Workshop on microbial growth control and biotechnological applications

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La Grande Motte, October 20, 2017

RESET project

- Project funded by « **Programme investissements d'avenir** », second call for projects « bio-informatique »
- Duration: 5 years, starting October 1, 2012
- Six **partners**:
  - INRIA Grenoble – Rhône-Alpes and Sophia-Antipolis - Méditerrannée
  - Laboratoire Interdisciplinaire de Physique (UJF/CNRS)
  - Laboratoire Etude de la Dynamique des Protéomes (UJF/CEA/INSERM)
  - UMR de Génétique Végétale de Moulon (INRA/Paris-Sud/CNRS/AgroParisTech)
  - Metabolic Explorer SA

Context

- **Key issue in biotechnology:** redesign of microorganisms to optimize production of molecules of interest
  - Biofuels, bulk and fine chemicals, molecules of medical interest, …
- **Classical approach:** genetic modification of specific components of metabolism
  - Overexpression of heterologous enzymes or enzymes involved in rate-limiting steps
  - Redirect fluxes from growth (biomass production) to product synthesis
- **Problem** with classical approach: robustness of regulatory mechanisms of cell that tend to maintain flux distribution optimal for growth

Aim of RESET project

- **Key issue in biotechnology:** redesign of microorganisms to optimize production of molecules of interest

  Biofuels, bulk and fine chemicals, molecules of medical interest, …

- **Novel approach** for improving yield and productivity: control **gene expression machinery (GEM)**
  - Biomass production is dependent on RNA polymerase, ribosome, and other components of the GEM
  - Arrest the GEM in precise and controlled way, so as to create non-growing cells with functional metabolism
  - When degradation of enzymes and other proteins threatens the stability of metabolic fluxes, switch on GEM again

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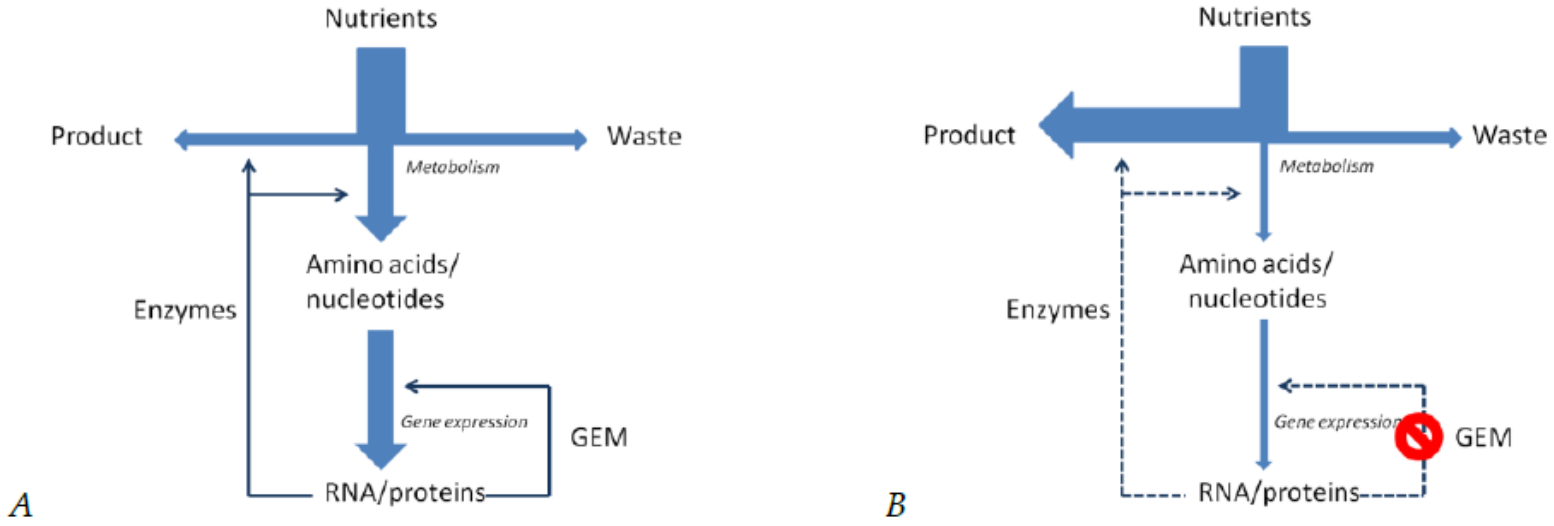

Scientific and technological challenges

- Arrest/restart GEM in quick and reversible way
- Develop coarse-grained but quantitatively predictive models of GEM and effect of GEM control on metabolism
- Test feasibility of approach both in academic lab and in pre-industrial environment: from μL to L scale
- Prepare technology transfer of approach from academia to industry

Workshop program

14h00-14h10 : **Introduction** (H. de Jong)

14h10-14h50 : **Measuring and controlling the burden of synthetic gene expression in *E. coli*** – Francesca Ceroni (Imperial College, UK)

14h50-15h20 : **Growth control in bacteria and its biotechnological applications** – Johannes Geiselmann (Université Grenoble-Alpes)

15h20-15h40 : **Break**

15h40-16h20 : **Control of gene expression and growth in *E. coli*** – Andreas Milias-Argeitis (University of Groningen, the Netherlands)

16h20-16h50 : **Optimal control of bacterial growth** – Jean-Luc Gouzé (Inria Sophia-Antipolis – Méditerranée)