

ÉCOLE DOCTORALE E2M2

THESE FINANCEE DANS LE CADRE DE L'ANR MAXIMIC

**Intitulé du sujet : Experimental and computational analysis of bacterial self-replicators
(thesis funded by the ANR project Maximic)**

Couleurs : *Micro-organismes, interactions, infections et Biomath-Bioinfo-Génomique évolutive*

Directeur/trice (NOM Prénom) : DE JONG Hidde	Co-directeur/trice (NOM Prénom) : GEISELMANN Johannes
Unité de recherche : Inria Grenoble – Rhône-Alpes	Unité de recherche : Laboratoire Interdisciplinaire de Physique, Université Grenoble-Alpes/CNRS
E-mail : hidde.de-jong@inria.fr	E-mail : hans.geiselmann@univ-grenoble-alpes.fr
HDR : OUI	HDR : OUI

Résumé :

The growth of bacteria is fundamentally an optimization problem which consists in allocating resources to cellular functions so as to maximize growth rate or another fitness criterion. Simple ordinary differential equation models, called self-replicators, have been used to formulate this problem in the framework of optimal and feedback control theory, which has allowed a variety of observations in microbial physiology to be explained. The predicted

resource allocation schemes of bacteria can be experimentally quantified using state-of-the-art techniques in molecular biology and biophysics.

The aim of the PhD thesis is (a) to generalize the self-replicator models so as to be able to take into account a broader range of phenomena in bacterial physiology and (b) to validate the model predictions using a combination of fluorescent reporter genes, time-lapse fluorescence microscopy, microfluidics, automated image analysis, and signal processing algorithms.

The project will be carried out at Inria Grenoble – Rhône-Alpes for the data analysis and modeling parts and the Laboratoire Interdisciplinaire de Physique (LIPhy) for the experimental part. Our interdisciplinary group, composed of biologists, computer scientists, mathematicians and physicists, studies bacteria, in particular *Escherichia coli*, at the level of the population and at the level of single cells. Our main focus is fundamental research, but we also aim at applications in biotechnology and synthetic biology.

Applicants may come from different disciplinary backgrounds – physics, biology, computer science, or mathematics. We expect them to be strongly motivated by interdisciplinary work combining experimental work in the lab with the mathematical modeling of biological systems and data analysis. Basic knowledge in microbiology and previous experience with some of the above-mentioned techniques would be appreciated. Good relational skills are important for the project, as it will be carried out in an interdisciplinary and international environment.

For more information, see <https://team.inria.fr/ibis/phd-thesis-experimental-and-computational-analysis-of-bacterial-self-replicators/>