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EQUIPE d'ACCUEIL			
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2. Titre du sujet

Transcriptional regulation of the alginolytic system in the marine bacteria *Zobellia galactanivorans*

3. Description du sujet

Alginate is a major component of brown algae and represents an abundant carbon source for some marine heterotrophic bacteria that can degrade it. During this internship, we will develop new approaches to study the regulation of the alginate degradation system in the model flavobacteria *Zobellia galactanivorans*, combining mathematical modeling and biological experiments.

Precisely, the kinetics of gene expression will be studied in different experimental settings, including growth with or without alginate. Samples taken at regular intervals will provide measures of the bacterial biomass, the substrate concentration and allow the RNA extraction of the cells. Levels of transcription will be quantified *via* RT-qPCR on a set of genes relevant for the alginolytic system. The intern student will also use a mathematical model currently in development in the lab to gain insight into the analysis of the collected data. The results will provide unprecedented knowledge about the expression of each gene involved in the alginolytic pathway, including its basal expression, the maximal response and the time needed to reach it. The data will help building a conceptual model of the complex alginolytic system and the regulation events leading to its induction.

Keywords: bacterial metabolism, transcriptional regulation, modeling of biological systems

Tools and methodologies: bacterial growth, molecular biology, transcriptomics, ordinary differential equations (ODE), numerical methods for ODE

Lab's interest:

The Marine Glycobiology group studies all aspects linked to marine macroalgal polysaccharides and their degradation. Three main axis are developed, (1) the synthesis and roles of polysaccharides in marine macroalgal tissues, (2) the bacterial mechanisms involved in the degradation of these

molecules in the marine environment and (3) the development of enzymatic tools for the bioconversion of algal biomass. The intern student will be involved in axis 2, and in particular the study of *Zobellia galactanivorans*, a model marine bacteria developed in the group.

Interdisciplinary aspect:

A new research topic is emerging in the marine Glycobiology group, to elucidate the regulations involved in polysaccharide catabolism in marine bacteria. Meanwhile, the LBI2M department develops a novel research field in biomathematics, with the support of the Laboratoire Jacques-Louis Lions (LJLL). The proposed internship project represents a synergistic effort to bridge biological data with mathematical modeling.

Possibilités de poursuite en thèse

Candidature envisageable au concours de l'Ecole Doctorale "Complexité du Vivant" UPMC

Candidature envisageable au programme doctoral "Interfaces pour le Vivant" UPMC s'il est reconduit pour 2017

Sélection de publication de l'équipe en lien avec le projet

Martin M, Barbeyron T, Martin R, Portetelle D, Michel G & Vandebol M (2015) The Cultivable Surface Microbiota of the Brown Alga *Ascophyllum nodosum* is Enriched in Macroalgal-Polysaccharide-Degrading Bacteria. *Frontiers in Microbiology*. 6: 1487

Groisillier A, Labourel A, Michel G & Tonon T (2015) The mannitol utilization system of the marine bacterium *Zobellia galactanivorans*. *Appl. Environ. Microbiol.* 81: 1799-1812.

Thomas F, Lundqvist LCE, Jam M, Jeudy A, Barbeyron T, Sandström C, Michel G & Czjzek M (2013) Comparative characterization of two marine alginate lyases from *Zobellia galactanivorans* reveals distinct modes of action and exquisite adaptation to their natural substrate. *J. Biol. Chem.* 288: 23021–37.

Thomas F, Barbeyron T, Tonon T, Génicot S, Czjzek M & Michel G (2012) Characterization of the first alginolytic operons in a marine bacterium: from their emergence in marine *Flavobacteriia* to their independent transfers to marine *Proteobacteria* and human gut *Bacteroides*. *Environ. Microbiol.* 14: 2379–94.