

GUY ELISHA

Mechanical Engineering
2145 Sheridan Rd, Room L386
Evanston, IL, 60640, USA

E // guyelisha2024@u.northwestern.edu
W // www.elishaguy.com
P // +1 (224)-420-1644

EDUCATION

PhD, Mechanical Engineering, Northwestern University, Evanston, IL, USA, July 2024
(awaiting defense)

- Field: biomechanics, neuromechanics, and computational modeling of organ physiology

BS, Mechanical Engineering, University of Oklahoma, Norman, OK, USA May 2019

- *summa cum laude*
- Valedictorian

RESEARCH AND DESIGN EXPERIENCE

Graduate Research Assistant, Department of Mechanical Engineering, Northwestern University, Evanston, IL, USA, 2019 – present

- Created a reduced-order neuromechanical model for studying esophageal motility disorders, resolving questions about normal and abnormal esophageal responses to distension.
- Developed a reduced-order mechanical model to study esophageal transport, revealing the impact of tube stiffness, fluid/bolus density, and contraction strength on esophageal contraction patterns.
- Classified trends in human sphincters through data analysis and simulations, providing a mechanics-based explanation for opening and closing patterns.
- Identified a fluid-structure instability linked to abnormal aortic dilatation and derived a measurable dimensionless number with an analytically derived critical threshold.
- Developed a mechanics-based physiomechanical marker for Endometriosis diagnosis by analyzing competition between uterus and fallopian tubes peristalsis.
- Collaborated with Northwestern's Feinberg School of Medicine.
- Published nine papers: Four first-author peer-reviewed papers, two high-profile first-author papers under internal review, and three co-authored publications in peer-reviewed journals.

Undergraduate Research Assistant, Department of Aerospace and Mechanical Engineering, University of Oklahoma, Norman, OK, USA, 2018-2019

- Developed methodologies and algorithms to enhance the accuracy of a home thermal model, slated for integration into software codes on a smart thermostat hardware platform.
- Computed a standardized table that will serve future nationwide studies for minimizing HVAC expenses while maximizing indoor comfort.

Undergraduate Research Assistant, Department of Civil Engineering and Environmental Science, University of Oklahoma, Norman, OK, USA, 2017

- Examined an innovating methodology for detecting dynamic characteristics of buildings during ground motion.
- Investigated and implemented a novel approach for monitoring the dynamic characteristics of buildings.
- Co-authored two peer-reviewed papers.

Fluid Flow Analysis Over a Bicycle Fairing, Department of Aerospace and Mechanical Engineering, University of Oklahoma, Norman, OK, USA, 2018-2019

- Engineered a streamlined fairing to enhance the aerodynamic performance of a recumbent bicycle.
- Utilized computational techniques, including CFD (Computational Fluid Dynamics) and FEA (Finite Element Analysis), to analyze and optimize the fairing design.
- Developed a comprehensive manufacturing plan, conducted material selection analysis, and executed testing procedures.

Human Powered Vehicle Challenge, Department of Aerospace and Mechanical Engineering, University of Oklahoma, Norman, OK, USA, 2016-2019

- Designed, analyzed, and constructed a high-performance recumbent bicycle as a key member of the university's competitive engineering team.
- Led the team in competing at the annual Human Powered Vehicle Challenge organized by the American Society of Mechanical Engineers (ASME).
- Served as Vice President and Safety Officer, overseeing team operations and ensuring safety compliance during competitions.

WindBAG Challenge, Department of Aerospace and Mechanical Engineering, University of Oklahoma, Norman, OK, USA, 2018

- Engineered, manufactured, and tested a wind energy conversion system to store mechanical and electrical energy for propelling a vehicle.
- Applied the Principles of Engineering Design to meet customer requirements, emphasizing authentic design solutions and fostering teamwork.
- Developed competencies crucial for a career as a professional engineer, gaining hands-on experience in translating customer needs into technical specifications.

TEACHING EXPERIENCE

Recitation instructor: Engineering Fluid Mechanics (ME 373), Department of Mechanical Engineering, Northwestern University, Evanston, IL, USA, WI2022, WI2023

- Undergraduate fluid mechanics course
- Topics: steady viscous flows, ideal inviscid flow, compressible flow, drag and lift, fluid physics of sustainability

Teaching Assistant: Introduction to Computational Fluid Dynamics (ME 423), Department of Mechanical Engineering, Northwestern University, Evanston, IL, USA, FA2022

- Graduate fluid dynamics course
- Topics: mathematical description of physical phenomena and discretization methods to solve steady and unsteady diffusion-type equations, convective-diffusion-type equations, and fluid-flow equations

Teaching Assistant: Fundamentals of Fluid Dynamics (ME 425), Department of Mechanical Engineering, Northwestern University, Evanston, IL, USA, FA2021

- Graduate fluid dynamics course
- Topics: introduction to continuum mechanics (vector calculus, deformation and deformation-rates tensors), dimensional analysis, analytic solutions (Poiseuille, Couette, Stokes', Rayleigh, etc.)

Graduate Research Mentor: Independent Research (ME 590), Department of Mechanical Engineering, Northwestern University, Evanston, IL, USA, 2021-2023

- Mentored and trained an undergraduate and graduate student in their first research experience.

STEM Tutor: Student Learning Center, University of Oklahoma, Norman, OK, USE, 2017-2017

- Assisted and instructed students in mechanical engineering and mathematics courses such as Heat Transfer, Thermodynamics, Statics, Dynamics, and Differential Equations.

TECHNICAL SKILLS

High Performance Computing (HPC), Computational Neuroscience, Computational Fluid Dynamics (CFD), Finite Element Analysis (FEA), Machine Learning, and Continuum Mechanics

Programming languages: C, C++, Python, MATLAB, Mathematica

Commercial packages: ANSYS, Abaqus, SolidWorks, QuickDAQ, LabVIEW, MultiSim

HONORS AND AWARDS

Martin Outstanding Doctoral Fellowship	2022
Walter P. Murphy Fellowships	2019
Student Speaker at the Gallogly College of Engineering Convocation	2019
Pre-Capstone Best Practice	2018
Mechanical Engineering Undergraduate Feature	2018
Design of Mechanical Components Outstanding Junior	2018
Honors Engineering Research	2016
David L. Boren Scholarships Institute of International Education	2016
United World College Davis Scholar	2015
Red Cross Nordic United World College Scholar	2012

COMMUNITY INVOLVEMENT / STUDENT ORGANIZATION

Graduate Society of Women Engineers - Board member and Social Chair	2022-2023
Graduate Women Across Northwestern - Board member and Social Chair	2021-2023
Northwestern Triathlon club	2019-2020
Northwestern Cycling club	2019-2020
Aerospace and Mechanical Engineering Student Advisory Council	2018-2019
Sooner Engineering Entrepreneurs	2018-2019
University of Oklahoma Triathlon Club	2017-2019
Human Powered Vehicle - VP	2016-2019
University of Oklahoma Cycling Club - VP	2015-2019

PUBLICATIONS

PUBLISHED / ACCEPTED

- 2023** Elisha, G., Acharya, S., Halder, S., Carlson, D.A., Kou, W., Kahrilas, P.J., Pandolfino, J.E. and Patankar, N.A., 2023. Peristaltic regimes in esophageal transport. *Biomechanics and Modeling in Mechanobiology*, 22(1), pp.23-41.
- 2023** Elisha, G., Halder, S., Acharya, S., Carlson, D.A., Kou, W., Kahrilas, P.J., Pandolfino, J.E. and Patankar, N.A., 2023. A mechanics-based perspective on the function of the esophagogastric junction during functional luminal imaging probe manometry. *Biomechanics and Modeling in Mechanobiology*, pp.1-19.
- 2023** Elisha, G., Halder, S., Carlson, D.A., Kahrilas, P.J., Pandolfino, J.E. and Patankar, N.A., 2023. A mechanics-based perspective on the pressure-cross-sectional area loop within the esophageal body. *Frontiers in Physiology*, 13, p.2693.
- 2023** Elisha, G., Halder, S., Acharya, S., Carlson, D.A., Kahrilas, P.J., Pandolfino, J.E. and Patankar, N.A., 2023. A mechanics-based perspective on the function of human sphincters during functional luminal imaging probe manometry. *Journal of biomechanical engineering*. p.1-23
- 2023** Zhao, T.Y., Johnson, E.M.I., Elisha, G., Halder, S., Smith, B.C., Allen, B.D., Markl, M. and Patankar, N.A., 2023. Blood-wall fluttering instability as a physiomarker of the progression of thoracic aortic aneurysms. *Nature Biomedical Engineering*, pp.1-13.
- 2023** Halder, S., Pandolfino, J.E., Kahrilas, P.J., Koop, A., Schauer, J., Araujo, I.K., Elisha, G., Kou, W., Patankar, N.A. and Carlson, D.A., 2023. Assessing mechanical function of peristalsis with functional lumen imaging probe panometry: Contraction power and displaced volume. *Neurogastroenterology & Motility*, p.e14692.
- 2022** Halder, S., Yamasaki, J., Acharya, S., Kou, W., Elisha, G., Carlson, D.A., Kahrilas, P.J., Pandolfino, J.E. and Patankar, N.A., 2022. Virtual disease landscape using mechanics-informed machine learning: Application to esophageal disorders. *Artificial Intelligence in Medicine*, 134, p.102435.

- 2018** Harvey Jr, P.S. and **Elisha, G.**, 2018. Vision-based vibration monitoring using existing cameras installed within a building. *Structural Control and Health Monitoring*, 25(11), p.e2235.
- 2018** Harvey Jr, P.S., **Elisha, G.** and Casey, C.D., 2018. Experimental investigation of an impact-based, dual-mode vibration isolator/absorber system. *International Journal of Non-Linear Mechanics*, 104, pp.59-66.

UNDER REVIEW

- 2023** **Elisha, G.**, Halder, S., Liu, X., Carlson, D.A., Kahrilas, P.J., Pandolfino, J.E. and Patankar, N.A., 2023. Neurological disorders leading to mechanical dysfunction of organs: emergent behavior of a neuromechanical dynamical system – internal review
- 2023** **Elisha, G.**, Gast, R., Halder, S., Solla, S.A., Kahrilas, P.J., Pandolfino, J.E. and Patankar, N.A., 2023. Propagation direction in unidirectionally coupled Wilson-Cowan oscillators – internal review

PRESENTATIONS / POSTERS

ORAL PRESENTATIONS

- 2023** **Elisha, G.**, Halder, S., Liu, X., Pandolfino, J.E., Kahrilas, P.J. and Patankar, N.A., 2023. Neurological disorders leading to mechanical dysfunction of organs: emergent behavior of a neuromechanical dynamical system. *Bulletin of the American Physical Society DFD*, Washington DC, USA
- 2023** Liu, X., Halder, S., **Elisha, G.**, Kou, W., Carlson, D.A., Kahrilas, P.J., Pandolfino, J.E. and Patankar, N.A., 2023. Mechano-pathogenesis of esophageal hypertrophy and atrophy. *Bulletin of the American Physical Society DFD*, Washington DC, USA
- 2022** **Elisha, G.**, Halder, S., Pandolfino, J.E., Kahrilas, P.J. and Patankar, N.A., 2022. Neuromechanical model of esophageal transport. *Bulletin of the American Physical Society DFD*, Indianapolis, IN, USA
- 2022** Liu, X., **Elisha, G.**, Halder, S., Carlson, D., Kahrilas, P.J., Pandolfino, J.E. and Patankar, N.A., 2022. Understanding esophageal pressure-area loop patterns in different diagnostic devices. *Bulletin of the American Physical Society DFD*, Indianapolis, IN, USA
- 2021** **Elisha, G.**, Acharya, S., Halder, S., Pandolfino, J.E., Kahrilas, P.J. and Patankar, N.A., 2021. Pressure–area loop based phenotypic classification and mechanics of esophagogastric junction physiology. *Bulletin of the American Physical Society DFD*, Phoenix, AR, USA
- 2021** Zhao, T.Y., **Elisha, G.**, Johnson, E. M. I., Halder, S., Smith, B.C., Allen, B.D., Markl, M. and Patankar, N.A., 2021. The fluid-structure instability driving aneurysm formation and growth. *Bulletin of the American Physical Society DFD*, Phoenix, AR, USA

- 2021** Halder, S., Yamasaki, J., Acharya, S., **Elisha, G.**, Kou, W., Pandolfino, J.E., Kahrilas, P.J. and Patankar, N.A., 2021. Esophageal virtual disease landscape for disease pathogenesis and diagnostics using mechanics-informed machine learning. *Bulletin of the American Physical Society DFD*, Phoenix, AR, USA
- 2021** **Elisha, G.**, Halder, S. and Patankar, N.A., 2021. A unified understanding of the function of human sphincters using functional luminal imaging probe. *Gender Equity in Academic Research Symposium*, Evanston, IL, USA
- 2020** **Elisha, G.**, Acharya, S., Halder, S., Pandolfino, J.E., Kahrilas, P.J. and Patankar, N.A., 2020. Peristaltic regimes in esophageal transport. *Bulletin of the American Physical Society DFD*, Chicago, IL, USA
- 2020** Acharya, S., Halder, S., **Elisha, G.**, Kou, W., Kahrilas, P.J., Pandolfino, J.E. and Patankar, N.A., 2020. Fluid mechanics-informed clinical practice in gastroenterology. *Bulletin of the American Physical Society DFD*, Chicago, IL, USA
- 2020** Halder, S., Acharya, S., **Elisha, G.**, Kou, W., Pandolfino, J.E., Kahrilas, P.J. and Patankar, N.A., 2020. Mechanics-informed radiology, fluoroscopy, and endoscopy enabled by deep learning techniques. *Bulletin of the American Physical Society DFD*, Chicago, IL, USA

POSTER PRESENTATIONS

- 2024** **Elisha, G.**, Halder, S., Liu, X., Pandolfino, J.E., Kahrilas, P.J. and Patankar, N.A., 2023. Neurological disorders leading to mechanical dysfunction of organs: emergent behavior of a neuromechanical dynamical system. International Biofluid & Mechanobiology Symposium, Eilat, Israel
- 2022** **Elisha, G.**, Halder, S. and Patankar, N.A., 2022. A unified understanding of the function of human sphincters using functional luminal imaging probe. *Context, Connections, and Community Symposium*, Evanston, IL, USA.
- 2022** Zhao, T.Y., **Elisha, G.**, Johnson, E.M.I., Halder, S., Smith, B.C., Allen, B.D., Markl, M. and Patankar, N.A., 2022. Fluid-Structure Stability Analysis to Predict Aortic Dilation. *Society for Cardiovascular Magnetic Resonance Scientific Sessions*, Fort Lauderdale, FL, USA.

REFERENCES

Neelesh A. Patankar, PhD

Title: Professor of Mechanical Engineering

Institution: Northwestern University

Email: n-patankar@northwestern.edu

Phone: (847)-491-3021

Relationship: Ph.D. advisor

John E. Pandolfino, MD

Title: Chief of Gastroenterology and Hepatology and Professor of Medicine

Institution: Northwestern University

Email: j-pandolfino@northwestern.edu

Phone: ((312)-695-0182

Relationship: Research collaborator and committee member

Peter J. Kahrilas, MD

Title: Professor of Medicine

Institution: Northwestern University

Email: p-kahrilas@northwestern.edu

Phone: (312)-695-4077

Relationship: Research collaborator and committee member