Universitat Autònoma de Barcelona

2018/2019

Synthetic Biology, Systems Biology and Metabolic Engineering

Code: 42904
ECTS Credits: 9

Degree	Type	Year	Semester
4313772 Advanced Biotechnology	OB	0	2

Contact

Name: Joan Albiol Sala

Email: Joan.Albiol@uab.cat

Use of languages

Principal working language: catalan (cat)

Teachers

Pau Ferrer Alegre

Prerequisites

A degree in Biotechnology, Biochemistry, Microbiology, Genetics, Bio/Chemical Engineering or similar are required.

Basic knowledge of Catalan language is required

Objectives and Contextualisation

The main objective of this module is to explore, acquire a high level of comprehension and be able to evaluate the different emerging methodologies in the fields of Synthetic Biology, Systems Biology and Metabolic Engineering. This includes the different '-omics' platforms for the integrated, global and quantitative analysis of cell physiology as a knowledge base for the Enzyme and Metabolic Engineering. That is for the rational design and improvement of cell lines, microorganisms or enzymes with the goal of its industrial or therapeutic application.

Content

1.- Omic platforms: Application of Systems Biology '-omic' analytical tools - from genomics and transcriptomics to metabolomics and fluxomics- for the engineering of industrial microorganisms.
2.- Metabolic Engineering and systems Biology: Bottom-up analysis and modelling of metabolism/cell function. Metabolic control theory. *In-silico* design of directed genetic modifications. Top-down analysis from analytical 'omic' platforms, including data treatment and its multilevel analysis. Global metabolic analysis using *in-silico* genome-scale metabolic models. Study cases: Applications of metabolic engineering and systems biotechnology to the improvement of strains producing small molecules (amino acids, antibiotics, etc.) and/or obtain robust strains adapted to industrial conditions (high levels of toxic compounds,...).
3.- Applied synthetic biology: construction and design of new industrial microorganisms or their parts - for example, construction of new metabolic routes- to obtain cell factories and/or biocatalyzers for the efficient production of biological compounds, new generation biofuels (butanol, jet fuel, etc.), APIs, industrial enzymes or therapeutic proteins.
4.- High throughput technologies: Application of non-directed techniques (combined with metabolic engineering strategies) for the optimization of enzymes, organisms and industrial cell lines: directed evolution,

mutagenesis, library screening, etc. Case studies: Production of enzymes tolerant to solvents, pH, high temperature, etc. Generation of robust industrial strains. Case studies: Tolerance to ethanol, phenolic compounds, high osmolarity, etc.