

# « HélioBiotec » - An introduction to the microalgal platform

From molecular genetics, physiology to lipidomics and biophysics of microalgae



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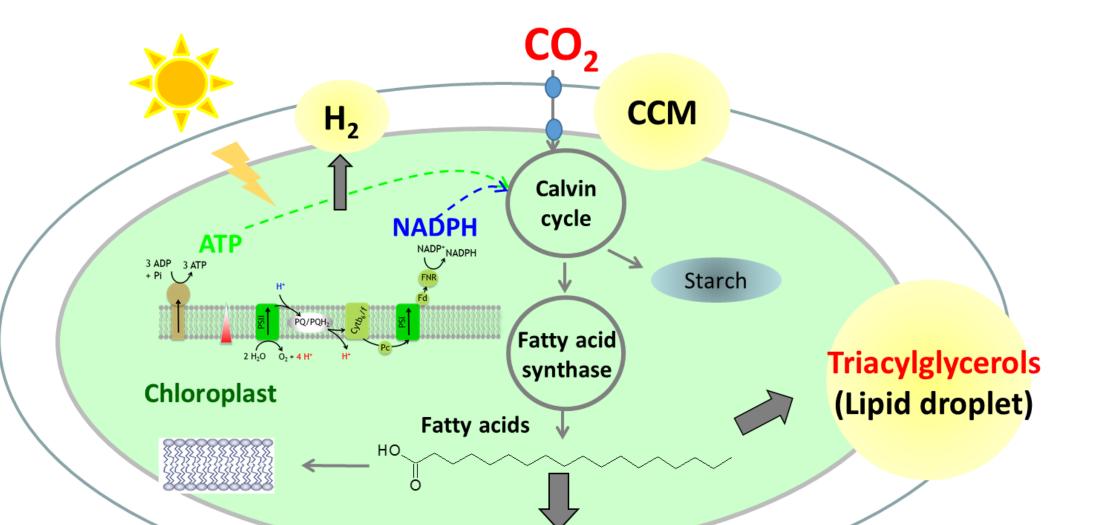
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**Our group:** The team is composed of >20 people (12 permanent staff scientists, engineers and technicians, and we train PhD students, postdocs and short-term contractual staff).

The goal: The major goal of our team is to investigate the molecular mechanisms involved in the conversion of solar energy and atmospheric CO<sub>2</sub> to energy-dense compounds such as oil, hydrogen and hydrocarbons. We assess the molecular limitations of these mechanisms and propose novel strategies for synthetic biology of microalgae. We explore the further use of this knowledge to design and create algal strains for nutrition, fuel, green chemistry or value added products (unusual fatty acids, pigments, etc), and to help addressing environmental issues. The tools and methods we developed over the years are grouped together under the HelioBiotec platform.



### HélioBiotec platform: a microalgal biotechnology platform

#### Algal cultivation:

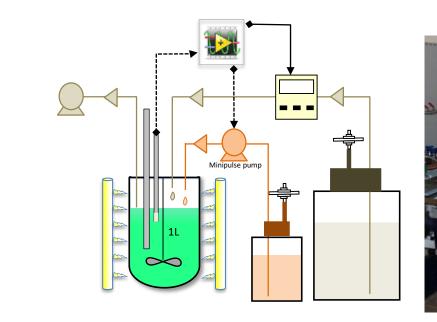
• Controlled cultivation chambers; Flow cytometer; Robotized high density strain management (96/384)

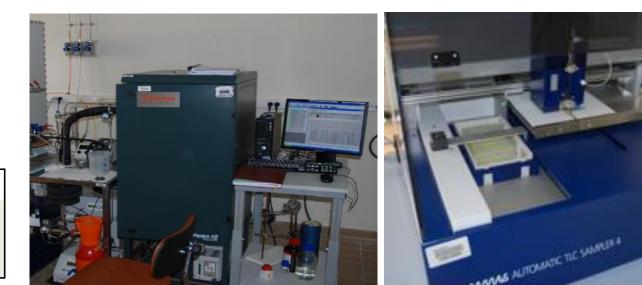
### **Physiology, genetics and strain characterizations:**

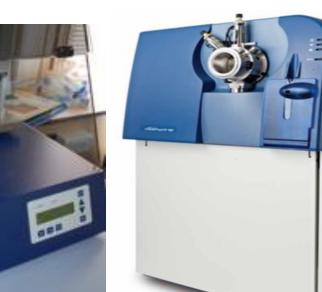
- Instrumented photobioreactors
- On-line gas analysis Membrane Inlet Mass Spectrometry
- Photosynthesis measurement PAM, JTS
- Genetic manipulaiton and genome editing (Crispr-cas9)
- MoClo toolkit for Chlamydomonas

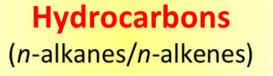
### Lipidomics:

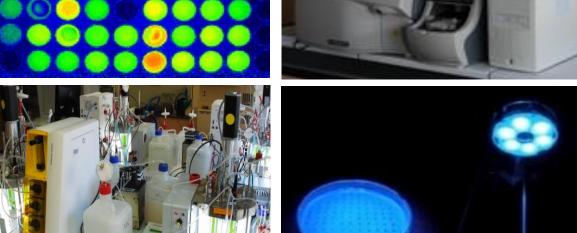
- For small volatil hydrocarbon analysis: GC thermo desorber
- For fatty acid composition analysis: GC-MS, GC-FID/MS
- For lipid classes analyses: HP-TLC
- For lipidomics: UPLC-QTOF-MS/MS ; UPLC Orbitrap MS/MS



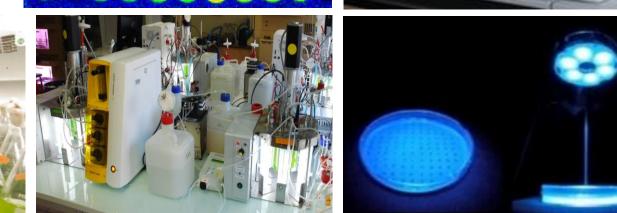




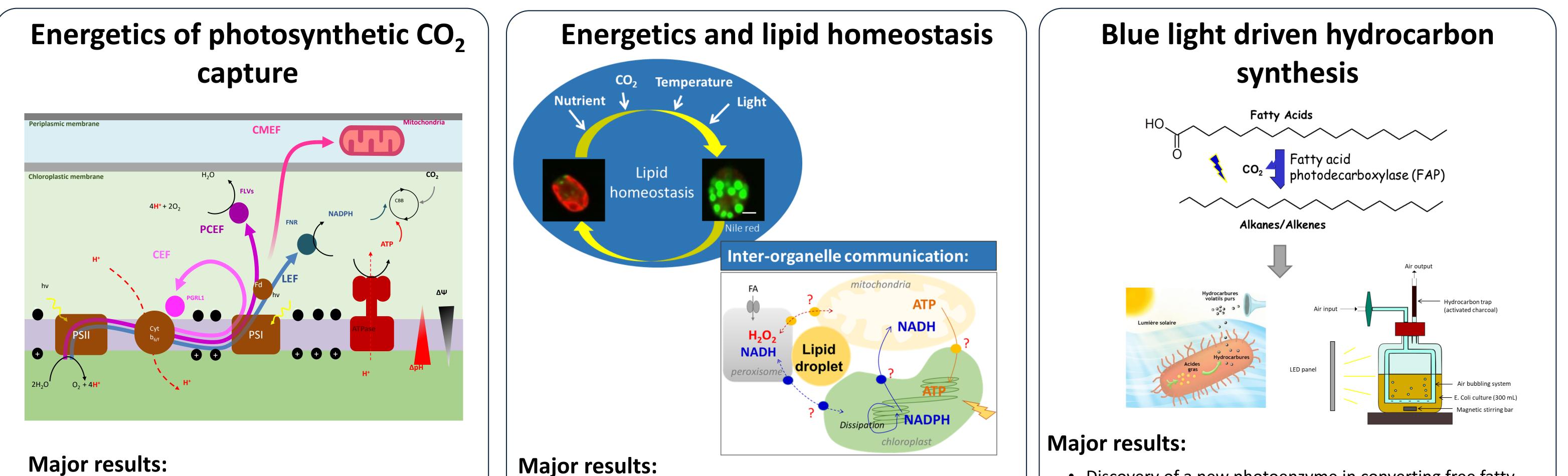








## **Project highlights:** Below are a few examples of current projects in our team.



#### • FLVs promote oxygen photo-reduction in algae

- Peroxisomal MDH2 play a role in connecting redox
- Discovery of a new photoenzyme in converting free fatty acids to hydrocarbons (FAP) (Sorigue et al 2017 Science;

(Chaux et al. 2017 Plant Physiol)

- FLVs catalyze NO photo-reduction in green algae (Burlacot et al. 2019 PNAS)
- AEFs supply energy to the algal CO2 concentrating mechanism (Burlacot et al. 2022 Nature)

trafficking, photosynthesis and lipid homeostasis (Kong et al. 2018 Plant Cell)

• Branched-chain amino acid catabolism in the mitochondria affects lipid homeostasis (Liang et al 2019 Plant Physiology)

• AEFs affects starch and lipid storage (Dao et al in prep)

Beisson et al 2016 patent)

• The proof-of-the concept in the use of FAP for bio-based hydrocarbon production (Moulin et al 2019 Scientific reports)

• Snapshot of molecular mechanism of the blue light driven reaction revealed (Sorigue et al Science 2021)









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