MARIE SKŁODOWSKA-CURIE INDIVIDUAL FELLOWSHIPS 2018

EXPRESSION OF INTEREST FOR HOSTING MARIE CURIE FELLOWS

HOST INSTITUTION

Instituto de Tecnologia Química e Biológica António Xavier (ITQB-NOVA) | MOSTMICRO Research Unit

RESEARCH GROUP AND URL

Microbial and Enzyme Technology Lab
http://www.itqb.unl.pt/research/biological-chemistry/microbial-enzyme-technology

SUPERVISOR (NAME AND E-MAIL)

Lígia O Martins
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SHORT CV OF THE SUPERVISOR

Prof. Lígia O Martins is leading a research group focused on the investigation of a variety of bacterial oxidoreductive enzymes, multicopper oxidases, heme peroxidases and flavo enzymes with importance in the conversion of natural and synthetic aromatics. She made pioneer studies in the structural and functional characterization of bacterial laccases and their applications. The studies of laccase-like enzymes from hyperthermophiles provided the first evidence of a notable thermostability, which is essential for biotechnological applications. Recent achievements include the development of directed evolution methodologies for the improvement of laccases and DyP´s performance and robustness. Prof Martins is/was Principal Investigator in 9 research projects, 2 of which funded by the European Commission, and national delegate of two COST actions. She has 68 papers in high impact journals (28 as corresponding author, 12 with 100+ citations, three journal covers, one part of the ACS Select Collection (2017) that encloses the 20 papers with latest groundbreaking research in Engineered Biomolecular Catalysts). Prof Martins is in the Scientific Committee of the PhD Program in Sustainable Chemistry jointly hosted by Aveiro, Porto and NOVA Universities and of the Master Biotechnology for Sustainability (ITQB) where she holds the chair of Environmental and Industrial Microbiology and Biocatalysis. She is/was involved in the supervision of 6 Post-docs, 9 PhD and 10 MSc students. Prof Martins is member of the Scientific Committee of the Bio-based Industries Joint Undertaking (2014-20).

5 SELECTED PUBLICATIONS

- Martins, LO, Durão, P, Brissos, V and Lindley, PF. 2015. Laccases of prokaryotic origin – enzymes at the interface of protein science and protein technology. Cell Mol Life Sci. 72: 911-22.

- Brissos, V, Ferreira, M, Grass, G and Martins, LO. 2015. Turning a hyperthermostable metallo-oxidase into a laccase by directed evolution. ACS Catalysis 5: 4932-4941.

- Mendes, S, Catarino, T, Silveira, C, Todorovic, S and Martins, LO. 2015. The catalytic mechanism of BsDyP an A-type dye-decolourising peroxidase: neither aspartate nor arginine is individually essential for peroxidase activity. Cat. Sci. Technol. 5: 5196-5207.

- Brissos, V, Tavares, D, Sousa, AC, Robalo, MP Martins, LO. 2017. Engineering a Bacterial DyP-type Peroxidase for Enhanced Oxidation of Lignin-related Phenolics at Alkaline pH. ACS Catalysis. 7, 3454-3465.

- Sousa, AC, Oliveira, MC, Martins, LO, Robalo, MA 2018. A Sustainable Synthesis of Asymmetric Phenazines and Phenoxazinones Mediated by CotA-Laccase. Adv Synth Catal 360, 575-583.

PROJECT TITLE AND DESCRIPTION

Tailor new enzymes using iterative laboratory and computational approaches

Deconstruction of lignin, the most abundant aromatic polymer in nature, requires the cooperative action of a large repertoire of microbial enzymatic activities. In this proposal the combination of (i) iterative laboratory and computational evolution of bacterial ligninolytic enzymes towards improved efficiency for different lignin-related compounds with (ii) kinetic, biochemical and biophysical characterization of hits and evolutionary intermediates, will allow 1) enlarging the tool-box of biocatalysts that targets components of lignocellulose, supporting the bio-based economy vision of the XXI century, 2) contribute to answering the long-standing question in protein science of "how function and structure are related" and, 3) investigating the molecular mechanisms of enzyme fitness evolution, a critical knowledge for engineering new proteins, metabolic pathways and organisms for biotechnological applications.

Keywords: Protein Science, Protein Engineering, Structure-function relationships, Biocatalysis, Green Chemistry.

SCIENTIFIC AREA WHERE THE PROJECT FITS BEST

Environment and Geosciences (ENV)