

CONTRATOS PREDOCTORALES 2022 SEVERO OCHOA

PROJECT TITLE / JOB POSITION TITLE:

Development of boron rich photosensitizers as antimicrobial and anticancer agents by combining PDT and BNCT.

JOB POSITION RESEARCH LINE:

Bioactive Materials for Therapy and Diagnosis

RESEARCH PROJECT / RESEARCH GROUP DESCRIPTION: (2.000 characters – including spaces)

Photodynamic therapy (PDT) has been well-established as a treatment for certain cancerous and pre-cancerous lesions. PDT works on the principle of light-induced activation of photosensitizers (PS), which can generate reactive oxygen species (ROS) that cause oxidative damage of the tumour tissue after irradiation. Nowadays, owing to the increasing resistance of bacteria towards antibiotics and the rise of new infections, the PDT is also a suggested technique to eliminate bacteria, fungi and viruses (i. e. SARS-COV-2). Antimicrobial Photodynamic Therapy (aPDT) can treat localized infections and yet is without the problems associated with drug resistance, by employing PSs. Notably, icosahedral boron clusters are non-toxic, biocompatible, and boron rich carriers for Boron Neutron cancer therapy (BNCT). When boron clusters are linked to fluorophores, they have demonstrated to be excellent in-vitro fluorescent probes. Our aim is to combine all these characteristics and **development of a new generation of biocompatible boron rich photosensitizers to be used in aPDT for the inactivation of microorganisms in sanitary instruments and medical devices. Moreover, due to their capability to produce $^{11}\text{B}^*$, these PSs with high boron content give rise to double cancer therapy by adding to the PDT the option of using the BNCT. The innovation is focus on the development of PSs with multiple applications both for antimicrobial (aPDT) and anti-cancer (PDT and BNCT) therapies**

The main objectives are (i) to synthesize and characterize a series of safe and cost-effective photosensitizers by coupling boron clusters to PS such as phenothiazines, porphyrins, or Bodipys (ii) to delineate their role in the photophysical process of singlet oxygen production under light; (iii) in vitro evaluation of the antimicrobial activity of the PSs. (iv) Anticancer evaluation of selected PSs under neutron irradiation.

The candidate will incorporate at LMI group in ICMAB-CSIC. Our group has leading expertise in the development of boron cluster derivatives and their applications in material science, biomedicine and energy. To date 50 doctors have been graduated and more than 450 articles published in high impact journals (see website).

JOB POSITION DESCRIPTION:

(2.000 characters – including spaces)

Include all the relevant information about the position, role, responsibilities and skills required within the project/group

We are looking for good candidates for a PhD position. The student will work in a project developing new luminescent boron-based molecular materials as photosensitizers with potential antimicrobial activity under the light, which is known as photodynamic inactivation (PDI). For this purpose, the student will work with air-sensitive compounds to synthesize new building blocks based on boron clusters for their covalent bonding to different fluorophores by using Schlenck techniques (vacuum-nitrogen lines, glovebox). The structural and electronic properties of the boron clusters will play a significant role in the photophysical properties of the final materials. The student will use different spectroscopic techniques for characterization: Infrared Spectroscopy (FT-IR), Nuclear Magnetic Resonance (^1H , ^{13}C , ^{11}B -NMR), UV-vis and fluorescence; as well as other useful techniques such as mass spectrometry (MALDI-TOF), or DSC-TGA; TEM, SEM among others. This will permit the PhD student to be directly in contact with all these techniques and learn to interpret the results. The project will also include a collaboration with a research group specialized on antimicrobial susceptibility testing, the group of Bacterial Molecular Genetics of the IBB. This is placed at UAB, the same Campus as the host LMI, so that the PhD student will be able to work in close cooperation with this group, which facilitates the achievement of the final project goals. To complete his/her training, during the fellowship it is expected that the student will publish articles and participate at conferences, workshops and seminars.

Skill required to applicants: excellent graduates in Chemistry or Chemical Engineering, with scientific interest and preferably practical training in courses on synthesis, purification techniques. Basic knowledge of standard characterization techniques, specially IR and NMR spectroscopy. Knowledge on UV-vis and spectrofluorometric techniques will be required. A recently obtained Master of Science level is mandatory.

GROUP LEADER:

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Research project / Research Group website: <http://departments.icmab.es/lmi/>

RELATED LINKS TO THE POSITION (optional)

URL:

Title link: