

## Team Scientific Questions

Process-environment-physiology interactions that limit performances ?  
Potentialities of microorganism-bioreactor system ?

## A Top-Down Systemic Approach...

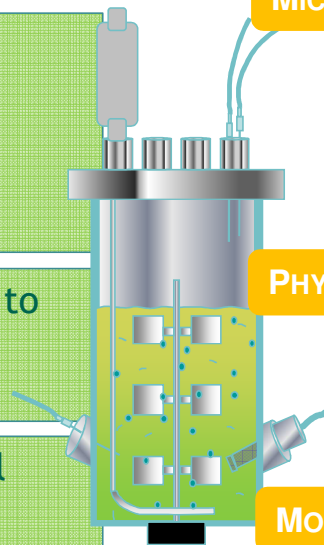
Choosing the more

- pertinent microbial producer
- pertinent substrat
- adapted mode of cultivation (batch, fed batch, membrane bioreactor)

Establishing the microbial dynamics to highlight the maximal microbial potentialities

Analysing the dynamic physiological behavior under intensive culture conditions and/or controlled perturbation

Integrating the generated knowledge coupling modelling and experimental data



### MICROBIAL DYNAMICS

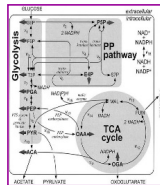
- Bio-kinetics
- Metabolism → Molecular
- Physiology / cell activity-morphology
- Sub-population Distribution

### PHYSICO-CHEMICAL DYNAMICS

- Physico-Chemical Properties
- Rheometry / Granulometry

### MODELLING

- Phenomenological models
- Kinetic and Metabolic models
- Hybrid Dynamic Model
- Model of population
- Hydrodynamic models (in collaboration)



...to deduce and design optimized strategies at...

### ...the bioprocess scale

- **Cultivation strategies** (*nutritional limitations fed batch or chemostat, A- and D-stats*)
- **Innovation in bioprocesses** (*membrane reactors, coupled extrusion-fermentation process, milli reactor, specific gaz reactors, mutagenesis reactor*)
- **Modelling** (*kinetic, metabolic, control, cybernetic*) for process simulation

### ...the microbial scale

- **Populations and sub-populations management**
- **Metabolic engineering** (*rational and inverse*)
- **Modeling** (*kinetic, metabolic, cybernetic, population*) for predictive microbial behavior simulation and targets identification