formulation were studied at different time intervals up to 8 hours. In vitro release of WAF-beta-CD from CS nanoparticles followed a Higuchi release profile whereas its ex vivo permeation (at pH 7.4) followed a zero-order permeation profile. Results suggested that the developed WAF-beta-CD loaded CS carrier could offer a controlled and constant delivery of WAF transdermally.

Liu, R. et al. (2016). "Liquid crystalline nanoparticles as an ophthalmic delivery system for tetrandrine: Development, characterization, and in vitro and in vivo evaluation." *Nanoscale Res Lett* 11(1):254.

The purpose of this study was to develop novel liquid crystalline nanoparticles (LCNPs) that display improved preocular residence time and ocular bioavailability and that can be used as an ophthalmic delivery system for tetrandrine (TET). The delivery system consisted of three primary components, including glyceryl monoolein, poloxamer 407, and water, and two secondary components, including Gelucire 44/14 and amphipathic octadecyl-quaternized carboxymethyl chitosan. The amount of TET, the amount of glyceryl monoolein, and the ratio of poloxamer 407 to glyceryl monoolein were selected as the factors that were used to optimize the dependent variables, which included encapsulation efficiency and drug loading. A three-factor, five-level central composite design was constructed to optimize the formulation. TET-loaded LCNPs (TET-LCNPs) were characterized to determine their particle size, zeta potential, entrapment efficiency, drug loading capacity, particle morphology, inner crystalline structure, and in vitro drug release profile. Corneal permeation in excised rabbit corneas was evaluated. Preocular retention was determined using a noninvasive fluorescence imaging system. Finally, pharmacokinetic study in the aqueous humor was performed by microdialysis technique. The optimal formulation had a mean particle size of 170.0 ± 13.34 nm, a homogeneous distribution with polydispersity index of 0.166 ± 0.02, a positive surface charge with a zeta potential of 29.3 ± 1.25 mV, a high entrapment efficiency of 95.46% ± 4.13%, and a drug loading rate of 1.63% ± 0.07%. Transmission electron microscopy showed spherical particles that had smooth surfaces. Small-angle X-ray scattering profiles revealed an inverted hexagonal phase. The in vitro release assays showed a sustained drug release profile. A corneal permeation study showed that the apparent permeability coefficient of the optimal formulation was 2.03-fold higher than that of the TET solution. Preocular retention capacity study indicated that the retention of LCNPs was significantly longer than that of the solution ($p < 0.01$). In addition, a pharmacokinetic study of rabbit aqueous humors demonstrated that the TET-LCNPs showed 2.65-fold higher ocular bioavailability than that of TET solution. In conclusion, a LCNP system could be a promising method for increasing the ocular bioavailability of TET by enhancing its retention time and permeation into the cornea.

Mah, C. S. et al. (2013). "A miniaturized flow-through cell to evaluate skin permeation of endoxifen." *Int J Pharm* 441(1–2):433–440.

Endoxifen, an anti-estrogenic agent, has been recently implicated in the use of breast cancer. Its physicochemical properties make it a good candidate for transdermal delivery. However, as an investigative drug, its limited supply makes it difficult to conduct extensive preformulation studies. To address this issue, a miniaturized flow-through diffusion cell has been fabricated that utilized minimal amounts of the drug for in vitro skin permeation studies. The novel flow-through cells have been validated