

Based mainly on the molecular principles that govern the interaction between pathogens and immune cells, nanotechnology has created a tunable way of communication with the immune system. Both, the composition and the physicochemical characteristics of nanocarriers, can influence their interaction with immune cells. [1].

During my presentation I would like to focus on the work that our team has been doing in the vaccination field. We started working with toxoid antigens, later with whole purified proteins and, currently, we are focused on the use of peptides and mRNA as purer and safer antigens. At the same time, we have used different nanotechnologies, such as nanoparticles and nanocapsules. The evolution of our work has moved from nanosystems that functioned as monolithic compartments, where the carrier worked as a simple antigen container, to a nanosystems designed at a molecular level. We are capable of modifying the physicochemical properties of the nanosystems to drain more favourably to the lymph nodes and to be uptaken more efficiently by the immune cells. Besides we can include different immunoregulators in the nanosystems to potentiate the immunostimulation, in the case of infectious diseases or, on the contrary, to generate tolerance in the case of autoimmune diseases.

With the modification of their physicochemical properties and the incorporation of different immunoregulators, NCs constitute highly tuneable nanosystems that offers a whole language in the communication with the immune system.

References

[1] S. Cordeiro, M.J. Alonso, M. de la Fuente, Nanoengineering of vaccines using natural polysaccharides, *Biotechnol. Adv.* 33 (2015) 1279–1293.

[2] S. Vicente, M. Peleteiro, B. Díaz-Freitas, A. Sanchez, Á. González-Fernández, and M. J. Alonso, “Co-delivery of viral proteins and a TLR7 agonist from polysaccharide nanocapsules: A needle-free vaccination strategy,” *J. Control. Release*, vol. 172, no. 3, pp. 773–781, 2013.

Figures

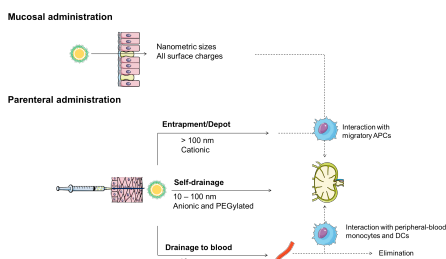


Figure 1: Summary of the influence of the physicochemical properties of nanocarriers (particle size and surface charge) in the fate of the nanosystems after administration: both particle size and surface charge play an important role in the outcome of nanosystems once administered, either by mucosal or parenteral routes.

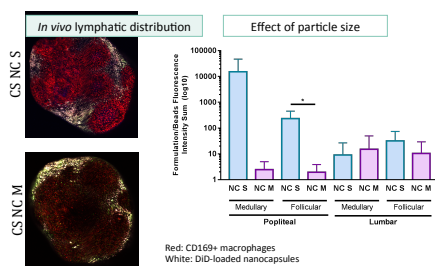


Figure 2: lymphatic distribution of small size (NC S, < 100 nm) and medium size (NC M, > 200 nm) nanocapsules after subcutaneous administration in the paw of mice.