Nanotechnology Enables Advanced and Precision Therapies

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Advanced and precision therapies that utilize proteins and RNA-based polynucleotides, are taking an increasing space in the industry pipelines. Despite their potency, the adequate exploitation of these macromolecules has been restrained by their difficulties for overcoming biological barriers and reach the intracellular targets.

Fortunately, improved understanding of the biological barriers, as well as advances in chemical biology and the synthesis of functional biomaterials is paving the way for a more comprehensive and rational design of advanced nanomedicines. Our laboratory, with a long-track record in formulating biological drugs using biomaterials, has significantly contributed to this field. As an example, in the 90's we were the first to report that nanoparticles made of biopolymers and/or lipids were efficient vehicles for the transmucosal delivery of proteins, antigens and polynucleotides. In the last few decades, we have made significant advances in terms of enabling the intracellular delivery of monoclonal antibodies and RNA molecules. These efforts have resulted in an array of nanotechnologies that can be used to develop advanced therapies and vaccines as well as personalized treatments.

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 (ii) oncological personalized therapies based mAb and siRNA targeted to intracellular onco-proteins.

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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