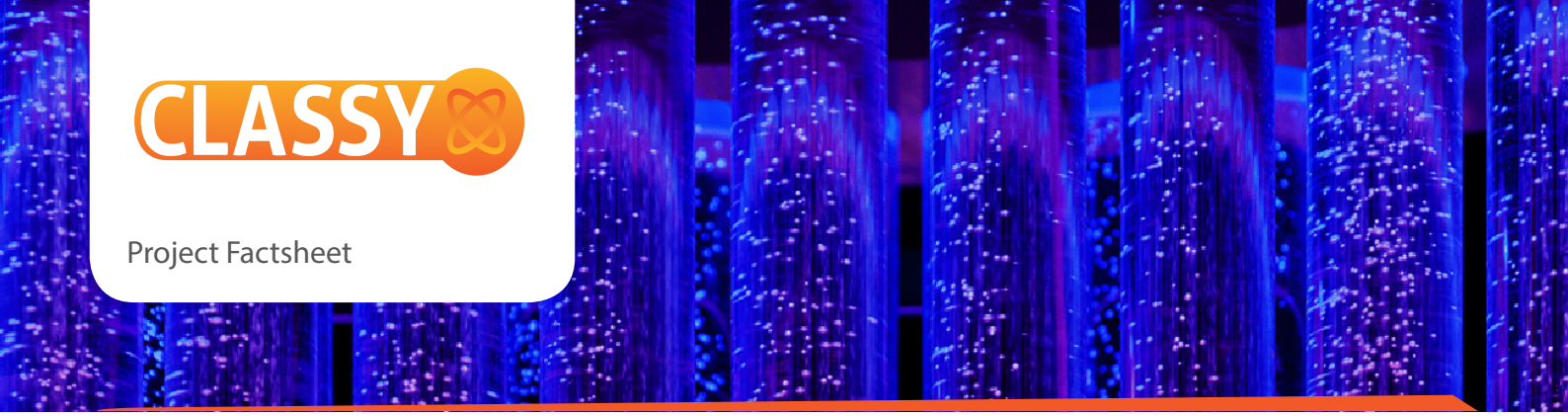


CLASSY

Project Factsheet

Cell-Like 'Molecular Assembly Lines' of Programmable Reaction Sequences as Game-Changers in Chemical Synthesis

Background

More than 85% of processes in the chemical industry depend on catalytic technologies, though many processes in this area have reached their technological limits and produce unsustainable amounts of waste (e.g., 25–100 kg of waste per kg of product, in the case of pharmaceutical drugs). Living cells, on the other hand, can efficiently synthesise an enormous variety of complex natural products, leaving behind limited amounts of waste. Although current state-of the-art catalytic technologies present various limitations, within the recently emerging field of systems chemistry, holistic methods of analysis/quantification of dynamic and complex molecular networks are starting to be developed. With these new tools in hand, the possibility of mimicking nature's synthesizing abilities is in closer reach. This can be achieved through the development of a new type of chemical reactor, able to synthesise complex molecules through 'programmable' reaction sequences in 'molecular assembly lines'. The main scientific challenges in creating cell-like molecular assembly lines include achieving an efficient compartmentalisation of the different steps for each reaction sequence and regulating such reaction sequences in a way that enables the same chemical reactor to produce a wide range of different molecules.

Objectives

CLASSY is a FET Open Research and Innovation Action (RIA) that brings together five leading scientists with expertise in systems chemistry, biocatalysis and microfluidics. The ultimate aim of this interdisciplinary consortium is to develop the first microfluidic platform of micro-reactors, through the compartmentalisation of multiple catalytic peptides and/or enzymes, to emulate living cells in their capacity to self-regulate and catalyse programmable multistep synthetic processes. The specific objectives of CLASSY are:

- the development of a microfluidic platform for the immobilisation of multiple enzymes or peptide catalysts in microfluidic compartments, so to produce a versatile set of flow reactors that can catalyse a variety of single-step reactions;
- the delivery of a new type of hybrid molecules capable to selectively control the catalysis of specific single-step reactions through programmable activation/deactivation of self-synthesising catalysts;
- the study of microfluidic programming of cascade reactions by selective activation/deactivation of catalysts that operate sequentially.

Funding Programme:

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 862081.

Project Duration:

01/11/2019-31/10/2023

Project Budget:

3.08 million euro

Project Website:

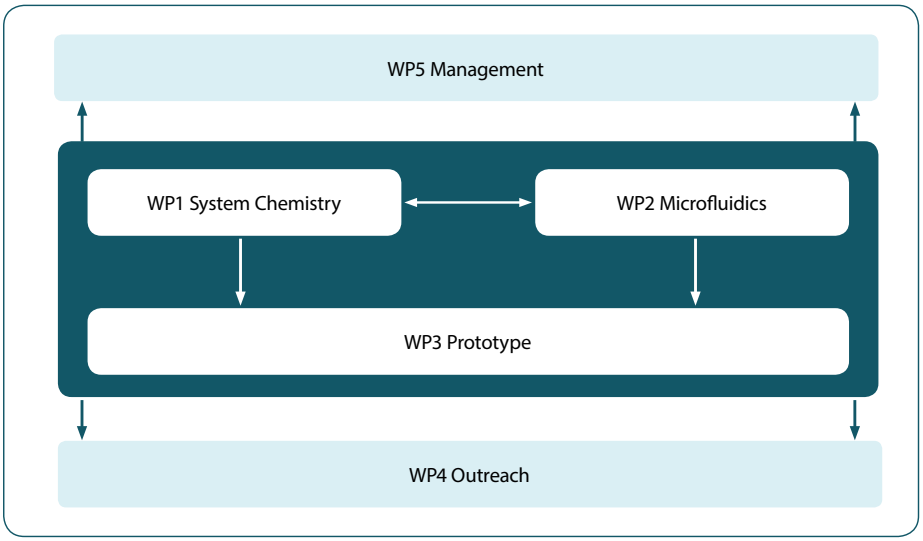
www.fetopen-classy.eu

CLASSY

Project Factsheet

Activities

The activities in CLASSY are organised in three scientific Work Packages (WP1-WP3) supported by two WPs focused on communication, dissemination and exploitation activities (WP4) as well as on organization and management (WP5).



The first two WPs will start simultaneously, establishing the chemistry of a series of peptide hybrids (WP1) and developing microfluidic flow reactors (WP2). Starting in month 13 of the project, WP3 will develop a prototype of a cell-like molecular assembly line. WP4 and WP5 will be continuously ongoing for the entire project duration to ensure its smooth management and effective communication of its results.

Impact

The undertakings of CLASSY support essential pillars for Europe`s future, such as renewability, sustainability, zero waste emissions and energy efficiency. Through its progress it also contributes to the competitiveness of Europe's chemical industry, one of the EU's most international, competitive and successful sectors, embracing a wide field of processing and manufacturing activities. The CLASSY project will ultimately strengthen Europe's innovation capacity in the young field of systems chemistry.

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