Frederick **Sebastian**

ENGINEER · SCIENTIST

(480) 421-8877 | professional@fred-sebastian.com | fred-sebastian.com | fredericksebastian | Scholar Profile | Boston, MA

Summary

Biomedical engineer with expertise in translational research, product development, and regulatory science. Experienced in developing medical technologies from preclinical concept through IDE-stage feasibility studies, including risk analysis, protocol design, and technical documentation. Background spans biomechanics, soft robotics, and diagnostic systems, with contributions to peer-reviewed publications, patents, and FDA-facing device validation. Collaborative and data-driven, with a strong record of aligning engineering innovation with clinical and regulatory requirements.

Education

Northeastern University — *Boston, MA*

PhD in Bioengineering | GPA 3.80 | *Thesis: Sex, Glaucoma, and Iris Biomechanics* — *June, 2024*

Graduate Certificate – Data Analytics Engineering

Arizona State University — *Tempe, AZ*

MS in Biomedical Engineering | GPA 4.00 | *Thesis: Design of a Soft Haptic Interface for Rehabilitation of Impaired Hand Function* — *May, 2018*

BSE in Biomedical Engineering | GPA 3.86 | *Thesis: Development of a Comfortable Myoelectric Prosthetic Socket* — *May, 2017*

Relevant Skills

Programming & Data	Python (NumPy, Pandas, Statsmodels, Scikit-learn), R (tidyverse, lme4, brms), MATLAB, SQL
Modeling & Tools	Abaqus, SolidWorks, LabVIEW, FEA, Tableau, Rapid Prototyping
Project & Learning Platforms	Canvas, Blackboard, Airtable, JIRA, Overleaf
Regulatory & Clinical	FDA IDE, IRB protocols, GMP, CAPA, Quality Management Systems
Languages	English, Malay (fluent); Tamil, Spanish, Indonesian (limited proficiency)

Professional Experience

Northeastern University — *Boston, MA*

Research Scientist/Engineer – Laboratory for Soft Tissue Biomechanics — *Aug 2019 – Present*

- Applied inverse FEA to analyze in vivo iris biomechanics, supporting strategic insights for diagnostic tool development and clinical decision-making
- Used data analytics & visualization in R & Python to extract insights from complex datasets, informing strategic healthcare recommendations
- Developed micro-indentation protocols for ex-vivo irides and automated the analysis using MATLAB and ABAQUS, reducing analysis time by 50%
- Optimized dynamic system responses and experimental procedures using sensor integration, directly enhancing precision in tissue biomechanics
- Performed biaxial mechanical testing on sclera, advancing collagen fiber models & linking tissue microstructure to anisotropic mechanical properties
- Taught classes of 50 students on statics and dynamics-based biomechanics projects; invited to instruct independently due to strong teaching skills

Third Pole Therapeutics — *Waltham, MA*

Systems Engineering Intern — *Jan 2023 – Jun 2023*

- Integrated & optimized control algorithms for a sensor-based nitric oxide system, ensuring reliability and aligning enhancements with strategic goals
- Conducted risk assessment and QA testing per ISO standards, providing insights for executive decisions on safety and efficacy
- Contributed to testing and documentation of the device under an FDA-granted IDE, validating its safety and practical application in a feasibility study

Halo Cures, Inc. — *Remote*

Innovation Scout (Consultant) — *2024 – Present*

- Scouted and evaluated scientific technologies for therapeutic applications using Airtable and JIRA for pipeline management
- Analyzed product-market fit and technical feasibility based on IP filings, publication metrics, and research strength

Northeastern University — *Boston, MA*

Research Assistant – Neuromotor Systems Laboratory — *Sep 2019 – Aug 2020*

- Developed an electrical stimulation system in LabVIEW to induce virtual dystonia in healthy subjects
- Designed MATLAB-based visual/audio feedback tasks for impairment adaptation experiments
- Recruited participants and structured experimental protocols to simulate neuromotor dysfunction

Dartmouth College — *Hanover, NH*

Research Assistant – The Hill Lab — *Jun 2018 – Jul 2019*

- Utilized gas chromatography-mass spectrometry (GCMS) to identify and quantify volatile substances in breath samples for tuberculosis diagnosis
- Acquired machine learning and Design of Experiments (DOE) skills through collaboration with the Quantitative Biomedical Sciences department

Arizona State University *Tempe, AZ*

Research Assistant – Bio-Inspired Mechatronics Lab *Jun 2017 – May 2018*

- Led design, prototyping & deployment of a robotic haptic interface using 3D printing, FEM & silicone fabrication, shaping strategic product strategy
- Conducted user testing and data analysis on stiffness perception, informing product specs & enhancing customer-focused decisions

National University of Singapore *Singapore*

Research Internship – Evolution Innovation Lab *May 2016 – Aug 2016*

- Designed & prototyped fabric actuators for Roceso Technologies' EsoGLOVE™, crucial for its launch as a leading lightweight rehabilitation device
- Characterized fabric actuators using fine-tuned force sensors and Arduino control systems

Arizona State University *Tempe, AZ*

Research Assistant – Human Performance & Sensorimotor Integration Lab *Aug 2014 – May 2017*

- Developed a lightweight, low-cost myoelectric prosthetic arm using rapid prototyping techniques
- Built and validated prosthetic socket designs using vacuum forming and usability testing
- Finalist in BioAccel Solutions Challenge; received $5,000 in seed funding from ASU Edson Entrepreneur Initiative

Teaching Experience

Northeastern University *Boston, MA*

Instructor and Teaching Assistant – Biomechanics *Sept. 2019 – Apr. 2024*

- Delivered presentations to multiple classes of 50+ students to explain statics and dynamics-based bioengineering concepts.
- Vetted and tested new educational technologies for classroom integration.
- Invited to independently instruct due to demonstrated teaching excellence.
- Used Canvas and Blackboard to manage course content, student evaluation, and feedback loops.

Arizona State University *Tempe, AZ*

Teaching Assistant – Biology Lab & Honors Seminar *Aug. 2016 – May. 2018*

- Clarified challenging quantitative and biological concepts for 100+ students in lab settings.
- Worked in a diverse team to improve pedagogy for Conceptual Approaches to Biology.
- Mentored an undergraduate assistant TA and supported peer development.
- Taught and graded 20 students in a seminar on critical thinking and argumentative writing (The Human Event).
- Facilitated out-of-class project development and mentorship.

Leadership & Service

Northeastern University *Boston, MA*

Mentorship Coordinator – Bioengineering Graduate Student Council *May 2020 – Apr. 2024*

- Founded and led a peer mentoring program to support incoming Ph.D. students in their academic and personal transition.
- Mentored 6 graduate students over 4 years; promoted community building within the department.

Member – Bioengineering Diversity and Inclusion Council *May 2020 – Dec. 2022*

- Addressed representation gaps and systemic bias through department-wide initiatives and policy discussions.

Mentor – Global Pathways Program & Young Scholars Program *2021, 2022–2023*

- Guided international graduate students and high school mentees in hands-on research and experimental design.

Publications & Patents

1. **Sebastian, F.**, DelCiello, H., Pant, A.D., Pathak-Ray, V., Dorairaj, S., & Amini, R. "Image-Based Inverse Modeling Analysis of Iris Stiffness Across Sex in Patients With a History of Angle-Closure Glaucoma." *ASME J Biomech Eng* (accepted for publication).
2. Pant, A., **Sebastian, F.**, Khoiy, K., Repeto, R., Dorairaj, S., & Amini, R. "Computational Modeling of Laser Peripheral Iridotomy and the Effects of Size & Location." *Modeling and Artificial Intelligence in Ophthalmology* (accepted for publication).
3. Ji, F., Islam, M.R., **Sebastian, F.**, Schilpp, H., Wang, B., Hua, Y., Amini, R., & Sigal, I.A. "Capturing Sclera Anisotropy Using Direct Collagen Fiber Models. Linking Microstructure to Macroscopic Mechanical Properties." *bioRxiv*, Cold Spring Harbor Laboratory. 2024.
4. **Sebastian, F.**, Vargas, A.I., Clarin, J., Hurgoi, A., & Amini, R. "Meta Data Analysis of Sex Distribution of Study Samples Reported in Summer Biomechanics, Bioengineering, & Biotransport Annual Conference Abstracts." *ASME J Biomech Eng*. November 2023; 1–29.
5. Manav, Y.A., **Sebastian, F.**, Baskota, A., Kuo, J.C., Amini, R., Lal, A., & Davaji, B. "Towards GHz Ultrasound Enabled Noninvasive Hydrogel Metrology for Mechanobiology." *MEMS*, Austin, TX, USA. 2024; pp. 276–279.

6. Pinto Costa, R., Nwotchouang, B.S.T., Yao, J., Biswas, D., Casey, D., McKenzie, R., **Sebastian, F.**, Amini, R., Steinman, D.A., & Loth, F. "Impact of Blood Rheology on Transition to Turbulence and Wall Vibration Downstream of a Stenosis." *ASME J Biomech Eng*. April 2023; 145(4): 041001.
7. Polygerinos, P., **Sebastian, F.**, Fu, Q., & Santello, M. "Soft Robotic Haptic Interface with Variable Stiffness for Rehabilitation of Sensorimotor Hand Function." US Patent 11,446,545. 2022.
8. **Sebastian, F.**, Fu, Q., Santello, M., & Polygerinos, P. "Soft Robotic Haptic Interface with Variable Stiffness for Rehabilitation of Neurologically Impaired Hand Function." *Frontiers in Robotics and AI*. 2017; 4(69).
9. Yap, H.K., **Sebastian, F.**, Wiedeman, C., & Yeow, C. "Design and Characterization of Low-cost Fabric-based Flat Pneumatic Actuators for Soft Assistive Glove Application." *ICORR*, London, UK. 2017; pp. 1465–1470.
10. **Sebastian, F.**, Kondiboyina, V., Dorairaj, S., & Amini, R. "Assessing the Influence of Environmental Factors and Sex on Porcine Iris Stroma Stiffness through Micro-Indentation." *ASME J Biomech Eng* (in preparation).
11. Wang, B., Hua, Y., **Sebastian, F.**, Amini, R., & Sigal, I.A. "Disagreement Between Structural and Mechanical Anisotropies of Equatorial Sclera." (in preparation).

Conferences

Speaker – "Viscoelastic Properties of Murine Placenta Measured via Micro-Indentation," ASME SB^{3}C, Santa Ana Pueblo, NM, 2025
Speaker – "Sex Differences in Iris Stiffness Among Healthy and Post-Peripheral Iridotomy Eyes," ISER Biennial Meeting, Buenos Aires, Argentina, 2024
Speaker – "Increasing Students' Exposure to Research Via Applied Homework Problems Integrated in Research Manuscripts," ASME SB^{3}C, Lake Geneva, WI, 2024
Poster Presentation – "Sex Differences in Iris Stiffness in Patients With a History of Angle-Closure Glaucoma," ASME SB^{3}C, Lake Geneva, WI, 2024
Poster Presentation – "Meta Data Analysis of Sex Distribution of Study Samples Reported in SB^{3}C Abstracts," Cutting-Edge Connections in PhD Research, Northeastern University, Boston, MA, 2023
Speaker – "Mechanical Properties of Porcine Iris Stroma Using Micro-Indentation," ASME SB^{3}C, Vail, CO, 2023
Speaker – "Mega Data Analysis of Sex Distribution of Study Samples Reported in SB^{3}C Abstracts," ASME SB^{3}C, Vail, CO, 2023
Poster Presentation – "Nonlinear and Anisotropic Mechanical Response of Fish Skin," ASME SB^{3}C, Vail, CO, 2023
Poster Presentation – "The Influence of Experimental Environment on the Mechanical Properties of Porcine Iris Stroma," ARVO, New Orleans, LA, 2023