Nanomedicine approaches in ocular drug delivery

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While the eye is readily accessible from the outside of the body, it has a number of efficient barriers in place to protect it from the environment which poses major challenges to effective drug delivery. This is mainly due to the fast nasolacrimal drainage and the poor permeation of topically applied drugs across the sandwich-like structure of the cornea, with the lipophilic corneal epithelium being the main barrier to ocular entry for most drugs. To overcome issues with topical ocular drug delivery, researchers have focused predominantly on two strategies: to increase ocular residence and to improve corneal permeability. Both can be achieved using nanotechnology with mucoadhesive nanoparticles having shown increased precorneal residence, while colloidal systems have also resulted in increased ocular bioavailability of topically applied drugs. Besides eye drops, nanotechnology has also been employed for more efficient drug delivery to the back of the eye by improving drug stability and prolonging the half-life after intravitreal injection.

This presentation will give an overview of the nanomedicine research performed within the Buchanan Ocular Therapeutics Unit including the use of polymeric nanoparticles,[1-4] nanostructured lipid carriers,[5] nanoemulsions,[6, 7] nanocrystals and dendrimers[8, 9] for enhanced drug delivery to the front and the back of the eye. Targeting approaches to deliver these carriers specifically to affected ocular cells and tissues will also be discussed.[3, 10]

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