Supervisor(s): Arturo Álvarez-Bautista and Catarina Duarte
Supervisor(s) email address: arturo.alvarez@itqb.unl.pt; cduarte@itqb.unl.pt
Lab/Institution:
TITLE: **EVALUATION OF THE CELLULAR UPTAKE IMPROVEMENT OF ENCAPSULATED NATURAL EXTRACTS NANOPARTICLES WITH ANTICANCER CAPACITY**

BACKGROUND

Leading chemotherapeutic agents are widely used in the clinic for cancer treatment. However, systemic side effects and the development of drug resistance have limited their therapeutic efficiency. To overcome these potential problems with chemotherapeutics, a number of phytochemical and herb extracts that show anticancer activities are being widely explored for cancer therapy. Entities in nanometer sizes are excellent platforms to incorporate various drugs or active materials that can be delivered effectively to the desired action site without compromising the activity of the incorporated drug or material. In particular, nanotechnology entities can be used to deliver natural products that have poor solubility or a short half life. Natural products used with entities in nanometer sizes enable us to solve many of the inherent problems (stability, solubility, toxicity) associated with natural products, and also provide a platform for targeted delivery to tumor sites. Despite outstanding advancements in fundamental cancer biology and chemoprevention using natural products in preclinical settings, they have not translated into progress from 'bench to bedside' for human use. Some of the reasons behind the lack of success of chemoprevention using natural products in clinical trials are: (i) diverse genetic backgrounds of patients at risk; (ii) varied food habits among patients, and more importantly; (iii) inefficient systemic delivery and poor bioavailability of active agents. In order to achieve a maximum response of natural products as chemopreventive agents for human use, strategies are required that can bypass these limitations. Strategies that could lead to sustained release of the chemopreventive agents could critically improve their bioavailability, and in turn reduce the toxicity associated with the high doses that are typically required for an optimum response.

OBJECTIVES

The aim of this proposal is to evaluate and improve the cellular uptake of different natural products studying the encapsulation of these products in different nanocarriers. The student enrolling in this project will have the opportunity to learn different methodologies for synthesis of nanoparticles and encapsulation of different natural extract for biomedical applications.

Moreover, the student will have opportunity to acquire expertise on preparation of nanoparticles using conventional and non conventional techniques (green chemistry), physic-chemical characterization of the nanoparticulate systems that involves diverse methods of analysis (morphology, structure, organization, particle size distribution), and finally the study of the capacity to induce cellular apoptosis of encapsulated extract in comparison with pure extract.

Task 1: Formulation of nanoparticles by different methodologies:
Nanoprecipitation, double-emulsion, PGSS (Green Technology)

Task 2: Characterization of the nanaparticles by different techniques:
FTIR, DSC, RMN, DLS

Task 3: Drug (natural extract) delivery studies
The drug delivery studies will be done by analytical and physico-chemical techniques such as HPLC and UV-Vis in different media conditions. This loaded nanoparticles will be tested using different cellular studies like viability, toxicity and uptake within a related on-going project in the host lab.

TIMELINE (use fill tool for the cells)

	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10
Task 1										
Task 2										
Task 3										