MARIE SKŁODOWSKA-CURIE INDIVIDUAL FELLOWSHIPS 2020

EXPRESSION OF INTEREST FOR HOSTING MARIE CURIE FELLOWS

HOST INSTITUTION

ITQB NOVA |Institute of Chemical and Biological Technology António Xavier
Research Unit: iNOVA4Health

RESEARCH GROUP AND URL

Biomolecular Diagnostic Laboratory
URL: https://www.itqb.unl.pt/labs/biomolecular-diagnostic

SUPERVISOR (NAME AND E-MAIL)

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SHORT CV OF THE SUPERVISOR

Dragana P C de Barros graduated in Biochemical Engineering and Biotechnology by University of Belgrade, Serbia. After graduation she was working around 5 years as an engineer in industry, first in the R&D Department and later on in the part of the Preparation and Manufacture Department. She decided to move to scientific research and in 2010 she completed her PhD in Biotechnology at Instituto Superior Técnico (IST), Technical University of Lisbon, Portugal, having during her PhD studies trainees at University of Ulm, Germany, and collaboration with the Max-Planck Institute, Mainz, Germany. She developed environmentally friendly and multifunctional biphasic system (miniemulsion) for biosynthesis of aroma products, including bioprocess optimization studies, the protein and media engineering, optimization of reactions parameters, and reaction stability. After PhD she gain the postdoctoral project in Institute for Bioenginering and Bioscience, Instituto Superior Técnico (iBB/IST), and Molecular Simulation Laboratory, Instituto de Tecnologia Química e Biológica, Universidade Nova (MSL-ITQB/NOVA). During her work at ITQB/NOVA she developed a new semi-empirical model based on continuous electrostatic to study partition behaviour of therapeutic and industrial proteins in alternative purification systems (aqueous two-phase system). By finishing postdoctoral contract, she stays one school year as an invited professor in Department of Bioengineering IST, working also as a research scientist in iBB/IST. During 6 months (2016) of advanced scientific training in MaxSynBio research project (Max Planck Institute, Mainz, Germany) she developed a novel surface functionalized silica nano- and micro-structured capsule to capture bioactive compounds.
She also has 4 months (2016) professional experience in clinical assessment of safety and efficacy of more than 50 commercial products and raw materials of Cosmetics products (in Spirit of Good Clinical Practices- GCP), for several clients (some of them from Fortune Global 500).
Currently she is senior research scientist, member of Biomolecular Diagnostic Laboratory at the ITQB NOVA, with the scientific interest including the crossover between experimental and modelling studies in the area of bioprocess and cutaneous drug delivery systems development. Present research interests involve design of drug delivery systems for cutaneous applications. In this context she explores the potential of biodegradable lipid

carriers based on natural compounds to capture polyphenolic compounds and the mechanism of transdermal delivery.

During her scientific career she also managed laboratory functions including organization and maintenance of lab space and equipment. Also participate in a training of Masters and PhD students in analytic techniques related with particles, protein and final product analysis. Participated in Master's Examination Committees and as the invited referee for international peer –reviewed journals, show solid verbal and written communication skills.

Barros co-supervised 2 PhD theses in the area of lipid nanocarriers synthesis (NLCs) for bioactive compounds delivery and biopolymers synthesis using biocatalysts using miniemulsion technique. She also co-supervised 2 MSc theses in the area of protein separation in biphasic system as a part of the European Project INTENSO (FP7-KBBE-2012- 6). DPC de Barros published 20 peer-reviewed scientific papers, 12 of them as first and corresponding author. She also has 6 communications published in the context of academic conferences, 10 oral communications (2 of them as an invited speaker), and participated with more than 20 poster communications in international and national conferences. She participated as a team member in 5 other national and international research projects and was part of the COHiTEC program (2007) and the ISCTE-IUL-MIT Venture Competition (2010) and HiSeedTech program (2018).

5 SELECTED PUBLICATIONS

- F Pinto, LP Fonseca, S Souza, A Oliva, DPC de Barros, Topical distribution and efficiency of nanostructured lipid carriers on a 3D reconstructed human epidermis model, Journal of Drug Delivery Science and Technology, 2020;
- F Pinto, DPC de Barros, C Reis, LP Fonseca , Optimization of nanostructured lipid carriers loaded with retinoids by central composite design, Journal of Molecular Liquids, 2019;
- F Pinto, DPC de Barros, LP Fonseca, Design of multifunctional nanostructured lipid carriers enriched with α-tocopherol using vegetable oils, Industrial crops and products, 2018;
- DPC de Barros, SRR Campos, AM Azevedo, AM Baptista, MR Aires-Barros, Predicting protein partition coefficients in aqueous two phase system, Journal of Chromatography A, 2016;
- DPC de Barros, F Pinto, ACD Pfluck, ASA Dias, P Fernandes, LP Fonseca, Improvement of enzyme stability for alkyl esters synthesis in miniemulsion systems by using media engineering, Journal of Chemical Technology & Biotechnology, 2018.

PROJECT TITLE AND SHORT DESCRIPTION

Transdermal delivery of bioactive polyphenolic compounds using biodegradable lipid nanocarriers

The ability to deliver bioactive compounds (BCs) by penetration or permeation through the skin is of outmost importance for topical therapy of skin diseases, but also highly relevant for systemic delivery of drugs with poor peroral bioavailability. In general, the challenge in transdermal delivery is getting drug across the epidermis, particularly stratum corneum, the outermost layer of the epidermis. Delivery nanocarriers provide a means to

improve and control stability, activity, solubility and bioavailability as well as controlled release and targeting of BCs. Nanocarriers may facilitate drug delivery to structural features of the skin, interacting with skin lipids to mediate transport and/or creating skin-based drug reservoirs for a sustained or stimuli-induced release. Lipid nanocarriers are efficient delivery systems of bioactive compound that can be produced in total absence of organic solvents, using only aqueous phase and natural emulsifier. The addition of liquid lipids, in some cases vegetable oil (VO), results in a 2nd generation of lipid nanocarriers, so-called nanostructured lipid carriers (NLCs). NLCs are very attractive for cutaneous applications due to their increased permeability, better surface adhesiveness (leading to better drug penetration), occlusive effect that improves skin hydration and diffusion of the formulation, high load capacity and high long-term stability.

The beneficial impact of VOs on human health is well known as they are rich in nutrients, vitamins, minerals, and also polyphenols (PPh). Polyphenols of olive oil (OO) are especially interesting with respect to their well-established beneficial effects on human health and metabolism. Polyphenols of olive oil, oleocanthal and oleacein, are recognized as having antioxidant, anti-inflammatory, antimicrobial, and antitumor properties. Controlled topical application of polyphenols is advantageous over oral or intravenous intake for maximizing the local exposure and decreasing systemic toxicity. Drug penetration after topical application can be improved by chemical enhancers that are able to transport BCs across the skin barrier through a variety of mechanisms. Some chemical enhancers are part of vegetable oils NLCs composition (e.g. oleic acid, terpens, etc.) which could interact with the skin lipids. Beside the well explained mechanisms involved in modulation of skin penetration, we will look into the permeation enhancement on molecular level. The potential of NLC delivery systems cannot be fully appreciated yet because of insufficient knowledge of the physicochemical aspect of nanoparticle systems organization, and of the interactions between bioactive molecules and their carrier matrices. Herein, our aim is to develop the skin model for NCL testing, and use it to identify promising NCL-enhancer-BC combinations.

SCIENTIFIC AREA WHERE THE PROJECT FITS BEST

LIFE SCIENCES (LIF)