



Muséum National d'Histoire Naturelle
“ Structure et Instabilité des Génomes”

INSERM U 1154 - CNRS UMR 7196

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Sujet: Design and control of bioreactors to study adaptation of microorganisms in structured environments.

Micro-organisms evolve in natural environments that are structured in space and time. For example, enterobacteria alternate between the intestines of their hosts and soils. Adaptation in complex environments is multifactorial and targets different levels from metabolism to genetic mutations. Experimental evolution aims to understand how microorganisms adapt to environmental challenges. However, the temporal and spatial constraints imposed by the environment have been poorly addressed in the literature. Here, we propose to use two model systems to address how the spatiotemporal structure of the environment influences the routes of adaptation. We will impose cyclic acidic challenges on *S. cerevisiae* and temperature gradients on *E. coli* in bioreactors developed specifically to study the two types of challenges.

The candidate will be trained in several experimental and analytic approaches. He will learn to set up and run the experiments in the two bioreactor set ups, which require to assemble complex sterile environments. Regarding the experiment with yeast, he will design several time structures of the environmental challenges and analyse the kinetics of adaptation as a function of the environment structure. He will also participate to the development of molecular biology approaches to detect potential mutations in the population resulting from the environmental challenges. Regarding the experiments with *E. coli*, the candidate will monitor and model the density profile along the temperature gradient.

The candidate will be hosted in the Structure and Instability unit, CNRS UMR7196, INSERM U1154, MNHN. The project is part of a collaboration between the hosting laboratory and the LPENS (ENS, Paris) represented by Nicolas Desprat.