

CONTRATOS PREDOCTORALES 2022 SEVERO OCHOA

PROJECT TITLE / JOB POSITION TITLE:

Organic radical nanostructures for magnetic resonance imaging and diagnosis

JOB POSITION RESEARCH LINE:

RL5 - BIOACTIVE MATERIALS FOR THERAPY AND DIAGNOSIS (IP: Imma Ratera)

RESEARCH PROJECT / RESEARCH GROUP DESCRIPTION:

Magnetic resonance imaging (MRI) is one of the most versatile and widely used clinical diagnostic tools nowadays that provides images of soft tissue anatomy in excellent detail with the use of contrast agents (CAs), in a non-invasive manner. Paramagnetic gadolinium (Gd) based contrast agents are the most widely used in MRI. These CAs have historically been considered as safe, but they are associated with potentially lethal nephrogenic systemic fibrosis and recent reports have emerged regarding the accumulation of residual toxic Gd(III) ions in the brain, bones, skin, liver and kidneys. Since the use of CAs in MRI is of vital importance to gain lifesaving clinical information, such as early detection of tumours and cancer treatment, it is critical to find alternative imaging probes than the current Gd-based CAs.

Our goal is the development of metal-free contrast agents that own similar or even better paramagnetic properties than current Gd-based CAs. To achieve this, we make use of organic radicals that are also paramagnetic species. Our strategy consists in the incorporation of many organic radical units to a dendrimer scaffold, which provides stability to the radicals, obtaining the so-called radical dendrimers. In addition, other functionalities (for example fluorescent dyes) can also be incorporated to obtain bi- (or multimodal) systems that combine the magnetic properties of radicals with other properties such as the optical ones for different imaging purposes. Moreover, such systems can be synthesized with external peptides for active targeting of a specific cell type, such as cancer cells. On the other hand, spin-labelled gold nanoparticles for biomedical applications will be explored.

JOB POSITION DESCRIPTION:

The researcher will join the pioneer, dynamic and active Department of Nano Science and Organic Materials (NANOMOL) at the Institut de Ciència de Materials de Barcelona (ICMAB-CSIC) located at the UAB university campus.

The candidate will be enrolled in the design, preparation and characterization of new dendrimers and radical dendrimers, with tuned structural characteristics at the nanoscale and different capabilities as CAs. The candidate will use different preparative methodologies (organic synthesis, molecular self-assembly) and advanced characterization techniques (EPR, HPLC-SEC, MALDI-TOF, UV-Vis, DLS, TEM, cryo-TEM, ITC, fluorimetry, etc.) available at the ICMAB and at the UAB campus.

In the frame of the interdisciplinary collaborative network, CIBER-BBN, the candidate will assess the toxicity and behavior against bio-reduction in biological fluids of the final compounds and their properties as MRI CAs under different conditions (in vitro, ex-vivo and in vivo). The candidate will participate in the evaluation of T1-weighted images in phantom experiments to calculate the relaxivity of the investigated radical dendrimers. MRI studies in vivo will be performed with the best in vitro/ex vivo performing radical nanostructures and compared with currently used Gd based CA, focusing in particular in the biodistribution in healthy mice and their contrast ability in different types of tumours like glioblastoma, among others.

Candidates must hold a degree in Chemistry, Biochemistry or similar and a recognized Master degree (or equivalent), both with high qualifications and with a good level of written and spoken English. An interdisciplinary outlook is desired and will be encouraged. Experience in organic synthesis and physico-chemical characterization will be highly valued.

GROUP LEADER:

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Research project / Research Group website: <https://nanomol.icmab.es/labs/organic-radicals-jose-vidal-gancedo>