Functional gold-based materials for the treatment of eye diseases

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Résumé/Abstract

A large number of drugs are administrated on different mucosal surfaces, such as the ocular mucosa. However, due to the poor mucoadhesion of the current formulations, their bioavailability is often very low. The development of efficient mucoadhesive drug delivery systems is thus crucial for improving the performance of these drugs. We investigated the mucoadhesive properties of gold nanoparticles. The different techniques used to study the gold nanoparticles strongly highlighted their mucoadhesive properties, which can be modulated through the use of peripheral thiol groups. Moreover, for their use in nanomedicine, gold nanoparticles need to be ultrastable. We developed a new synthesis leading to their resistance against ultracentrifugation, heat treatments, autoclave sterilization, salts exposure and freeze-drying cycles. Their cytotoxicity was also assessed with human corneal epithelial cells and human tissue engineered corneas at different doses. Eventually, since it is known that gold nanoparticles have good drug encapsulation properties,

it should be possible to produce gold nanoparticles for drug delivery that are highly mucoadhesive and that would improve the medication thanks to their longer residence time on their mucous target. In particular, medication for ocular diseases, requiring topical application on the corneal mucosa, might be enhanced. Due to their unique properties, gold nanoparticles have thus a great potential to be used as drug delivery system for various eye diseases.

Bio

Dr. Boisselier received her PhD from Université de Bordeaux (France) in 2009 during which she synthesized and functionalized gold nanoparticles and dendrimers for biomedical applications. She then completed a postdoctoral training at Université Laval (Canada) where she studied the biophysical behavior of membrane proteins involved in ocular diseases. She joined the ophthalmology department as an assistant professor in 2014 and is now associate professor in this same department. She has developed an extensive expertise in synthesis, functionalization, stabilization and encapsulation of gold nanoparticles, and her group is currently developing new delivery systems based on gold nanoparticles for ophthalmic drugs. She is the co-holder of 3 patents that address concrete problems encountered by manufacturers. Her research group also studies the influence of various parameters related to the properties of phospholipids on the membrane binding of several proteins present in the eye.