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Supervisor's contact details

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Title of the project

Protein nanocages against multidrug-resistant bacteria

MSCA-PF Research Panel

☐ Chemistry (CHE)

☐ Social Sciences and Humanities (SOC)

☐ Economic Sciences (ECO)

☐ Information Science and Engineering (ENG)

☐ Environment and Geosciences (ENV)

☒ Life Sciences (LIF)

☐ Mathematics (MAT)

☐ Physics (PHY)

Description of the project

Multidrug-resistant (MDR) bacteria have become one of the biggest threats to human health worldwide. The development, therefore, of new strategies to prevent and treat infections caused by MDR bacteria is of paramount importance. Nanoparticles with sizes between 1 to 100 nm are promising therapeutic tools in biomedical applications. Their use has also been suggested in the fight against MDR microbes. However, the development of bacterial resistance to nanoparticles and toxicity issues could limit their use. Among nanoparticles, superparamagnetic iron oxide nanoparticles (SPIONs) have drawn considerable attention for their potential in medicine, diagnostics, and imaging, owing to their large magnetic moment under an external magnetic field. The use of protein nanocages to create SPIONS has several advantages over the chemical synthesis of SPIONS. Thus, our aim here is to use Streptococcus suis Dpr mini-ferritin, one of the smallest protein nanocages, to i) produce SPIONs with uniform size and superior magnetic and structural properties, and ii) to test them as carriers of antimicrobial agents against MDR bacteria. This project will apply a multi- and interdisciplinary approach and offer unique opportunities for education and training in modern biochemical and biophysical techniques. The proposed work will generate various mutants of Dpr, which will be characterized for their structure and magnetic properties, followed by bioconjugation to proteins with antibacterial activity. International collaboration with groups from Greece and Spain will provide mobility and further opportunities for training.

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References:

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Prats-Ejarque, G. et al. & Boix, E. (2019). Front Microbiol. 10, 1357

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Research objectives or research questions of the project

1. To characterize the role of negatively charged cavity residues in iron core formation
2. To characterize the iron core of the mutants
3. To study the effect of metals on the iron core properties
4. To test Dpr mutants as antimicrobial delivery vehicles to combat MDR bacteria