

# KYLE STEVEN MARTIN, PH.D.

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<http://ksm362.github.io/>

## EDUCATION

Ph.D.	<i>University of Virginia</i> , Department of Biomedical Engineering, Charlottesville, VA <b>Dissertation:</b> "Agent-based modeling of skeletal muscle adaptation" <b>Advisers:</b> Shayn Peirce-Cottler and Silvia Salinas Blemker	2015
B.S.	<i>Drexel University</i> , Department of Biomedical Engineering, Philadelphia, PA	2009

## AWARDS

Whitaker International Scholarship, <i>Karolinska Institutet</i>	2017
Wenner-Gren Fellowship, awarded but declined, <i>Karolinska Institutet</i>	2017
Cardiovascular Research Postdoctoral Training Grant, NIH 4T32HL007284-39, <i>University of Virginia</i>	2016
Image-Based Biomedical Modeling (IBBM) fellowship, <i>Scientific Computing and Imaging Institute</i>	2014
American Society of Biomechanics President's award, <i>World Congress of Biomechanics</i>	2014
Tomorrow's Professor Today, <i>University of Virginia</i>	2013
SEAS Graduate Teaching Fellowship, <i>University of Virginia</i>	2013
Cardiovascular Research Graduate Student Training Grant, NIH 5T32HL007284, <i>University of Virginia</i>	2010
Double-Hoo Scholarship, <i>University of Virginia</i>	2010

## RESEARCH

### Positions

Post-Doctoral Researcher, <b>Jorge Ruas lab</b> , <i>Karolinska Institutet</i> , Sweden	2017 – present
Organs and tissues are in constant communication with each other. I am interested in the inter-organ communication between adipocytes and sensory neurons. Their local communication is both understudied and could have an impact on metabolic disorders or obesity. Through the use of microfluidic devices, RNAseq, and traditional cell culture methods, I am investigating 1) how sensory neurons innervate adipocytes, 2) how sensory neurons regulate adipocytes function (metabolism, adipokine production, etc) and 3) how adipocytes modify sensory neuron growth and function.	
Post-Doctoral Researcher, <b>George Christ Lab</b> , <i>University of Virginia</i>	2016 – 2017
Severe muscle injuries, such as volumetric muscle loss, involves the disruption of many biological systems that work congruently to function (muscle, nervous system, vasculature, etc.). While the effects of injury on muscle fibers are actively researched, the blood vessels and nerves are less studied. My projects focused on exploring the hypotheses generated from my computational models created during my graduate studies as well as understanding the vasculature and nervous system in muscle before and after volumetric injury.	
Graduate Student, <b>Labs of Silvia Blemker and Shayn Peirce-Cottler</b> , <i>University of Virginia</i>	2009 – 2015
I developed a novel tissue level agent-based model of skeletal muscle and used the model to simulate muscle adaptation. The first application was to investigate disuse-induced muscle atrophy. Through the inclusion of muscle injury and inflammation, I adapted the model to probe how muscles recovery and adapt after injury (contusion/crush/laceration). The agent-based model was able to 1) elucidate the importance of inflammatory cell recruitment timing (neutrophils, pro or anti-inflammatory macrophages) during muscle regeneration and 2) provides insight into optimum timing/duration of therapeutics during muscle recovery.	

## Journal Publications

**KS Martin\***, M Azzolini\*, J Ruas. "The Kynurenine Connection: How exercise shifts muscle tryptophan metabolism and affects energy homeostasis, the immune system, and the brain." *American Journal of Physiology - Cell Physiology*, May 2020 (\* authors contributed equally)

KM Virgilio, B Jones, E Miller, E Ghajar-Rahimi, **KS Martin**, SM Peirce, SS Blemker. "Computational models provide insight into in vivo studies and reveal the complex role of fibrosis in mdx muscle regeneration" *Annals of Biomedical Engineering*, submitted

KM Virgilio, **KS Martin**, SM Peirce, SS Blemker. "Agent-based model illustrates the role of the micro-environment in regeneration in healthy and mdx skeletal muscle" *Journal of Applied Physiology*, August 2018

JA Call, J Donet, **KS Martin**, AK Sharma, ...Z Yan. "Muscle-derived extracellular superoxide dismutase inhibits endothelial activation and protects against multiple organ dysfunction syndrome in mice" *Free Radical Biology & Medicine*, October 2017

CC Henry, **KS Martin**, BB Ward, GG Handsfield SM Peirce, SS Blemker. "Spatial and age-related changes in the microstructure of dystrophic and healthy diaphragms" *PloS one*, September 2017

**KS Martin**, CD Kegelmann, KM Virgilio, JA Passipieri, GJ Christ, SS Blemker, SM Peirce. "In silico and in vivo experiments reveal M-CSF injections accelerate regeneration following muscle laceration" *Annals of Biomedical engineering*, March 2017

**KS Martin**, KM Virgilio, SM Peirce, SS Blemker. "Computational modeling of muscle regeneration and adaptation to advance muscle tissue regeneration strategies" *Cells, Tissues, Organs*, November 2016

**KS Martin**, SS Blemker, SM Peirce. "Agent-based computational model investigates muscle-specific responses to disuse-induced atrophy" *Journal of Applied Physiology*, May 2015

- Featured in the editorial: An, Gary. *Journal of Applied Physiology*, May 2015

- Editor's pick: June 2015

KM Virgilio, **KS Martin**, SM Peirce, SS Blemker. "Multiscale models of skeletal muscle reveal the complex effects of muscular dystrophy on tissue mechanics and damage susceptibility" *Interface Focus*. February 2015

JA Call, KH Chain, **KS Martin**, VA Lira, M Okutsu, M Zhang, Z Yan. "Enhanced skeletal muscle expression of EcSOD mitigates streptozotocin-induced diabetic cardiomyopathy by reducing oxidative stress and aberrant cell signaling" *Circulation: Heart Failure*. Dec 2014

M Okutsu, JA Call, VA Lira, M Zhang, JA Donet, BA French, **KS Martin**, SM Peirce, CM Rembold, BH Annex, Z Yan. "Extracellular Superoxide Dismutase Ameliorates Skeletal Muscle Abnormalities, Cachexia and Exercise Intolerance in Mice with Congestive Heart Failure" *Circulation: Heart Failure*. May 2014

AO Awojodu, ME Ogle, LS Sefcik, DT Bowers, **KS Martin**, KL Brayman, KR Lynch, SM Peirce, E Botchwey. "Sphingosine 1-phosphate receptor 3 regulates recruitment of anti-inflammatory monocytes to microvessels during implant arteriogenesis" *Proceedings of the National Academy of Sciences*. August 2014

AM Guendel\*, **KS Martin\***, J Cutts, PL Foley, AM Bailey, F Mac Gabhann, TR Cardinal, SM Peirce. "Murine Spinotrapezius Model to Assess the Impact of Arteriolar Ligation on Microvascular Function and Remodeling" *Journal of Visualized Experiments*. March 2013 (\* authors contributed equally)

M Zhang, M Huang, C Le, PB Zanzonico, F Claus, KS Kolbert, **KS Martin**, CC Ling, JA Koutcher, JL Humm. "Accuracy and reproducibility of tumor positioning during prolonged and multimodality animal imaging studies" *Physics in Medicine and Biology*. October 2008

## Presentations

**KS Martin**, AF Kahrl, BM Ivanov, MA Johnson. "Copulation rates in anole lizards are correlated with muscle damage" The Society for Integrative and Comparative Biology Annual Meeting. Jan 2018, San Francisco, CA

**KS Martin**, KM Virgilio, SM Peirce, SS Blemker. "Agent-based model of inflammation and regeneration following contraction-induced muscle injury" American Society of Biomechanics Annual Meeting. Aug 2015, Columbus, OH

**KS Martin** “Agent based modeling of skeletal muscle atrophy and inflammation” University of Kentucky, Center for Muscle Biology Forum. May 2015, Lexington, KY

**KS Martin.** “Vascular adaptations in response to exercise” University of Virginia Graduate Biomedical Engineering Society symposium. Sept 2012, Charlottesville, VA

### Posters

**KS Martin,** H Wu, F Lallemand, J Ruas. “Exploring Adipocyte and Sensory Neuron Crosstalk” Biomedical Engineering Society Annual Meeting. Oct 2019, Philadelphia, PA

**KS Martin,** J Ruas. “Role of kynurenine metabolites in adipose and sensory nerve crosstalk” 9<sup>th</sup> SRP Diabetes-EndoMet-MetEndo retreat. May 2019, Stockholm, Sweden

**KS Martin,** KM Virgilio, JA Passipieri, C Kegelman, G Christ, SM Peirce, SS Blemker. “Computational Model-Driven Design of a Pharmacological Intervention During Muscle Regeneration” Biomedical Engineering Society Annual Meeting. Oct 2016, Minneapolis, MN

E Mintz, JA Passipieri, **KS Martin,** S Poonam, G Christ. “Satellite Cell Enhancement of Tissue Engineered Muscle Repair Technologies for the Treatment of Volumetric Muscle Loss” Biomedical Engineering Society Annual Meeting. Oct 2016, Minneapolis, Mn

**KS Martin,** KM Virgilio, JA Passipieri, C Kegelman, G Christ, SM Peirce, SS Blemker. “Guiding muscle injury experiments using an agent based computational model” Advances in Skeletal Muscle Biology in Health and Disease. Jan 2016, Gainesville, FL

KM Virgilio, **KS Martin,** SM Peirce, SS Blemker. “Multiscale computational models recapitulate progression of fibrosis in dystrophic muscle” Advances in Skeletal Muscle Biology in Health and Disease. Jan 2016, Gainesville, FL

KM Virgilio, **KS Martin,** SM Peirce, SS Blemker. “Multiscale models predict how accumulated microtears lead to acute muscle injury. Aug 2015, Columbus, OH

**KS Martin,** CC Henry, SS Blemker, SM Peirce. “Intramuscular sarcomere length variability in ageing healthy mouse diaphragm muscle” Biomedical Engineering Society Annual Meeting. Oct 2014, San Antonio, TX

**KS Martin,** SS Blemker, SM Peirce. “Agent-based model of skeletal muscle tissue predicts immobilization-induced remodeling” World Congress of Biomechanics. July 2014, Boston, MA

CC Henry, **KS Martin,** D Webber, G Handsfield, BB Ward, SM Peirce, SS Blemker. “Structural Analysis of Healthy and Dystrophic Diaphragms” World Congress of Biomechanics. July 2014, Boston, MA

### TEACHING

#### Guest lecturer

Advanced Physiology (HL2018), <i>Karolinska Institutet</i>	2018
Ran a circulation and respiration lab for undergraduates	
Human Physiology (BME2102), <i>University of Virginia</i>	2016 - 2017
Assisted in syllabus design, coursework, grading, and teaching	
Engineering Physiology (BME6101), <i>University of Virginia</i>	2013 - 2015
Administered and graded the oral final exam	
Systems Bioengineering Modeling and Experimentation (BME 4550), <i>University of Virginia</i>	2014
Developed and delivered 3 lectures on performing sensitivity analysis and model construction.	
Computational principles of Biomedical engineering (BME 6440), <i>University of Virginia</i>	2014
Taught graduate students various computational techniques (optimization, root finding)	
Motion Biomechanics (BME 4280/6280), <i>University of Virginia</i>	2014
Prepared and lectured on muscle adaptation to stimulation and disease	

### Co-Instructor

Biomedical Engineering: Design and Discovery (BME2000), *University of Virginia* 2013  
Created the syllabus, lectured 1/3<sup>rd</sup> of the course, co-wrote and graded both the midterm and final exams

### Teaching Assistant

Biomedical Engineering: Capstone Design (BME4063/4064), *University of Virginia* 2011

### Undergraduate Student Mentoring

Madeleine McDonald *Reproducibility in creating skeletal muscle constructs* 2017  
Katherine Crump and John Hanckel *Modelling muscle atrophy during space flight* 2017  
Catherine Henry *Investigation of non-uniform sarcomere lengths in the mouse diaphragm* 2013 - 2016  
Chris Kegelman and Ruba Shalhoub *Sarcomere adaptations during muscle-tendon transfer* 2015  
Bridget Ward *Microscale muscle analysis of healthy and dystrophic diaphragm* 2013  
Brennan Torstrick *Induction of murine spinotrapezius ischemia via cauterization* 2011 - 2012  
Julie Kokinos *Diaphragm Modeling in Duchenne Muscular Dystrophy* 2012  
Ross Gordon *Immunogenic response to PCL-PEO nanoparticles* 2010  
Grace Stuntz *Creation of a novel aortic flow system* 2010  
Scott Schubert *Effects of combination drug treatment on smooth muscle cells* 2010  
Caryn Just *Evaluation of thin films vs electrospun mats for intraluminal use* 2010

### Posters

**KS Martin** "Works in Progress: Development of a need-based BME design course focused on current NICU challenges" ASEE 121<sup>st</sup> annual conference, June 2014, Indianapolis, IN

### Non-academic teaching

Socialdansutskottet (Swedish Swing Society), *Stockholm, Sweden* 2017 - present  
Taught blues dancing to all levels of students.  
SwingCville, *Charlottesville, Virginia* 2011 - 2017  
Taught swing dancing (Lindy hop, Balboa, Charleston, East coast swing, and Blues) to all levels of students.

### PROFESSIONAL SERVICE AND OUTREACH

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BMES Teaching Panel, *University of Virginia*, Co-organizer and moderator 2014  
Planned a teaching focused panel for undergraduates, graduates, and post docs  
Day in the Life, *Zion Union Baptist Church*, Volunteer tutor 2014 - 2015  
Tutored K – 12 students in all subjects  
Mini-Med Laboratory Night Best Practices, *University of Virginia* 2011 - 2013  
Educated participants in a community program about current medical research  
Led science demo for 3-5<sup>th</sup> grade visitors to BME at UVA 2014 - 2015  
Showed students how cell culturing works and looked at cheek cells under a microscope

### Affiliations

Biomedical Engineering Society 2014 - Present  
American Society for Engineering Education 2014 - Present  
Society of Integrative and Comparative Biology 2017 - Present

## REFERENCES

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**Shayn Peirce-Cottler**, Professor  
Department of Biomedical Engineering  
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