

Ph.D position (M/F) in artificial photosynthesis based on multi-copper oxidases in Marseilles

Offer description. A Ph.D (expected starting date: end 2025) is available at the “Institut des Sciences Moléculaires de Marseille” (iSm2, UMR 7313) within the frame of an ANR-funded project.

Project. With the continuous increase in energy demands and environmental issues associated to the use of fossil fuels, it is of high societal importance to propose alternative energy sources. The use of abundant and clean solar energy therefore appears as one attractive solution to replace fossil fuels. Inspired by natural photosynthesis, researchers develop artificial systems with the ultimate goal to store solar energy into fuels or convert it into chemical feedstocks for our modern societies.

Under these circumstances, utilization of solar energy to promote important chemical oxidation reactions such as Oxygen-Atom-Transfer Reactions (OATR) is a highly promising approach. Within ARCHITECTE, we aim at developing hybrid photocatalytic systems associating a catalyst, a photosensitizer and a robust multicopper oxidase, a fungal laccase to couple the light-triggered challenging 2-electron oxidation (OATR) at the level of the catalyst to the four-electron reduction of dioxygen into water at the lever of Laccase. We will associate the different components following a modular approach to generate hybrid architectures. Our project will combine approaches including: (i) protein engineering (ii) design of photocatalytic molecular assemblies (iii) generation of hybrid architectures with selective orientation of the components at the enzyme's surface (iv) electrochemical characterization (v) spectroscopic and photophysical studies and (vi) photo/electrocatalytic assays.

The project will be conducted within the frame of an ANR-funded project (ARCHITECTE ANR-24-CE50-7419) and will associate 3 complementary teams. The candidate will join the [BiosCienc](#)es group at iSm2 (Marseille). This group has a strong expertise in the study of metalloenzymes and in particular of artificial photosynthetic units based on laccases.^{1,2,3} He/She will evolve in a multidisciplinary environment (chemistry / biology / biophysics).

The candidate will be involved in the following tasks:

- Preparation of laccase's hybrids by surface functionalization
- Physicochemical characterization (spectroscopy, electrochemistry, spectroelectrochemistry etc.)
- Functional investigations of the hybrids enzymes on different substrates
- Mechanistic investigations

Keywords: *bioinorganic chemistry, metalloenzymes, artificial photosynthesis, photocatalysis*

Candidate profile and skills. Highly motivated candidates (master degree or equivalent with excellent academic records) with a background in chemistry and / or biochemistry and / or biophysics are strongly encouraged to apply.

Previous laboratory experience in biochemistry, electrochemistry, spectroscopy, metalloenzyme or any other field that could benefit the project would be valuable but is not mandatory

Applications. Applications have to be submitted exclusively online via the CNRS job portal ([link](#)). Please include A CV including a summary of research experiences, A motivation letter and the name of two references.

Contact details:

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¹ Lazarides, T. *et al.*, Visible Light-Driven O₂ Reduction by a Porphyrin-Laccase System. *J. Am. Chem. Soc.*, **2013**, 135: 3095.

² Schneider, L. *et al.*, Visible-Light-Driven Oxidation of Organic Substrates with Dioxygen Mediated by a [Ru(bpy)₃]²⁺/Laccase System. *Chem. Sus. Chem.*, **2015**, 8: 3048

³ Farran, R. *et al.* Tracking light-induced electron transfer toward O₂ in a hybrid photoredox-laccase system. *iScience*, **2021**, 24, 102378