience, and (4) how your experience and interests fit with the proposed project.

2. Curriculum vitae including a detailed description of the academic degrees, titles of theses, names and affiliations of supervisors, places of employment, list of scientific publications, conferences, awards and trainings.

3. Address details of at least one direct supervisor/scientist who may recommend the given candidate.

4. Copies of obtained diplomas.

5. For the purpose of the recruitment process, please attach a scan of signed, written permission for recruitment-related personal data processing. This should state: “I give permission to the University of Warsaw, registered at the address of ul. Krakowskie Przedmieście 26/28, 00-927 Warszawa, to process my personal data for the purposes of carrying out the recruitment procedure, choosing the employee, and entering into an employment contract with the University of Warsaw, if applicable. I have been informed about my legal rights and obligations in relation to these actions. I acknowledge that providing the aforementioned personal data is done by me on a voluntary basis.”

Project abstracts

1. **Identifying bacterial transmission routes and host species through mutational signatures.**

We currently lack effective strategies to prevent pathogen infections and zoonotic spillover events, despite their major impacts on human and animal health. Infection control efforts are greatly hampered by poor understanding of transmission routes and natural host species, which are difficult to detect directly. Over the past few years, we have discovered that mutational signatures (specific patterns of nucleotide substitution caused by mutagenic and repair processes) are a new way to prevent pathogen infections and detect spillover events by identifying transmission routes and host species in real time.

Microbes that transmit through different routes and live in different hosts are exposed to distinct sets of mutagens. Each mutagen damages DNA in a specific way and therefore leaves a characteristic context-dependent pattern of mutations that is referred to as a mutational signature. Therefore, the exposure to distinct sets of mutagens means that transmission routes and host species leave specific characteristic mutational signatures within pathogen genomes.

We have identified specific mutational signatures using our software tool MutTui (**Ruis** et al *bioRxiv* 2023) and applied these to (i) identify dominant and novel transmission routes for clinically impactful bacteria (**Ruis** et al *Nature Microbiology* 2021; **Ruis** et al *Nature Communications* 2023), (ii) infer host species driving outbreaks and thereby guide World Health Organization guidelines for outbreak cessation (**Ruis** et al *Nature Medicine* 2024; **Ruis** et al *Nature Medicine* 2025; **Ruis** et al *bioRxiv* 2025), (iii) rapidly reveal virulence of emerging pathogen lineages (**Ruis** et al *Microbial Genomics* 2023), and (iv) demonstrate the emerging impacts of antiviral drug therapy leading to changes in global prescription guidelines (Sanderson, …., **Ruis** *Nature* 2023). We have found additional mutational signatures associated with biological differences between bacteria (**Ruis** et al *Nature Communications* 2023).

These analyses have demonstrated the potential for mutational signatures to transform the way we prevent pathogen infections and zoonotic spillovers. However, we currently lack mutational signatures for many transmission routes, host species and biological processes, which limits the inferences that we can make.

In this project, we will carry out large scale comparisons of mutational patterns across a broad diversity of pathogenic and commensal bacteria to computationally extract mutational signatures associated with transmission routes, host species, environmental factors and bacterial biology. We will then apply these signatures to identify dominant transmission routes for clinically impactful bacteria (for example, *Acinetobacter baumannii* and *Pseudomonas aeruginosa*), major host species for multi-host bacteria (for example, *Staphylococcus aureus*) and biological differences between pathogens. We will also examine the impact of variation in mutational signatures across lineages and timescales on pathogen evolution.

The project will involve curation of large existing genomic datasets, phylogenetic and phylodynamic analyses, integration of sample metadata, calculation of mutational spectra (the overall patterns of mutation), extraction of mutational signatures and development of applications for public health.

Depending on the direction of the project, there may be opportunities to develop novel methods to calculate mutational signatures in microbiome samples and/or extract mutational signatures of environmental mutagens.

2. Experimental measurement of microbial mutational signatures.

We currently lack effective strategies to prevent pathogen infections and zoonotic spillover events, despite their major impacts on human and animal health. Infection control efforts are greatly hampered by poor understanding of transmission routes and natural host species, which are difficult to detect directly. Over the past few years, we have discovered that mutational signatures (specific patterns of nucleotide substitution caused by mutagenic and repair processes) are a new way to prevent pathogen infections and detect spillover events by identifying transmission routes and host species in real time.

Microbes that transmit through different routes and live in different hosts are exposed to distinct sets of mutagens. Each mutagen damages DNA in a specific way and therefore leaves a characteristic context-dependent pattern of mutations that is referred to as a mutational signature. Therefore, the exposure to distinct sets of mutagens means that transmission routes and host species leave specific characteristic mutational signatures within pathogen genomes.

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One major current challenge is ascribing drivers to mutational signatures. Previous experimental work in human cells has measured mutational signatures of individual mutagens and repair genes. However, these signatures may differ in bacteria due to distinct pathways of repair of DNA damage.

In this project, we will combine experimental methods with high throughput sequencing to measure ground truth mutational signatures associated with a broad range of mutational drivers, including panels of mutagens, DNA repair genes, bacterial genes and polymerases. We will expose bacteria to individual mutational drivers and then sequence to measure the induced patterns. The measured signatures will then be applied to identify drivers of bacterial mutagenesis and to identify transmission routes, host species and active biological processes.

This project will involve cutting-edge laboratory methods including microfluidics, transposon libraries, deep mutational scanning, cloning, mutagenesis, bacterial culture and library preparation, as well as analysis of whole genome deep sequencing data.

Project references

Ruis C, ..., Floto RA, Parkhill J (2023). Mutational spectra are associated with bacterial niche. *Nature Communications*, 14, 7091

Ruis C, ..., Floto RA, Parkhill J (2021). Dissemination of Mycobacterium abscessus via global transmission networks. *Nature Microbiology*, 6, 1279-1288

Sanderson T, ..., **Ruis C** (2023). A molnupiravir-associated mutational signature in global SARS-CoV-2 genomes. *Nature*, 623, 594-600

Ruis C, …., Floto RA (2025). Mutational spectra reveal influenza virus transmission routes and adaptation. *bioRxiv* 2025.11.26.690773

Ruis C, …., Rambaut A (2025). A systematic nomenclature for mpox viruses causing outbreaks with sustained human-to-human transmission. *Nature Medicine*, 31, 2854-2858

Otieno J*, **Ruis C***, …., Subissi L (2024). Global genomic surveillance of monkeypox virus. *Nature Medicine*, 31, 342-350

Ruis C, ..., Parkhill J, Floto RA (2023). A lung-specific mutational signature enables inference of viral and bacterial respiratory niche. *Microbial Genomics*, 9, 001018

Ruis C, …., Parkhill J (2023). Calculating and applying pathogen mutational spectra using MutTui. *bioRxiv*, 2023.06.15.545111

The scholarship will be awarded and carried out within the framework of the project “Identifying bacterial transmission routes, host species and biology through mutational spectra”, 2025/58/E/NZ2/00538 (Sonata Bis).

……..
given and family name

Information on personal data processing

Controller

Controller of your personal data processed in connection with the recruitment process is the University of Warsaw, ul. Krakowskie Przedmieście 26/28, 00-927 Warszawa, as the Employer.

Contact with the controller:

- by traditional mail at: University of Warsaw, ul. Krakowskie Przedmieście 26/28, 00-927 Warszawa (name the organizational unit to which your letter is addressed);
- by phone: 22 55 20 355.

Data Protection Officer (DPO)

Controller has designated Data Protection Officer whom you may contact via email at iod@adm.uw.edu.pl. You may contact the DPO in all matters relating to your personal data processing by the University of Warsaw and the exercise of rights in relation to the processing of personal data.

The DPO, however, does not proceed other matters, like handling recruitment procedures, collecting recruitment documents, providing information on current recruitment process.

Purpose and legal grounds of data processing

Personal data of candidates for employment shall be processed for recruitment purposes only.

Your personal data shall be processed in the scope as indicated by employment law[1] *(given name (names) and family name, date of birth, contact information as provided, education, professional qualifications, previous employment)* for the purposes of this recruitment process[2], whereas other data[3] shall be processed based on your consent which may take the following wording:

I agree to the processing of personal data provided in .... (e.g. CV, cover letter, and other submitted documents) by the University of Warsaw for realising my recruitment process.

[1] Art. 22[1] of the law of June 26, 1974 Labour Code (i.e. Journal of Laws 2019 item 1040 with subsequent changes);

[2] Art. 6 section 1 letter b of the Regulation of the European Parliament and the Council (EU) 2016/679 of April 27, 2016 on protection of individual persons with regard to the personal data processing and on the free flow of such data, and also repealing Directive 95/46/EC (general regulation on data protection) (Official Journal EU L 119 of 04.05.2016, page 1, with subsequent changes) (hereinafter as the GDPR);

[3] Art. 6 section 1 letter a of the GDPR;

If your documents include data as mentioned in Art. 9 section 1 of the GDPR (special categories of personal data), processing shall be possible upon your consent to processing such data[4] which may take the following wording:

I agree to the processing of special categories of personal data, as mentioned in Art. 9 section 1 of the GDPR, provided in ..... (e.g. CV, cover letter, and other submitted documents) by the University of Warsaw for realising my recruitment process.

The University of Warsaw shall be also processing your personal data in future recruitment processes upon your consent[5] which may take the following wording:

I consent to processing of my personal data for the purposes of any future recruitment processes at the University of Warsaw for the period of the next nine months.

You may revoke all such consents at any time by, for example, sending an email at ..... (email address due for the recruitment process).

Be advised that the revocation of your consent does not affect legal compliance of processing which had been completed upon consent before its revocation.[6]

Data retention period

Your personal data collected in this recruitment process shall be stored over the period of three months from the date the recruitment process is completed.

In case you agree to process your data in future recruitments, your data shall be used over the period of nine months.

Data recipients

Officers authorized by the Controller shall have access to your personal data, the processing of which is in the scope of their duties.

Recipients of personal data may be other subjects obligated by the Controller to provide specific services involving data processing, like

.....

(name all recipients of data)

Data transfer outside the European Economic Area (EEA)

Your personal data shall be disclosed to subjects authorized by law. Signing-in is through Google Forms. Your personal data may be also processed by our provider of G-Suit for education by Google Company in their data processing centres.[7] Your data shall be protected under the standards of the Privacy Shield, accepted by the European Commission.[8] This shall guarantee an adequate level of data security.

[4] Art. 9 section 2 letter a GDPR;
[5] Art. 6 section 1 letter a GDPR;
[6] Art. 7 section 3 GDPR;
[7] https://www.google.com/about/datacenters/inside/locations/index.html
[8] https://www.privacyshield.gov

Rights of the data subject

Under the GDPR data subjects have the following rights:

- to access data and to receive copies of the actual data;
- to correct (rectify) your personal data;
- to restrict processing of personal data;
- to erase personal data, subject to provisions of Art. 17 section 3 of the GDPR;
- to file a claim with the President of the Personal Data Protection Office, if you believe data processing violates law.

Information on the requirement to provide data

Providing your personal data in the scope resulting from law is necessary to participate in the recruitment process. Providing other personal data is voluntary.

....

place and date applicant's signature