PhD in Chemical Engineering

Research Title:
Option 1) CO_2 conversion to value-added products by microorganisms engineering
Option 2) Microbial CO_2 conversion to value-added products

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Context of the research activity	Captured CO_2 can be a useful industrial feedstock and has a wide variety of potential applications that can safely sequester hopefully decisive quantities of it from the atmosphere, while also displacing fossil fuels as a raw material. Nature displays an enormous diversity of microorganisms which fix CO_2 and transform a carbon feedstock into chemicals and materials. However, since microorganisms have not evolved to suit the human practical outcomes, their efficiency in producing any molecule is unsatisfactory. Biochemical engineering, biochemistry and microbiology collectively nowadays enable the rational engineering of efficient bio-factories. The strategies one would apply strongly depend on the molecule of interest, and the nature of the required production process, e.g. enhanced production of native compounds or production of heterologous products. Therefore, the isolation and practical implementation of suitably tailored strategies demand to address challenging tasks.

Objectives	The objectives of this PhD are: - Acquaintance with the global context of bio-based production (process sustainability, market valorization, societal attractiveness) - Integrative knowledge of streamlined processes (strain development, fermentation, product separation and purification) - Theoretical and practical mastering of cutting-edge methods in biological engineering and synthetic biology - Adoption of multi-stage strategies for optimizing the

	native production of compounds of interest by microorganisms (pathway overexpression, enrichment for substrates and/or cofactors, removal of feedback inhibition, tuning of competing pathways, application of general regulation engineering) and testing of engineered microorganisms in different experimental bioreactor settings - Design and implementation of microorganisms embedded with novel production capabilities through the heterologous expression of biosynthetic pathways, which can imply the examination of the pathway compatibility with the host strain (substrate and co-factor availability) and the pathway optimization (biosynthesis of functional groups, transcription engineering, product efflux pumps); testing of engineered microorganisms in different experimental bioreactor settings

Skills and competencies for the development of the activity	- Knowledge in biochemistry or microbiology and chemical engineering is mandatory - Pro-active orientation and commitment to innovation In addition, the candidate could bring: - Previous experience in chemical laboratories - Comfort/experience with biochemical reactions analysis or modelling - Strong communication and time-management skills to drive quality results - Ability to interact and collaborate in a multi-disciplinary environment