



**CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY**

Name(s) Christina Zhu	Project Number S1317
Project Title Investigation of Auditory Nerve Intraneural Implant Designs with Finite-Element Analyses	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Intraneural implants aim to provide a sense of hearing to the deaf and hard of hearing. By using computer simulations to model the potential distribution and electrical fields in a material with electrodes, this project aims to understand the path of electrons in the auditory nerve. This project investigates several designs with the purpose of creating the optimal design for an intraneural implant.</p> <p>Methods/Materials I used COMSOL Multiphysics, a finite-element analysis program, to model the electrical field distributions and the potential distributions of different electrode array designs for an intraneural implant.</p> <p>Results The potential and electric field distribution plots showed that stimulating two electrodes further apart decreased the density of the electric field lines and decreased the likelihood that nerve bundles other than the one right above the tip will be stimulated. Setting the ground to be all around the tissue created a similar effect, so pure tones would be heard. Insulating the electrodes with a thin layer of silicon dioxide allows the implant to be more efficient, preventing the loss electrons to surrounding tissue and minimizing damage to the tissue.</p> <p>Conclusions/Discussion Signal transmission in an intraneural implant carries significance for the scientific community, not to mention the deaf and hard of hearing community. With intraneural implants that accurately transmit sound waves, patients with damaged cochleas # those who cannot benefit from cochlear implants # are able to process sounds. Through lab experiments and computer simulations, it is possible to design an optimal intraneural implant that will give those who are deaf or hard of hearing the ability to hear fully.</p>	
Summary Statement I used computer simulations to develop and investigate several different designs for intraneural implants for the deaf and hard of hearing.	
Help Received Used lab equipment at the University of California, Irvine under the supervision of Dr. Tang.	