

Title: Turbulent Partners: Unravelling Host-Virus Coevolution in Dynamic Environments

Main Supervisor: Wolfram Moebius, **Co-Supervisors:** Daniel Kattnig, Adam Monier

Project:

Coevolution is the process of species evolving together and influencing each other's evolutionary path. For a system of microbes and viruses, this entails an ongoing dynamic of the host microbe evading infection and the virus overcoming this protection. When fluid flow drives these partners apart, several questions arise: How will past coevolution affect the interactions with new partners? What happens when descendants encounter each other, again through fluid flow? Understanding these questions is essential for understanding evolution in the ever-changing world of aqueous ecosystems.

You will address these questions with physical modelling, simulations, and analytical calculations. You will build agent-based and concentration-based models of host and virus population dynamics and evolution whose dynamics will be affected by an external flow field. Depending on your interest, there will be an opportunity to test some of the simulation results using a laboratory model system.

You will join a supervisory team that is dedicated to research at the interface of physics and biology with significant research experience in model building and simulations: Wolfram Moebius, a physicist with research experience and interest in evolution of bacterial viruses; Daniel Kattnig, a physicist and expert in large-scale simulations; Adam Monier, a marine biologist with particular interest in the ecology and evolution of microbes and their viruses.

The project represents an opportunity to develop sought-after skills in modelling and simulation at the interface of physics and biology as well as the interface of basic and more applied research.