



**CALIFORNIA STATE SCIENCE FAIR  
2005 PROJECT SUMMARY**

<b>Name(s)</b> <b>Evangeline J. Fleischaker</b>	<b>Project Number</b> <b>S0403</b>
<b>Project Title</b> <b>Use of Quartz Crystal Microbalance to Study Antibody Antigen Interactions</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> The Quartz Crystal Microbalance (QCMB) is a simple device. The adsorption of a compound on the quartz surface causes a decrease in the resonance frequency that is proportional to the mass adsorbed. My goal was to use the QCMB to prepare a biosensor capable of measuring baculovirus particles.</p> <p><b>Methods/Materials</b> Self assembled monolayers (SAM's) were used to modify the surface of a quartz crystal to enable the attachment of proteins such as antibodies. Antibodies against the baculovirus coat protein gp64 were immobilized on a SAM that contained an N-hydroxysuccinimide(NHS) group.</p> <p>Additionally the regeneration of the bound antibody was examined by screening a series of reagents which enabled me to identify a combination of these reagents that efficiently disrupt the antibody antigen interaction with out damaging the bound antibody. This enabled the repeated reuse of the antibody.</p> <p><b>Results</b> Results show that the quartz crystal microbalance successfully and rapidly detected the presence of the baculovirus via the gp64 antigen. The biosensor shows a remarkably linear response, in the range of 10E6 to 10E7 pfu per mL. On the positive side, this response is sensitive enough to be useful in cell culture, since the concentration of baculovirus produced in cell culture is typically in the range of 10E7 to 10E9 pfu per mL. On the negative side, the unit is temperature-sensitive, often requiring an hour or more to stabilize before useful measurements can be obtained.</p> <p>The cleaning study showed that a mixture of acids, salts, and EDTA could completely regenerate the antibody and permitted more that 10 uses without any apparent lose in antibody capacity.</p> <p><b>Conclusions/Discussion</b> The target antigen chosen for this project, the baculovirus <i>Autographa californica</i>, is of particular interest to many in the pharmaceutical and pesticide industries. This virus is most active against the alfalfa looper, which destroys many crops. This project has demonstrated its applicability to industry in that baculovirus titers were obtained with the quartz crystal microbalance biosensor, in less than a day, with ability to re-use it numerous times. The capability of this biosensor could expedite industry's ability to produce the virus or products made by them.</p>	
<b>Summary Statement</b> The preparation of a biosensor to baculoviruses using a quartz crystal microbalance.	
<b>Help Received</b> Used lab equipment at Vista Biologicals under the supervision of Robert Fleischaker; Steven Fleischaker for writing a C++ program to parse the data captured in a text file; Chisato Shiohara of Vista Biologicals for preparation of the baculovirus stock.	