



**CALIFORNIA STATE SCIENCE FAIR  
2014 PROJECT SUMMARY**

<b>Name(s)</b> <b>Sriram Somasundaram</b>	<b>Project Number</b>  34728
<b>Project Title</b> <b>Novel Design and Evaluation of Chitosan Nanoparticle Ocular Drug Delivery System</b>	
<b>Objectives/Goals</b> After working in an Indian Hospital, I realized that surgery for eye diseases is costly, unavailable, and inefficient, while the alternative is a drug in the form of eye drops. Current ocular drug delivery systems are insufficient due to the difficulty in penetrating protective layers of the eye such as the sclera, cornea, and conjunctiva while maintaining drug safety, efficacy, and bioavailability. My research proposes a fluorescein labeled chitosan nanoparticle complex (CSFLNP) that can enhance the surface area of the drugs, permeability through the layers of the eye, control release of the drug, and target specific areas of the eye. This study researches the capabilities of CSFLNP to bind, load, and release drugs for three diseases as well as its permeability through a cornea simulated in vitro. <b>Abstract</b> <b>Methods/Materials</b> CSFLNP was synthesized through ionic gelation using Tripolyphosphate (TPP). For drug loading, release, and permeability, certain wavelengths were examined to represent drugs and Nanodrop spectrophotometer was used to assay drug concentrations. Data was normalized against controls to get percent of drug loaded/released/permeated. Collagen gel was synthesized to model cornea. Dielectric test was used to examine binding. <b>Results</b> Chitosan was able to be gelled into nanoparticles and (10ul) was able to load all three of the drugs at certain potent concentrations/ amounts: 20mM for ampicillin, 50mM for propranolol, 200ul for carnosine. For carnosine and amp, there was one exponential loading phase, whereas prop had two, probably due the CS amino group switching from binding to the drugs from the stabilizer. The CSFLNP complex also provided a sustained release of the drug over a 7-hour period modeled by Non-Fickian diffusion, and increased permeation through the simulated cornea by 25%. There was also a change in strength of electric field as the concentration of prop loaded increased, showing the efficient binding and medium of binding (the amino groups). <b>Conclusions/Discussion</b> The CSFLNP efficiently bound the drugs as shown by the dielectric test and the absorbances in the loading tests, and they were able to release the drugs over a period of time. The system also had greater permeability than just the drugs alone against an in vitro simulated cornea. With this system, topical drugs can become a promising mass solution.	
<b>Summary Statement</b> I designed and tested an ocular drug delivery system based on chitosan nanoparticles that helps drugs in eyedrops reach the actual targeted part of the eye better, making eyedrops a promising and practical solution over surgery.	
<b>Help Received</b> FedEx printed board. Parents greatly helped with transportation. I used the lab equipment at the Harker School under the supervision of Dr. Gary Blickenstaff and Mr. Chris Spenner. Used lab equipment at Stanford under supervision of Dr. Jiang and Professor Mellins.	