INL Therapeutics: innovative systems for the induction of immunotolerance and selective cell death

Liliana Pires[1], Begoña Espiña[1], Vânia Vilas-Boas[1,2], Félix Carvalho[2], Manuel Bañobre[1] and **Inês Pinto**[1]

[1] International Iberian Nanotechnology Laboratory (INL), Portugal
[2] Faculty of Pharmacy, University of Porto, Portugal

The advent of nanotechnology has opened new avenues for creating alternative and innovative approaches to be applied in clinical practice. Within the general framework of INL research in nanomedicine we investigate and develop nano and micro-based systems for the treatment of neurogenerative diseases, such as multiple sclerosis, and cancer.

Multiple sclerosis is a neurodegenerative disease in which degeneration is triggered by the abnormal infiltration in the central nervous system of immune cells which shown an aberrant behaviour recognizing and degrading myelin. The use of tolerogenic vaccines is currently under investigation by the administration of specific peptides that are expected to be able to restore immune homeostasis, and consequently stop the aberrant degradation of myelin and neurodegeneration.

A comparative study revealed that vaccine application through transdermal microneedles can provide more effective immunization than subcutaneous injection, allowing significant antigen sparing. Moreover, these micro-structures hold the promise of allowing injection without pain, reducing the biohazardous waste and avoiding the need for specialized administration. Microneedles patches have been developed at INL for the transdermal delivery of drugs or peptides. As the dermis is a skin layer highly rich in immune cells, such as Langerhans cells, known to be responsible for inducing antigen-specific tolerance, we are interested on the development and application of these devices for the delivery of tolerogenic vaccines under the scope of multiple sclerosis.

The development of anti-cancer therapies at INL is based on the use of targeted nanoparticles able to induce magnetic hyperthermia ultimately leading to selective cell death. Magnetic hyperthermia (MHT) has emerged in recent years as an experimental anti-cancer strategy that may be used either alone or as a sensitizing strategy. It exploits the local heat generated by magnetic nanoparticles (MNPs) in an external alternating magnetic field. MNPs functionalized with specific antibodies against cancer cells are currently being investigated, in order to induce a localized heating of cancer cells. The efficacy of these nanoparticles in hyperthermia cancer therapy is tested at INL using in vitro models.