

Virtually all organisms across the tree of life are infected with viruses. In bacteria, those viruses are called phages and are the most abundant biological entities on our planet. The long-term arms race between bacteria and phages led to the emergence of a large repertoire of defense systems that protect bacteria against infection, together defining bacterial immunity. In turn, phages have developed multiple anti-defense proteins to evade immunity and restore infection.

Bacterial immunity has long been considered limited to restriction-modification and CRISPR-Cas systems, which happen to be absent in eukaryotes. As a result, prokaryotic and eukaryotic immunity have long been considered very distinct. However, dozens of defense systems against phages were recently discovered in bacterial genomes, revealing that some components of our own immune system have a deep evolutionary origin in bacterial defenses against phages. In turn, the existence of immune mechanisms shared between prokaryotes and eukaryotes suggests that phages and eukaryotic viruses encode similar strategies to evade immunity.

The Microbial Molecular Genomics lab led by Dr. François Rousset exploits phage-bacteria interactions to investigate the molecular basis of innate immunity all across the tree of life. We are seeking motivated students for an ambitious project using computational structural genomics to detect long-range conservation of defense and anti-defense strategies across the tree of life. The candidate will (i) predict thousands of protein structures from viruses with AlphaFold; (ii) use cutting-edge structural homology searches to detect similar proteins in high-throughput; (iii) perform phylogenetic analyses to explore the evolutionary history of conserved proteins; (iv) implement a web-based visualization tool to disseminate the results.

Your profile

Candidates must have a deep curiosity for fundamental research and a sense of teamwork. Good computational skills (Python/Unix) and communication skills in English are required.

Contact

Candidates should send a CV and letter to François Rousset (francois.rousset@inserm.fr).

Relevant publications

- Nomburg, J. et al. (2024). Birth of protein folds and functions in the virome. *Nature*.
- Rousset, F., et al., (2023). A conserved family of immune effectors cleaves cellular ATP upon viral infection. *Cell*.
- Rousset, F. (2023). Innate immunity: the bacterial connection. *Trends in Immunology*.
- Rousset, F. & Sorek, R. (2023). The evolutionary success of regulated cell death in bacterial immunity. *Current Opinion in Microbiology*.



About CIRI

The CIRI gathers 400 researchers exploring the biology of pathogens and their interactions with their host, with the long-term aim to better combat infectious diseases and other immune-related diseases. The CIRI develops cutting-edge research at the intersection of bacteriology, virology and immunology and is supported by extensive scientific facilities. Our group is based in the modern Rosalind Franklin building, a few meters away from the Gerland park