

Pharmaceutical nanotechnology: a way to help drugs reaching their targets

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Biological drugs, including proteins and RNA-based polynucleotides, are taking an increasing space in the industry pipelines. Despite their potency, the difficulties of these macromolecules for overcoming biological barriers and reach the intracellular targets have limited their full exploitation.

Fortunately, the continuously improved understanding of the biological barriers and the molecular biology associated to pathological conditions is paving the way for a more comprehensive and rational design of protein formulations based on the use of nanotechnology. Our laboratory, with a long-track experience in the formulation of macromolecules using polymer nanoparticles, has significantly contributed to this field. As an example, in the 90's we were the first to report that nanoparticles made of either PLA-PEG or chitosan were efficient vehicles for the transmucosal delivery of proteins, antigens and polynucleotides. In the last decades, we have made significant advances in terms of optimizing the targeting of monoclonal antibodies and RNA molecules to their targets, either cancer cells or the immune system. The result of our subsequent efforts is an array of nanotechnologies, which make use of polymers and lipids and can be used to deliver biologicals across mucosal surfaces, and to facilitate their intracellular delivery following parenteral administration.

In my presentation, I will focus on the design of carriers for proteins and RNA molecules that could be used in two major therapeutic areas: (i) nanovaccines, i.e. HIV and COVID vaccines (iv) delivery of mAb and siRNA targeted to intracellular onco-proteins, as new oncological treatments.

Overall, our experience in this field has benefited from integrative approaches adopted by specifically designed consortia. Hopefully, the results of these cooperative efforts will help to accelerate the progress of a rational design of protein-based nanomedicines.

More information about these projects and associated publications can be found at:

<http://www.usc.es/grupos/mjalonsolab/>

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