THE HARTWELL FOUNDATION

2011 Individual Biomedical Research Award

Review of Proposed Research

Investigator: **Silvia Salinas Blemker, Ph.D.**
Associate Professor
Departments of Mechanical and Aerospace Engineering, Biomedical Engineering, and Orthopedic Surgery

Institution: **University of Virginia**

Proposal: **Silvia Salinas Blemker, Ph.D., Associate Professor, Departments of Mechanical and Aerospace Engineering, Biomedical Engineering**

The plastic surgery community has been attempting by trial-and-error to improve cleft palate repair surgery outcomes for over a century, but with limited success. The first modern-medicine-based surgery for a cleft palate was described in the 1800s and variations of this surgery remain in use today. Unfortunately, the thousands of children who undergo this surgery each year continue to suffer from significantly impaired speech for their entire lives. With approximately one in every 700 infants born in the U.S. born with either a combined cleft lip/palate or an isolated cleft palate (roughly 6,000 infants per year), cleft palate deformities are one of the most common birth defects. Unfortunately, many children in the U.S. who undergo cleft palate repair require follow-on surgeries and many never develop normal speech. Despite the existence of established surgical treatments, palate deformities continue to have a significant negative long-term impact on the physical and mental health of affected children. The outcomes of cleft palate repair surgeries and speech recovery remain suboptimal because the mechanics and function of palate muscles are complex and poorly understood. To address this need, Silvia proposes through the use of advanced imaging and computer modeling to create a modeling and simulation framework for predicting palate muscle function during speech, before and after cleft palate repair surgery. The physics-based models that she has previously developed for simulating the action of skeletal muscle portray the complex three-dimensional behavior of muscle with an extraordinary level of detail and accuracy. Refining these modeling techniques to achieve representation of the palate musculature will represent an important advance for cleft palate surgeons. The model will be validated by comparisons with novel dynamic magnetic resonance imaging (MRI) data, which together with her surgeon collaborator will be used to design more effective approaches for cleft palate repair. The idea of using such muscle models as a platform for surgical prototyping is unprecedented. If Silvia is successful, this new approach for cleft palate repair will lead to optimized clinical outcomes that will improve the physical and mental health of children born with this birth defect.