MATHEMATICAL MICROBIAL RESOURCE MANAGEMENT

Background

KERMIT is a partner in the most important Belgian research program "Interuniversity Attraction Poles (IAP) Phase VII" of the Belgian Federal Science Policy Office, entitled "Microbial Resource Management (MRM) in engineered and natural ecosystems (μ-manager)". This IAP will focus on developing knowledge to generate research hypotheses for MRM, which will enable us to develop novel products and processes, and to improve our environment in the most sustainable way. During the course of the IAP, KERMIT will provide the other partners with sound and adequate mathematical tools for assessing the likeliness of new microbial ecological hypotheses. Clearly, the IAP constitutes a unique coupling between mathematical and experimental ecology.

Objectives

We are seeking a motivated PhD candidate for setting up a sound spatio-temporal mathematical model that will allow for conducting so-called in silico experiments. The outcome of these computer simulations should yield a basis for rejecting or accepting new microbial ecological hypotheses that will be put forward by experimental microbial ecologists. For that purpose, one can either rely on partial differential equations (PDEs), or spatially explicit models such as cellular automata or individual-based models that track each organism individually through space and time and, as an additional surplus to PDE-based models, provide a straightforward means to incorporate spatial heterogeneities or environmental gradients that are known to affect the ecosystem's invasibility. Furthermore, the latter constructs allow for simulating microbial interactions directly at the appropriate spatial scale. In silico experiments will be conducted in parallel to wet lab experiments in order to unravel the mechanisms that are underlying microbial biodiversity and to substantiate a judgment about new microbial ecological hypotheses.

Requirements

The prospective candidate should be familiar with the basic concepts of mathematical modeling and should be eager to explore the wealth of modeling paradigms that exists besides the well-established PDEs. Furthermore, programming experience is a valued asset and familiarity with microbiology in general, and microbial ecology in particular will be highly appreciated during the solicitation procedure.