Matthew DiSalvo, PhD

Biomedical Engineer

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EDUCATION:

University of Virginia (2018-2024)
Ph.D. Biomedical Engineering

Duke University (2016-2018)
M.S. Biomedical Engineering

Lehigh University (2012-2016)
B.S. Bioengineering with Honors

EXPERIENCE:

AV (Formally BlueHalo) *(August 2024-November 2025)*

Biomechanical Research Scientist – Research and development of computational biology models for projects with AV's Human and Performance Technologies division.

- Lead and designed strategy for multiscale physical experiments and paired simulations for directed energy exposure injury research, culminating in significant company proposal addressing sub-cellular to systemic impact of multiple exposure modalities.

- Designed new analytics for health-related patient measures for a next-generation vestibular and mild traumatic brain injury (mTBI) rehabilitation virtual reality system (*Praxis*), including head motion, full body motion (with wearable IMUs), eye motion, gaze stability, reaction times, decision processing, and sleep monitoring (with health wearables). (https://doi.org/10.3389/fnhum.2026.1850913, https://doi.org/10.1093/milmed/usag160)

- Built an AI/ML pipeline and analysis system for a major division-wide internal research effort.

University of Virginia *(August 2018-May 2024)*

Multiscale Muscle Mechanophysiology (M3) Lab – PhD dissertation research under PI Silvia Blemker, PhD to develop clinical applications of finite element (FE) modeling and computational biology to address a variety of muscle related health-related issues.

- A model of the rat tibialis anterior muscle was developed to design and execute virtual experiments for the study of volumetric muscle loss injuries, with the goal of understanding the mechanics of injury driving force-loss in specific muscle regions, and act as a virtual twin to *in-vivo* experiments of cytokine-laced muscle recovery scaffolds.

- A novel constitutive model of muscle was written to incorporate force-velocity behavior to work in an open-source finite element framework (FEBio). This new constitutive model was used to study the propagation of strain in a finite element model of the biceps femoris (long head) to study the effect on rapid elongation of the muscle during sprint gait cycle on the potential for muscle injury. (https://doi.org/10.1016/j.jbiomech.2024.112089)

- A generalized finite element model of the veleopharyngeal sphincter was developed, including the lateral and posterior pharyngeal walls, the velum, and the levator veli palatini, using MRI data. The finite element model was used to gain insights into the local mechanics of muscle activation to better understand healthy speech and pharyngeal closure for clinical assessments. (https://doi.org/10.1044/2024_jslhr-24-00353)

Duke University (*August 2016-May 2018)*

Injury Biomechanics Lab: Assisted with cervical and lumbar spinal extractions, sample testing, and MRI segmentation for data for simulation and testing of a new spinal component for the WIAMan dummy for high-strain injury testing.

Independent Research: Developed a generic finite element model of viscoelastic loading of anisotropic skin to determine suture failure conditions with respect to suture technique and skin age.

Lehigh University (*August 2012-May 2016*)

Capstone Project: Project sponsored by St. Luke's Health Network in Pennsylvania in a yearlong design project to implement additive manufacturing into different areas, including orthotics and surgical instrumentation with biocompatible polymers.

Cellular Biomechanics: Executed a study on pulsatile stress on cardiac endothelial cell cytoskeletal development and the potential implications in the development of heart disease using bovine aortic endothelial cell cultures using a Flexcell system.

ADDITIONAL EXPERIENCE:

Teaching: Biomechanics; Capstone Design for Biomedical Engineers.

Blast Injury Modeling: Developed a probabilistic simulation for blast injury modeling for forensic analysis.

Drug Delivery Simulations: Modeling the mechanical behavior and spatial orientation of protein and DNA string folding to determine volume and energy necessary for encapsulation for use in drug delivery systems.

FDA: Proposal for optimal method for FDA approval for a company seeking to expand their line of tests for use in chemotherapy patients in the United States.

Product Design: Used industry-standard software to produce final design and manufacturing specifications on various parts and complete assemblies, including designing, machining, and using injection mold plastics.

SKILLS:

Programming

- Java, C++, Python, Excel, and MATLAB
- Machine learning experience in classification and detection
- Experienced in writing data management programs, mathematical models, and simulations
- Ability to author and optimize programs for efficiency

3D Modeling and Simulation

- Part and geometry design in NX, Solidworks, Autodesk Inventor, Autodesk Fusion, and Ansys SpaceClaim, for both medical device design and biological digital twins
- Component FE meshing in Corefum Cubit, NX
- Experience in relevant assembly and section drawings for use in manufacturing in compliance with ASME, ANSI, and other industry standards
- Experience in mechanical simulation modeling using the finite element method, such as COMSOL, NX, and FEBio, as well as with self-written FE code utilizing MATLAB and python
- Developed novel constitutive tissue model for FE simulation as an FEBio software plugin
- Designed radio frequency and optical simulations for tissue exposure experiments

Machining and Manufacturing

- Experience with CNC Milling and G-Code conversion from 3D models
- Experience with injection molding mold design, simulation, machining, and end-process manufacturing

Bench Skills

- Experience with cell culture, including mammalian cells
- Work with cadavers, cadaver tissue, and human anatomical extraction
- Human assessment of motion with motion-capture and force measurements
- Experience with a wide variety of bench instruments and techniques, including, but not limited to: microscopy, staining, bacterial transformations, yeast transformations, control of mammalian cell differentiation, DNA and protein isolation, PCR, bioinformatics, media preparation, immunoassays, organic compound synthesis and purification, microfluidic and cell capture devices, video and image capture, piezoelectric sensing, video motion analysis and point tracking, analysis of mass spectrometry, and photospectrometry

LIST OF GRADUATE COURSEWORK:

- Applied Partial Differential Equations and Fourier transforms
- Introduction to Blasts and Ballistics
- Introduction to Immunology
- Biology by Design/ Synthetic Biology
- Biomechanics (Continuum Mechanics)
- Biomaterials and Medical Device Design
- Finite Element Method
- Biostatistics
- Viscoelastic Material Mechanics
- Nanobiomechanics (Atomic Force Microscopy)
- Signal Processing
- Engineering Physiology I and II
- Motion Biomechanics

LIST OF UNDERGRADUATE COURSEWORK:

Bioengineering

Research Topics, Elements of Bioengineering and Mass Balance, Engineering Physiology, Biomechanics, FDA Regulatory Affairs, Biological Fluid Mechanics, Biomolecular and Cellular Mechanics, Quantitative Biology, Organic Biomaterials, Metabolic Engineering, Biomimetic and Bio-enabled Materials, Integrated Product Development I & II (Capstone courses)

Biology

Cellular & Molecular Biology, Genetics

Chemistry

Chemical Principles, Chemical Equilibrium in Aqueous Systems, Organic Chemistry

Computer Science

Engineering Computer Methods, Breadth of Programming, Programming and Data Structures.

Environmental Science

Introduction to Environmental Science, Exploring Earth, Environmental/Organismal Biology

Material Science

Materials and Processes, Thermodynamics of Materials

Mathematics

Calculus I, II, & III, Linear Algebra and Differential Equations, Statistics

Mechanical Engineering

Fundamentals of Engineering Mechanics, Strength of Materials (Statics), Graphics for Engineering Design, Engineering Reliability, Manufacturing

Physics

Physics I (Mechanics) & II (Electromagnetism)

Miscellaneous

Macroeconomics, Principles of Economics, Entrepreneurship, American Political System, Ethics, Introduction to Psychology, English Composition and Literature I & II, World History, American History, Technology and World History, History of Modern Medicine