MARIE SKŁODOWSKA-CURIE POSTDOCTORAL FELLOWSHIPS 2021

EXPRESSION OF INTEREST FOR HOSTING MARIE CURIE FELLOWS

HOST INSTITUTION

NOVA University Lisbon | ITQB NOVA - Instituto de Tecnologia Química e Biológica António Xavier

RESEARCH GROUP AND URL

Inorganic Biochemistry and NMR
https://www.itqb.unl.pt/research/biological-chemistry/inorganic-biochemistry-and-nmr

SUPERVISOR (NAME AND E-MAIL)

Ricardo O. Louro
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SHORT CV OF THE SUPERVISOR

Leader of the Inorganic Biochemistry and NMR laboratory
Coordinator of the Centre for Magnetic Resonance António Xavier
Co-coordinator of the Molecular Biosciences PhD program
Elected member of the ITQB-NOVA scientific council since 2013
Supervised 5 post-docs, 13 PhD students, and numerous masters and bachelor students.
Invited speaker in more the 50 international scientific conferences
Coordinator of more than 15 national and international research projects of which 3 are currently active.

5 SELECTED PUBLICATIONS

- Trindade IB, Hernandez G, Lebègue E, Barrière F, Cordeiro T, Piccioli M, Louro RO, Conjuring up a ghost: Structural and functional characterization of FhuF, a ferric siderophore reductase from *E. coli*, *J Biol Inorg Chem* (2021) **26**, 313-326, DOI: 10.1007/s00775-021-01854-y

- Trindade IB, Invernici M, Cantini F, Louro RO*, Piccioli M*, PRE-driven Protein NMR Structures: an Alternative Approach in Highly Paramagnetic Systems, *FEBS J*, (2021) **288,** 3010-3023 DOI:10.1111/febs.15615

- Costa NL, Herman B, Fourmond V, Faustino MM, Teixeira M, Einsle O, Paquete C M, Louro RO, How thermophilic Gram-positive organisms perform extracellular electron transfer: characterization of the cell surface terminal reductase OcwA, *mBio* (2019) **10**, e1210-19. DOI: 10.1128/mBio.01210-19

- Strum G, Richter K, Doetsch A, Heide H, Louro RO, Gescher J, A dynamic periplasmic electron transfer network enables respiratory flexibility beyond a thermodynamic regulatory regime, *ISME J*, 9, 1802-11 (2015) DOI:10.1038/ismej.2014.264

- Paquete CM, Fonseca BM, Cruz D, Pereira T, Pacheco I, Soares CM, Louro RO, Exploring the molecular mechanisms of electron shuttling across the microbe/metal space, *Frontiers Microbiol*, **5**:318, (2014) DOI: 10.3389/fmicb.2014.00318

PROJECT TITLE AND SHORT DESCRIPTION

The Life electric: structural and functional characterization of cytochromes that enable bacteria to survive by producing electricity

In line with the notion expressed by the Nobel Prize winner Albert Szent-Györgyi that 'Life is nothing but an electron looking for a place to rest', some bacteria are capable of living by delivering electrons to electrical circuits. This enabled the development of a new paradigm of bioelectrical devices that are powered by the microbial metabolism, and that operate in conditions of low ecological footprint. Despite great strides in the development of these new technologies, no detailed characterization of the redox enzymes that sit at the beginning of these novel bioenergetics redox chains has been reported thus far. This is the crucial biochemical step where the metabolism diverges from the traditional aerobic respiration with oxygen or anaerobic respiration of diverse compounds such as sulfate or nitrate. These key enzymes interface the quinone pool of the cytoplasmic membrane with the specific electron transfer chains that deliver the electrons to the electrical circuit outside of the cell. In the genus *Shewanella*, which are model electricity generating bacteria, the key enzyme is CymA. It is a tetraheme cytochrome of ~20kDa with a N-terminal alpha helix inserted in the cytoplasmic membrane. NMR spectroscopy is uniquely suited for the detailed structural and functional characterization of an enzyme of this size that is membrane bound. Its characterization will conclude the structural and functional characterization of this unique electron transfer chain allowing, for the first time, to have a complete functional and structural picture of how "Life Electric" operates.

SCIENTIFIC AREA WHERE THE PROJECT FITS BEST*

Life Sciences (LIF)
Chemistry (CHE)