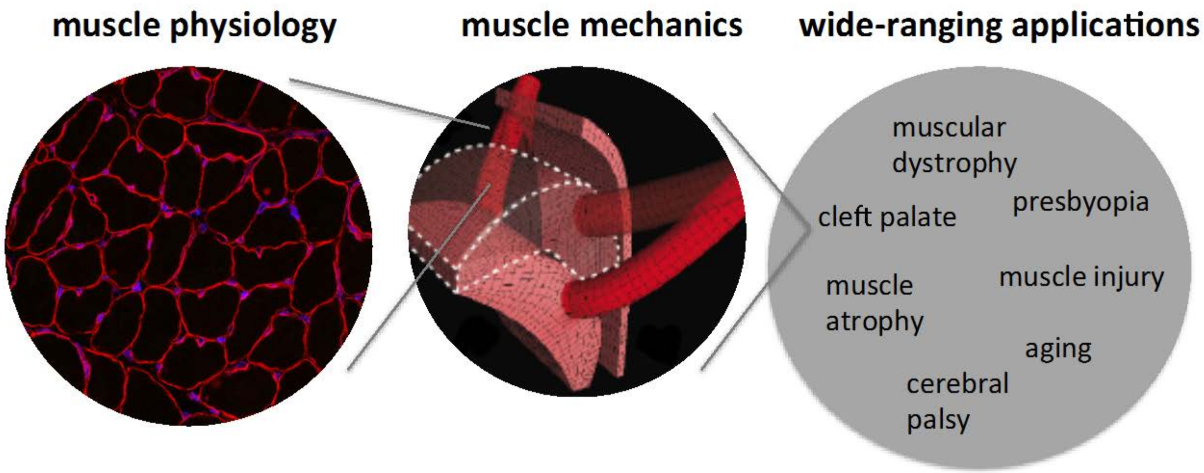

Multiscale Muscle Mechanophysiology Lab

Silvia Salinas Blemker
ssb6n@virginia.edu
www.bme.virginia.edu/muscle/

Dept. of Biomedical Engineering
University of Virginia
Charlottesville, VA
434.924.6291

"The goal of our work is to leverage engineering tools to solve important problems in human health, while providing student mentees with a superior interdisciplinary educational and research experience."

The Multi-scale Muscle Mechanophysiology ("M3") lab is collectively fascinated by skeletal muscles, which are the motors for all the wide range of voluntary movements in the human body. Each muscle's properties are beautifully tuned for a specific function in the body, which can be easily disrupted by diseases such as muscular dystrophy, cerebral palsy, or in aging populations. We seek to gain new insights into the form, function, biology, and diseases of muscles. Our work has the ultimate goal of improving treatments and quality of life for individuals suffering from muscle-related clinical problems. We integrate a variety of computational and experimental approaches to achieve this goal.

Our research objective is to use engineering approaches to improve clinical treatment of a variety of health problems. All our projects are centrally focused on restoring function of skeletal muscle in the human body. Three themes of the M3 lab's research include:

(1) Create multi-scale computational models in order to simulate biomechanical and biological behaviors of muscle. The M3 lab is well known for creating highly accurate and realistic computer models of skeletal muscle. Our models span scales from sub-cellular to whole body, and we are consistently developing novel methodology for advancing the realism and predictive capacity of the models.

(2) Develop and apply novel experimental techniques to validate and test computational models. We incorporate experimental measurements into our modeling approach in order to provide data as input to our models as well as to test the predictions and hypotheses generated by our models. Experimental methods used by the lab include magnetic resonance imaging, mechanical testing, confocal imaging, and a recently acquired technology called the "Zebrascope" that allows for measurement of human sarcomere *in vivo*.

(3) Apply the modeling-experimental paradigm to areas of clinical need. All our modeling projects initiate with a purpose of addressing a critical need in medicine. Examples of current projects in the lab include:

- Using computational models as a paradigm for treatment discovery in **Duchenne muscular dystrophy**, a fatal genetic disease that affects one in 3,500 boys and for which there currently is no FDA-approved treatment.

- Using computational models to develop more effective surgical approaches for **cleft palate** repair. Cleft palate is one of the most common birth defects (one in 700 births). Currently, surgeries to correct cleft palate fail to restore normal speech in approximately one in four children.

- Using computational models to develop interventions that address how age-related changes in muscle and tendon affect **mobility in aging populations**. Mobility issues in aging populations are a significant problem: roughly 20% of adults over the age of 65 years self-report walking difficulties that affect health and performance of daily activities.

RECENT RESEARCH DEVELOPMENTS

- Computational model of dystrophic muscle provide new insights into the effects of the disease on muscle properties.
- Computational model of the soft palate muscles reveal a new improved cleft palate repair surgical approach.
- MRI-based technology provides an entirely new view of muscle impairment in children with cerebral palsy.

RECENT GRANTS

- The National Institutes of Health
- National Science Foundation
- The Hartwell Foundation
- Wallace R. Coulter – UVA Translational Partnership

SEAS Research Information
Pamela M. Norris,
Executive Associate Dean for Research
University of Virginia
Box 400232
Charlottesville, VA 22903
pamela@virginia.edu
434.243.7683

University of Virginia Engineering