



**CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY**

Name(s) Josef Alavi	Project Number S0602
Project Title Application of Nanostructured Porous Silicon as an Electrical Biosensor for Alzheimer's Screening	
Abstract Objectives/Goals The goal of my research project was to create reusable electrical biosensors which utilize nanostructured porous silicon as a substrate to accurately measure the concentrations of two peripheral biomarkers: alpha 2 macroglobulin (a2M) and complement factor H (CFH). Both biomarkers have high correlation (in independent studies) with Alzheimer's disease Methods/Materials Fabricated nanoporous silicon by electrochemical etching in HF solution. Functionalized nanoporous silicon with aminopropyltriethoxysilane (APTS) and antibodies against CFH and a2M protein. Measured altered electrical conductivity following incubation in known concentrations of CFH and a2M with a picoammeter. Used a pH shift with Glycine-HCl pH 3 to elute protein binded to the biosensors. Results Between 2 and 5.5 volts, the electrical biosensors for a2M and CFH were non-ohmic and exhibited an exponential relationship ($R^2 > 0.94$). Following a sudden increase in current, the electrical biosensors exhibited high linearity between protein concentration and electrical current at voltages ranging from 6.5 to 7.5 ($R^2 > 0.98$). Furthermore, incubation in protein elution buffer (0.2 M Glycine*HCl at pH 3) removed over 94% of immobilized protein from the used electrical biosensor, allowing the electrical biosensor to be reused. Conclusions/Discussion The linear calibration curves for a2M and CFH allow for linear interpolation of unknown quantities of each protein, making the electrical biosensors suitable for measuring a2M and CFH concentrations in human serum. The ability to accurately measure unknown protein concentrations of a2M and CFH using the reusable biosensor may allow the peripheral serum biomarkers to reliably screen Alzheimer's disease.	
Summary Statement I successfully fabricated and characterized reusable porous silicon biosensors to interpolate unknown concentrations of Alzheimer's implicated a2M and CFH ranging from 25 to 50 ug/ml.	
Help Received I used the facilities at the Buck Institute for Research on Aging to conduct my research project.	