THE HARTWELL FOUNDATION

2010 Individual Biomedical Research Award

Review of Proposed Research

Investigator: **Cristina E. Davis, Ph.D.**
Associate Professor
Department of Mechanical and Aerospace Engineering

Institution: **University of California, Davis**

Proposal: **Point-Of-Care Breath Sensor to Improve Childhood Asthma Control**

Childhood asthma remains very poorly diagnosed in part, because there are currently no convenient non-invasive, real-time tests to track this disease in children. Dr. Davis proposes to address this unmet need with a small portable device with a chemical sensor to monitor exhaled, volatile breath biomarkers in children. More than 5 million children have asthma and the prevalence of asthma in some inner cities in the United States is greater than 20%. Asthma is the most common chronic childhood disease and asthma attacks are the most common reason children miss school. Missed asthma diagnoses in children and poorly controlled asthma have serious economic impact for both the families of asthmatic children and the school systems that the children attend. Recent surveys suggest that only 67% of children are properly diagnosed with asthma in inner cities, such as Detroit. In Sacramento County, the lifetime prevalence of childhood asthma is almost 20% and these children have a high rate of hospital visits. The non-invasive diagnostic monitor for children with asthma proposed by Cristina will measure a specific category of biomarkers called eicosanoids (fatty acid derivatives that act as molecular signals for the immune system) that have been shown to correlate with lung inflammation. After modeling pediatric lung volume sampling, Cristina intends to evaluate the device by tracking the five fatty acid metabolites she recently identified in exhaled breath condensate from asthmatics (2009, accepted for publication) and compare her instrument with high-performance liquid chromatography electrospray tandem mass spectrometry. Confirmed biomarker(s) will form the basis for daily measurement of asthma progression. The design of her device will provide for daily monitoring by an asthmatic child that is easy and non-invasive. The child simply exhales into a miniature portable sensor (similar in size to an inhaler), and the amount of breath biomarker is measured in real-time. She expects that when the child's asthma is well controlled, lower levels of any biomarker(s) will be measured. If the pediatric breath sensor platform is successfully translated into practical use, she expects that the device would also be useful in managing the response to pediatric asthma medications, which for affected children would potentially result in fewer exacerbations of asthma compared to the current standard-of-care. Given its high prevalence, childhood asthma is by far the most relevant and timely application for pediatric breath testing; but Dr. Davis envisions many other important applications, including measuring markers of acute fungal infections in immune compromised children and deadly bacterial infections commonly found in pediatric cystic fibrosis.