Short Term Research Stay – Call for Applications

Overview of Research Groups

Nr.	**Academic Field**	**Title of Research Project**	**Project Leader**	**Time period**	**Spots**
1	Biology	Antimicrobial Resistance Evolution	Prof. Jens Rolff	4 May – 24 July	1
2	Chemistry	Theoretical Chemistry - Molecular Dynamics	Prof. Bettina Keller	4 May – 24 July	1
3	Chemistry	Scalable Synthesis and Spray Formulation of Efficient Virucidal Inhibitor	Dr. Ievgen Donskyi	4 May – 31 July	1
4	Computer Science	Post Quantum Cryptography	Prof. Marian Margraf	4 May – 30 June	3
5	Physics (Teaching Methodology)	Supporting Science Teachers' Reflective Practice	Prof. Marcus Kubsch	11 May – 31 July	2

Please send the following documents to strs@international.fu-berlin.de:

- Transcript of Records
- Personal Data Sheet
- Motivational Letter (max. 2 pages)
  Please make sure to explain your motivation regarding the research program and state the title of the research project at the beginning of your motivational letter

In the following, the research group leaders present their research groups and the corresponding placement opportunities.

Project 1

Antimicrobial Resistance Evolution

Name of the Research Project: Antimicrobial resistance evolution
Project Leader: Prof Jens Rolff
Faculty/Department: Department of Biology, Chemistry, Pharmacy; Institute of Biology
Link to Research Group: Rolff Group • Department of Biology, Chemistry, Pharmacy

Offered Spots: 1
Period: 4 May 2026 – 24 July 2026

About the Project: We study the evolution of bacterial resistance against antimicrobial peptides and by comparison to antibiotics. We use experimental evolution combined with genome sequencing. We also investigate how sub-lethal drug concentrations and treatment regimens contribute to the evolution of antimicrobial resistance.

Recent papers of interest include:

Antunes B, Zanchi C, Maron B, Witzany C, Regoes R, Hayouka Z, Rolff J. Evolution of antimicrobial peptide resistance in *Pseudomonas aeruginosa* severely constrained by random peptides. PLOS Biology, *22(7): e3002692.*

Rolff J, Bonhoeffer S, Kloft C, Leistner R, Regoes R, Hochberg M (2024). Forecasting antimicrobial resistance evolution. Trends Microbiol https://doi.org/10.1016/j.tim.2023.12.009
Rodriguez-Rojas A., Baeder, D, Johnston P, Regoes R and Rolff, J (2021) Bacteria primed by antimicrobial peptides develop tolerance and persist. PLoS Pathogens, doi.org/10.1371/journal.ppat.1009443
Lazzaro B, Zasloff M, Rolff J (2020) Antimicrobial Peptides: application informed by evolution. Science, 368, eaau5480.

Prerequisites:

Basic microbiological skills are required

Project 2

Theoretical Chemistry - Molecular Dynamics

Name of the Research Project: Theoretical Chemistry – Molecular Dynamics
Project Leader: Prof Bettina Keller
Faculty/Department: Department of Biology, Chemistry, Pharmacy; Institute of Chemistry
Link to Research Group: https://www.bcp.fu-berlin.de/en/chemie/chemie/forschung/PhysTheoChem/agkeller/index.html

Offered Spots: 1
Period: 4 May 2026 – 24 July 2026

About the Project:

The research group of Prof. Dr. Bettina Keller at the Department of Biology, Chemistry, and Pharmacy (Freie Universität Berlin) works in the field of Theoretical and Computational Chemistry. We use molecular simulations and statistical methods to investigate how molecules move, react, and self-organize. A central theme of our work is the development and application of molecular dynamics simulations to study kinetic processes in complex chemical systems, ranging from biomolecules to soft materials.

We offer the opportunity to participate in 2–3 month research internships that provide hands-on experience with computational chemistry tools and current research questions. Depending on interest, student projects can contribute to one of the following areas:

1. Method development for enhanced sampling and dynamical reweighting
How can we accelerate molecular simulations and extract reliable kinetic and thermodynamic information? This project focuses on algorithmic advances for rare-event sampling and statistical reweighting of simulation data.
https://doi.org/10.1146/annurev-physchem-083122-124538

2 Self-assembly processes in peptide-based hydrogels
Short peptides can spontaneously assemble into nanostructures with applications in biomedicine and materials science. In this project, simulations are used to unravel the molecular mechanisms of peptide aggregation and gel formation.
https://doi.org/10.1021/acs.biomac.3c01225

3 Allostery and the role of phytic acid as an allosteric ligand
Many proteins are regulated by allosteric interactions, where binding at one site changes activity at another. Here, simulations help us understand how the small molecule phytic acid modulates protein function.
https://doi.org/10.1073/pnas.2419263122

4 Modeling chemical reactions with machine-learned force fields
Modern machine-learning methods can be trained to reproduce quantum-chemical calculations and used in molecular dynamics. This project explores how such force fields can be applied to study chemical reactivity.
https://doi.org/10.1002/jcc.27529

These placements are a chance to gain practical experience with molecular modeling, simulation software, and data analysis, and to work as part of an international research team.

Prerequisites: Prior programming or simulation experience is helpful but not strictly required—most important is motivation and curiosity about molecular processes at the atomic scale.

Please state in your motivational letter which research project you would be interested in and detail any prior experience with physico-chemical modelling, computational methods or programming.

Project 3:

Scalable Synthesis and Spray Formulation of Efficient Virucidal Inhibitor

Name of the Research Project: Scalable synthesis and spray formulation of efficient virucidal inhibitor.
Project Leader: Ievgen Donskyi
Faculty/Department: Department of Biology, Chemistry, and Pharmacy
Link to Research Group:
https://www.bcp.fu-berlin.de/en/chemie/chemie/forschung/OrgChem/donskyi/index.html
Offered Spots: 1
Period: 04 May 2026 - 31 July 2026

About the project: This project focuses on the scaling and optimization of efficient pathogen-destroying systems for antiviral applications. The Internship student will adapt and refine the synthesis protocol that was previously fully developed and optimized in our group previously to enable gram-scale production of selected antiviral agents. The goal is to establish process suitable for potential large-scale manufacturing.
Student will get support from PhD student and the technician from my group. In addition, the project will investigate different antiviral formulations, such as spray, with emphasis on their stability, shelf life, and antiviral efficiency. Together with the postdoctoral researcher from
WP1 and the PhD student from WP3, the internship student will confirm the efficacy of materials in in vitro studies to optimize the composition and determine the required amounts of active components and additives.
Ultimately, the project aims to develop a stable and effective antiviral spray formulation containing pathogen-destroying agents suitable for further industrial applicability.

Prerequisites: This project is primarily intended for Bachelor students.
Applicants should have solid basic laboratory skills in chemistry, typically acquired during practical courses within a Bachelor program.
Experience with standard synthetic techniques is required, and familiarity with handling air- and moisture-sensitive compounds using a Schlenk line and glovebox is highly desirable. A careful and safety-conscious working style, as well as the ability to document and interpret experimental results, is expected.

Project 4:
Post Quantum Cryptography

Name of the Research Project: Post Quantum Cryptography
Project Leader: Marian Margraf
Link to research group:
Informationssicherheit • Fachbereich Mathematik und Informatik
Offered Spots: 3
Period: 1 May 2026 – 30 June 2026

About the Project: The aim is to develop cryptographic protocols that are resistant to attacks using quantum computers. In particular, hybrid and crypto-agile protocols are to be developed for use in the automotive and financial sectors.

Prerequisites: Experience in the field of cryptography

Project 5:
Supporting Science Teachers' Reflective Practice

Project Leader: Marcus Kubsch
Department: Department of Physics
Link to research group:
Research Group Kubsch • Physics • Creating Fundamentals for Future Innovations
Offered Spots: 2
Period: 11 May 2026 – 31 July 2026

About the Project:

Reflection is a cornerstone of professional growth for science teachers. Through reflection, teachers can analyze their classroom experiences, connect practice with theory, and continuously refine their instructional strategies. However, reflective practice is also inherently challenging. It requires time, structure, and often external feedback to move beyond surface-level descriptions toward deeper insights about teaching and learning. Many teachers struggle to engage in sustained, critical reflection without dedicated support or guidance.

Recent advances in generative artificial intelligence (GenAI) offer promising new ways to scaffold teachers' reflection. Large Language Models (LLMs) such as ChatGPT can analyze written reflections and provide structured feedback or act as interactive conversational partners to stimulate deeper thinking. This opens new opportunities for supporting teacher professional development—especially in contexts where personal mentoring is limited.

In this project, you will explore how GenAI can effectively support science teachers' reflective practice. Depending on your interests, you can pursue one of two directions. In a data-analytic trajectory, you will examine to what extent LLMs can automatically generate valid and meaningful feedback on teachers' reflective texts. Alternatively, in a design-oriented trajectory, you will develop and test a prototype of an interactive AI-based system that encourages teachers to engage in deeper reflection.

Throughout the project, you will receive close supervision and methodological support. You will learn how to work with AI tools, conduct small-scale empirical studies or prototype evaluations, and analyze qualitative or quantitative data. The project combines cutting-edge research on AI in education with a clear practical relevance for teacher professional learning, and it has the potential to contribute to both scientific and practitioner-oriented publications.

Prerequisites:

Students should have a strong interest in science education, teacher learning, or educational technology. Basic familiarity with concepts of reflective practice and teacher professional development is helpful but not required. Depending on the chosen project direction, additional skills are advantageous but not strictly required:

- For the data-analytic trajectory, basic experience with text analysis, programming (e.g., Python or R), or prompt-based interaction with large language models (LLMs) will be useful.
- For the design-oriented trajectory, interest or experience in user-centered design, prototyping (e.g., with web-based tools or low-code interfaces), or educational innovation is beneficial.

In both cases, students should be motivated to engage critically with AI tools in an educational context and be willing to combine conceptual, methodological, and practical work. Good written English skills and an openness to interdisciplinary collaboration are also expected.

No prior expertise in artificial intelligence or machine learning is necessary—conceptual and technical guidance will be provided throughout the project.