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Science, technology and innovation policy and expectations in practice: insights from the sociological study of an interdisciplinary project on microbial bioenergy

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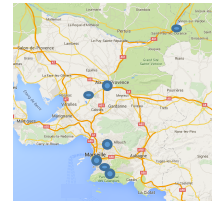
Introduction

How do science, technology and innovation policies and associated regimes of funding and orienting research materialise in day-to-day research? What are their relationships with the very practices, objects, devices and results of research? What is the fate of technoscientific promises and expectations (Borup et al., 2006; Audétat, 2015) on the lab bench?

This studies addresses such questions via the detailed study of one specific project entitled 'MICROBIO-E'. MICROBIO-E is a broad project that federate a diverse research community working on issues potentially relevant to emergent bioenergy technologies. Relying on STS and actor-network theory approaches (Latour & Woolgar, 1986; Latour, 1987; Akrich, 1992; Knorr-Cetina, 1999), I consider the project as something that simultaneously affects the organisation and rhetoric of scientific work, and the actual production of knowledge and innovation. I thus analyse current trends and constraints in STI policy as they are enacted in one project, and explore what the classic tools of STS can tell of project-based, promise-oriented science as it unfolds.

The MICROBIO-E Project

- "Biomass valorization by MICRObes for BIOEnergy production"
- A 2-year interdisciplinary project federating research teams in Aix-Marseille University (AMU) around issues related to "advanced bioenergies".
- Funded via the IDEX programme a scheme initiated in 2010 to promote regional academic clusters. AMU was one of 8 selected clusters. It was awarded several million euros that it is free to allocate via internal calls for proposals. Promotes interdisciplinary, application-oriented research on selected themes, among which "Energy".
- A dozen laboratories: biology, bioinformatics, chemistry, physics, process engineering, sociology, economics. Mostly basic research, but links to potential applications and bioenergy as a unifying perspective.
- Stated scientific objective: to develop an "integrated approach" to remove "the constraints on production of advanced biofuels" (Progress report, 2015). To this end, a collection of sub-projects organised along three axes.



Location of participants

Research design

Ethnography of a research project

- Social sciences embedded in the project: a requirement from funders, and an opportunity to witness scientists at work and interdisciplinarity in action.
- Mapping of the project
- "Laboratory life" (Latour & Woolgar, 1986) and "epistemic cultures" (Knorr-Cetina, 1999) in the context of project-based, promise-oriented research
- A work in progress started in January 2016.

Material collected so far

41 interviews with project participants; project documents; slides from presentations; field notes and recordings from direct and participatory observation (lab visits, project and team meetings, daily interactions with researchers).

PhD Students	7	Task 1 (Enzymes)	12
Post-docs	10	Task 2 (Microalgae)	15
Lecturers (PR, MCF)	9	Task 3 (Hydrogen)	12
CNRS (DR, CR, ITA)	13	Not in Microbio-E	4
INRA	2	Administrative staff	2
CEA	4		

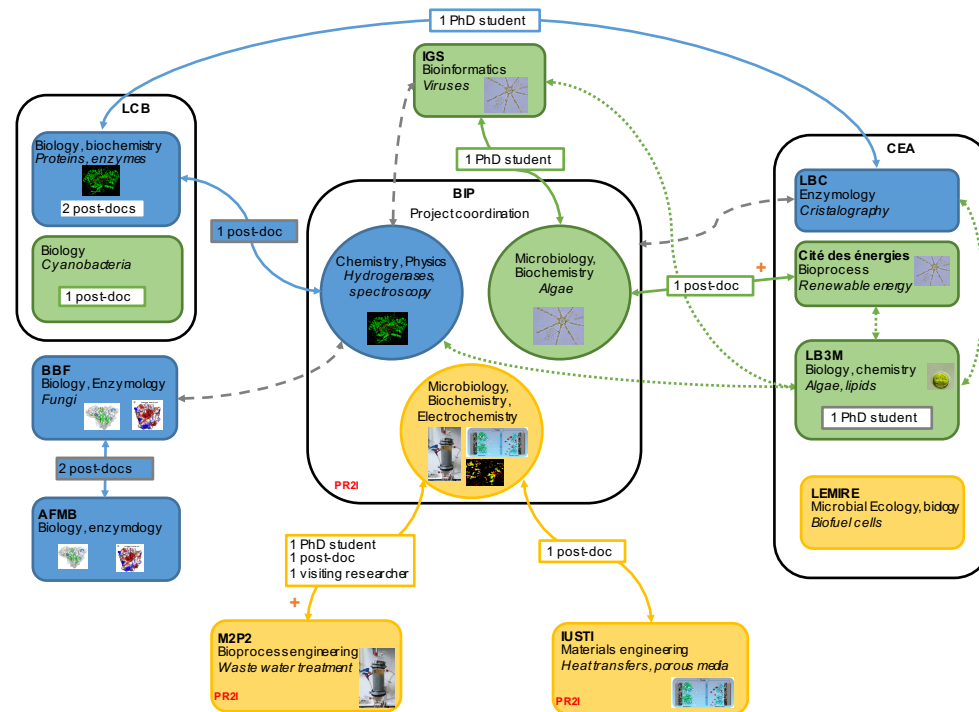
Number of interviews according to status and tasks in Microbio-E

Particular attention to 3 dimensions:

- Day-to-day scientific life: practices, devices, topics, theories, networks...
- Role and position within the project, collaborations and involvement
- Individual and team research strategies, especially as they play out within the project; broader positioning in relations to science, technology and innovation policies.

First observations and insights

- The project is broad in scope and loosely structured, and there is a **variety of ways of engaging** with it across the teams involved.
- Its frame and orientation have effects on research practices, but these are **not straightforward**.
- It enacts the perspective of microbial bioenergy in a specific way, by organising collaborations and framing research questions.
- Bioenergy as an area of application serves as a unifying perspective for federating diverse teams, exchanging ideas, methods and staff, and testing collaborations. It takes shape not so much as pilots, but via the **cross-fertilisation** of scientific topics, the **circulation** of researchers, the **direction of the scientific gaze** towards specific characteristics of model organisms, the inclusion of extra-disciplinary or extra-scientific considerations (e.g. the price of oil) in the design of research strategies.



- Collaboration organised by Microbio-E
- Informal collaboration facilitated by Microbio-E
- - - - Collaboration outside of Microbio-E

- PR2i Involved in the University's interdisciplinary network on Energy (PR2)
- + Attempt at scaling-up

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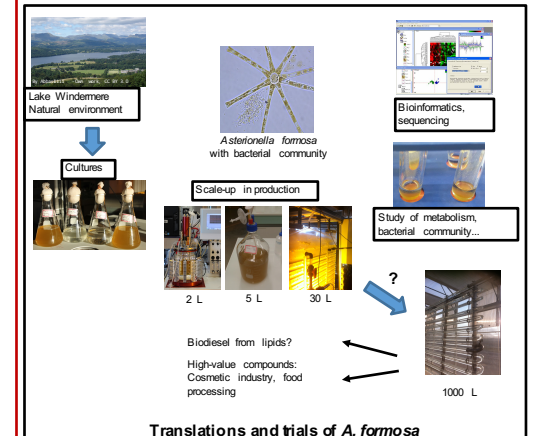
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Example of a subproject on microalgae

Asterionella formosa from lakes to labs, then to markets?

- A collaboration centred around one species of microalgae, *Asterionella formosa*, and its potential to yield lipids for biofuels and other high-value compounds.
- New collaboration involving 3 teams: biology and biochemistry; bioinformatics; process engineering for renewable energy development. All find an interest in the study of *Asterionella formosa*.
- *Asterionella formosa* is displaced from its natural environment to a lab setting, then from lab to lab, and it is subjected to a wide variety of treatments and trials in the process.
- Threefold objective:
 - foster new scientific interactions
 - produce better basic **understanding** of a biological organism
 - develop proto-industrial processes to **exploit** the algae



- Basic research interests and R&D market-oriented approaches are interwoven throughout the project, though clear and sharp differences are maintained in perspectives, research designs, and expected results.
- Research questions shaped by both approaches; regular meetings and interactions help.
- Yet not all research interests overlap, and complementarity, differences and cross-team adjustments remain to be investigated further.