

COLLABORATIVE IBEC INTERNATIONAL PhD PROGRAMME

Position

1. Project Title:
New Strategy to Tackle Infections: Innovative Prophylactic and Therapeutic Tools
2. Research project/ Research Group description

There is a need for treatments that can effectively prevent or treat infectious diseases and especially combat MultiDrug Resistant (MDR) bacteria. This is where prophylactic agents different to antibiotics and specific immunomodulators come in, as they have the potential to promote a healthy microbiota, enhance the immune response, and prevent the growth of harmful microorganisms, which can help prevent and treat infectious diseases. Recently, both research groups have demonstrated that B-BOOST is an effective product capable of inhibiting bacterial infections caused by different pathogenic bacteria (*Pseudomonas aeruginosa*, *Acinetobacter baumannii*, *Klebsiella pneumoniae*, and *Escherichia coli*) by modulating the host immune system to varying degrees (**a joint patent is pending between the two groups IBEC and UAB**). Our results indicate that our product B-BOOST triggers a protective immune response in the host. B-BOOST immune priming eliminates all circulating pathogenic bacteria by activating multiple pathways and promoting the production of different antimicrobial peptides and enzymes. This treatment represents a promising tool with the potential to combat MDR bacteria effectively. Moreover, B-BOOST was shown to be completely safe and non-toxic in *in vivo* animal models such as mice and *Galleria mellonella*. Therefore, the introduction of B-BOOST therapy could significantly reduce healthcare cost. Furthermore, this therapy could have a profound social impact by lowering morbidity and mortality rates, improving public health, and mitigating the spread of infectious diseases.

This research project aims to unravel the molecular mechanisms and nature of the immune protection conferred by B-BOOST, focusing on both the host and the agent simultaneously. Additionally, it is critical to evaluate how changes in the microbiota induced by B-BOOST play a key role in infection protection. Gender dimension will be considered in the planned activities.

Over the past 5 years, UAB and IBEC labs have collectively contributed to >60 scientific publications, secured >20 highly competitive research projects and submitted 3 patents. The two collaborating groups have a strong history of joint projects, and this next phase calls for a dedicated PhD student to pursue the outlined objectives. In the last 3 years they have shared 1 thesis, 5 published articles, 3 submitted manuscripts, 1 patent and are currently submitting another joined patent. The BIAT group at the IBEC will provide expertise in microbial molecular biology and advanced technologies to investigate host-pathogen interaction. Meanwhile, the UAB team will contribute its expertise in immunology of infections, cell biology and using mice and rats as infections models.

3. Job position description

The doctoral candidate's primary objective will be to investigate the immunostimulatory mechanisms of B-BOOST and evaluate how changes in gut microbiota influence the elimination of bacterial pathogens during infection. Additionally, the candidate will explore how different formulation can enhance the efficacy of the immunomodulator. The doctorate candidate will gain expertise fields, including immunology, cell biology, microbiology and nanotechnology.

Key responsibilities:

- Develop and manipulate B-BOOST for experimental purposes.
- Perform *in vitro* analyses using cell cultures to study bacterial host interaction between all the components (pathogen, cell, B-BOOST).
- Evaluate immune system changes following immune priming and investigate mechanisms of pathogen elimination.
- Conduct infections in animal models (*Galleria mellonella*, mice, rats) to study administration routes, immunological stimulation, and antibacterial efficacy.
- Analyze changes in host microbiota composition (impact in both metabolome and microbiome) and assess how B-BOOST enhances antibacterial activity.
- Formulation of the immunomodulator and evaluation of its antimicrobial efficacy.

Requirements for candidates:

Essential:

- Bachelor (BSc) and/or Master (MSc) degree in Life Science
- Self-critical mindset with a strong capacity for learning and applying new knowledge.
- Core competencies and skills: Communication, Teamwork, Proactivity, Commitment, Collegiality, Integrity, Critical and Analytical thinking
- High proficiency in English

Advantageous:

- Experience or background in molecular biology or microbiology.
- Experience or background in microscopy.

Group Leader at IBEC

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Collaborator in the other institution

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