



CHEMICAL COMMUNICATION IN ECOLOGICAL SYSTEMS

Application Call 2024 - Project 1

Structural basis of two-component system signaling

Supervisors:

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Background:

As bacteria explore new habitats, go to war with competitors or collaborate against common enemies, they rely heavily on intra- and interspecies communication and precise molecular scouting of their environment. So-called two-component systems (TCS) are essential molecular communication modules in quorum sensing and enable bacteria to probe and react to environmental cues (e.g. redox state, nutrients, pH). Prototypical TCS consist of a membrane-bound histidine kinase (HK) with an extracellular sensor domain, a transmembrane region, and an intracellular kinase domain as well as a soluble response regulator that acts as a dedicated transcription factor. Despite their importance in all areas of intra- and interspecies signalling, the molecular basis of TCS-activation and regulation, as well as the structural interplay of the three elements (signal molecule-histidine kinase-response regulator) are not well understood.

Project description:

In this project, you will use state of the art structural, biophysical and biochemical approaches to determine how a two component sensing system works. Specifically, you will use these methods to elucidate the allosteric pathways between the histidine kinase's sensor and kinase domain. Embedded in a highly interdisciplinary team, you will explore how bacterial and plant-derived signalling molecules activate and shape two component system signalling. Methods include protein biochemistry, microbiology, functional assay development, NMR spectroscopy, cryo-electron microscopy and/or X-ray crystallography, natural product extraction and analysis and molecular dynamics simulations.

Candidate profile:

We seek a dedicated team player enthusiastic about the structure, function and dynamics of membrane proteins. Successful candidates will have an MSc in Biochemistry, Chemistry, Molecular Biology, Biophysics or a related discipline. Prior experience with protein purification, molecular biology and/or structural biology methods is an advantage. Proficiency in English (writing and oral) is necessary.