

CONTRATOS PREDOCTORALES 2022 SEVERO OCHOA

PROJECT TITLE / JOB POSITION TITLE:

Light responsive soft materials for molecular transport

JOB POSITION RESEARCH LINE:

RL, General.- FUNCTIONAL OR MULTIFUNCTIONAL NANOSTRUCTURED MATERIALS

RESEARCH PROJECT / RESEARCH GROUP DESCRIPTION:

The research project builds on recent results that show how molecules can be made to move along supramolecular fibres using light. The specific aim of this predoctoral research project is to make materials where the movement of the molecules leads to a measurable effect, be it optical, electrical or mechanical, and to apply that response to an applied area. It will use gel materials and responsive compounds – molecular switches – that provide the energy transfer that leads to molecular motion.

This part of the wider project will focus on the preparation of molecular switches that operate in the visible part of the electromagnetic spectrum. The new molecules – based on a spiropyran core – will be prepared and purified using green chemistry approaches, and their switching ability under irradiation will be characterised. They will be incorporated into gel materials, and their ability to move molecular travellers (based on fluorophores) will be characterised using total internal reflection fluorescence microscopy (available in the CSIC). Ultimately, gradient systems will be prepared where light irradiation gives micron scale molecular movement generating a potential.

The Amabilino Research Team is historically an inclusive and diverse assembly of people, now in the Sustainable Molecular Systems (SusMoSys) group, that enthusiastically tackle challenges in molecular materials chemistry, especially focussed on energy capture and storage. Our approach is to design and synthesise new compounds that have unique and useful properties. David Amabilino is an expert in molecular materials in general, and led the prior work that is the foundation for the present proposal. His group working in the ICMAB are making molecules that self-assemble to give new functionalities. The interdisciplinary work that he carries out enjoys many fruitful collaborations with groups with complementary skills. He has previously mentored twenty doctoral researchers.

JOB POSITION DESCRIPTION:

This predoctoral position will involve the preparation of supramolecular materials that are able to capture light's energy and transfer it into molecular movement, and visualize this motion directly in a microscope.

The doctoral candidate, preferably a chemist with some knowledge of synthetic and physical chemistry, will first be trained in the synthesis of molecular switches and fluorophores for optical microscopy. They will also be shown the many tools available for the purification and characterization of the compounds. They will learn how to combine these materials with gelator molecules to give responsive systems that will be characterized by total internal reflection fluorescence microscopy that is used to observe molecular motion. They will also receive transversal skill training determined by their career development plan, including for presentations, innovation, outreach and project management. It is expected that the results will be presented in international meetings of high standing, giving experience and exposure to the candidate to help in their career.

The new materials will be made using the tenets of green chemistry, with sources of starting materials and reagents analyzed in detail, and the processing performed using the same guiding principles. The aim is to show that using light, a chemical potential can be generated, with the ultimate goal of making new systems for light energy harvesting and storage.

GROUP LEADER:

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