Maulee Sheth

Ph.D., Biomedical Engineering | Boston, United States

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Training & Education

Tufts University **Boston, MA**
Incoming Postdoctoral Fellow, Department of Biomedical Engineering Aug. 2025
Advisor: *Prof. Shelly Peyton*

University of Cincinnati **Cincinnati, OH**
PhD Candidate, Department of Biomedical Engineering (4.0/4.0) Aug. 2021 – Aug. 2025
Advisor: *Prof. Leyla Esfandiari*
UC CEAS highlight

Purdue University **West Lafayette, IN**
Bachelor of Science, School of Mechanical Engineering (3.4/4.0) Aug. 2017 – May 2021
Advisor: *Prof. Cagri Savran*

Research Experience

University of Cincinnati **Cincinnati, OH**
Graduate Researcher, Esfandiari Lab Aug. 2021 – Aug. 2025
Project 1/Dissertation: Spheroids to Vesicles – Decoding Matrix Stiffness in a 3D Head and Neck Cancer Model
Impact: Identified mechanosensitive Piezo1 and TRPV4 ion channels' role in the reception of matrix stiffness stimuli in 3D spheroids. Conducted a pioneering study on the influence of biophysical cues on EV secretion and cargo in 3D. Identified novel mechanosensitive biomarkers within cancer spheroid-derived EVs, providing insight into their potential as predictive biomarkers for cancer progression.

Project 2: Remote Activation of Piezoelectric Scaffolds for Peripheral Nerve Regeneration
Impact: Demonstrated how controlled electric stimulation can influence cellular alignment and differentiation, opening avenues for enhancing tissue engineering and regenerative medicine applications.

Project 3: Impedance Spectroscopy for Radiation Biosensing
Impact: Will contribute to the utility of a rapid, non-invasive impedance spectroscopy technique for monitoring radiotherapy response, with potential applications in drug screening and personalized medicine.

Purdue University **West Lafayette, IN**
Undergraduate Researcher, Savran Lab Oct. 2019 – May 2021
Project 1: Deterministic Culturing of Single Cells in 3D
Impact: Developed a highly efficient and effective method to generate tumoroids from isolated, individually targeted single cells, providing insights into both inter- and intratumor heterogeneity.
Project 2: Critical Review of Single-Cell Culture Technologies
Impact: Will provide a critical analysis that serves as a valuable resource for researchers aiming to design single-cell culturing technologies, particularly in cancer and stem cell research.

Publications & Patents (*Indicates co-authorship)

[1] **Sheth M**, Sharma M, Lehn M, Reza H, Takebe T, Takiar V, Wise-Draper T, Esfandiari L. (2024). Three-Dimensional Matrix Stiffness Modulates Mechanosensitive and Phenotypic Alterations in Oral Squamous Cell Carcinoma Spheroids. *APL Bioengineering.* 8:3. 10.1063/5.0210134

[2] **Sheth M**, Sharma M, Supasek K, Lehn M, Takebe T, Takiar V, Wise-Draper T, Chutipongtanate S, Esfandiari L. (2025). Matrix stiffness modulated release of spheroid-derived extracellular vesicles and discovery of Piezo1 cargo. *bioRxiv*. 10.1101/2025.01.13.632826 – Under peer review (2025)
[3] Sharma M*, **Sheth M***, Poling H, Kuhnell D, Langevin S, Esfandiari L. (2023). Rapid purification and multiparametric characterization of circulating small extracellular vesicles utilizing a label-free lab-on-a-chip device**.** *Scientific Reports.* 13:18293 10.1038/s41598-023-45409-4
[4] **Sheth M** and Esfandiari L. (2022). Bioelectric Dysregulation in Cancer Initiation, Promotion, and Progression. *Frontiers in Oncology.* 12:846917. 10.3389/fonc.2022.846917
[5] Macke G, **Sheth M**, Sharma M, Lehn M, Takiar V, Wise-Draper T, Esfandiari L. Impedance Spectroscopy for Radiation Biosensing in 3D Cancer Spheroids – In preparation (2025)
[6] Sharma M*, Supasek K*, **Sheth M**, Chutipongtanate S, Esfandiari L. Distinct molecular profiles in Schwann cell-derived extracellular vesicles reveal stage-specific contributions to peripheral nerve regeneration– In preparation (2025)
[7] Bryan AE*, Krutko M*, Westphal J, **Sheth M**, Esfandiari L, Harris GM. (2023). Ultrasound-activated piezoelectric polyvinylidene fluoride-trifluoroethylene scaffolds for tissue engineering applications. *Military Medicine*. 10.1093/milmed/usad018
[8] Jain R, **Sheth M**, Savran CA. Review of single cell culture technologies – In preparation (2025)
[9] Krutko M, Poling H, **Sheth M***, Supasek K*, Bryan A, Sharma M, Singh A, Reza H, Weikenheiser-Brokamp K, Takebe T, Helmrath M, Harris G, Esfandiari L. Thermal Annealing Enhances Piezoelectricity and Regenerative Potential of PVDF-TrFE Nanofiber Scaffolds. *Advanced Materials Technologies.* – in press (2025)
[10] Poling H, Singh A, Supasek K*, **Sheth M***, Krutko M, Reza A, Srivastava K, Wells J, Helmrath M, Esfandiari L. Promoting Human Intestinal Organoid Formation and Stimulation Using Piezoelectric Nanofiber Matrices – Under revision (2025)
[11] Brodersen K, Bywater E, Lanter A, Schennum H, Furia K, **Sheth M**, Kiefer N, Cafferty B, Rao A, Garcia J, Warsinger D. (2021). Direct-drive ocean wave-powered batch reverse osmosis. *Desalination.* 523: 115393.10.1016/j.desal.2021.115393
[12] Esfandiari L and **Sheth M**. Piezo-1 Activation in Cancer Spheroid-Derived Small Extracellular Vesicles – Provisional patent – Filed (2024, 2025)

Research Talks & Presentations (Select) (U indicates presenting author)

[1] **Sheth M**, Sharma M, Supasek K, Lehn M, Reza H, Takebe T, Takiar V, Wise-Draper T, Chutipongtanate S, Esfandiari L. Esfandiari L. (June 2024). Matrix stiffness drives piezo-1 activation in three-dimensional head and neck cancer spheroids and derived small extracellular vesicles. *TERMIS, Seattle* – **Oral presentation (top 10% abstract)**
[2] **Sheth M**, Sharma M, Poling H, Kuhnell D, Langevin S, Esfandiari L. (Oct. 2023). Multiparametric analysis of small extracellular vesicles purified by a rapid and label-free lab on a chip device. *BMES, Seattle* – **Oral presentation**
[3] **Sheth M**, Sharma M, Shi L, Zhang Y, Esfandiari L. (Dec. 2022). A Label-free Microelectronic Device for Purification and Characterization of Extracellular Vesicles. *IEEE EMBS Micro and Nanotech in Med., Kapolei, HI* – **Best poster presentation**
[4] **Sheth M**, Sharma M, Supasek K, Lehn M, Reza H, Takebe T, Takiar V, Wise-Draper T, Chutipongtanate S, Esfandiari L. (Oct. 2024). Three-dimensional matrix stiffness drives piezo1 activity in oral squamous cell carcinoma spheroids and derived small extracellular vesicles. *BMES, Baltimore* – **Poster presentation**
[5] **Sheth M**, Sharma M, Supasek K, Lehn M, Reza H, Takebe T, Takiar V, Wise-Draper T, Chutipongtanate S, Esfandiari L. (May 2024). Three-dimensional matrix stiffness drives piezo1 activation in cancer spheroid-derived small extracellular vesicles. *ISEV, Melbourne* – **Poster presentation**
[6] **Sheth M**, Sharma M, Esfandiari L. (Feb. 2024). Matrix stiffness induced piezo-1 activation promotes metastatic potential in three-dimensional head and neck cancer spheroids. *BPS, Philadelphia* – **Poster presentation**
[7] **Sheth M**, Sharma M, Kuhnell D, Langevin S, Esfandiari L. (May 2023). Multiparametric analysis of small extracellular vesicles purified by a rapid and label-free lab on a chip device. *ISEV, Seattle* – **Poster presentation**
[8] **Sheth M**, Krutko M, Lehn M, Takiar V, Wise-Draper T, Esfandiari L. (Feb. 2023). Alteration of membrane potential of head and neck cancer cells using a piezoelectric nanofiber interface. *BPS, San Diego* – **Poster presentation**
[9] **Sheth M**, Krutko M, Lehn M, Bryan A, Harris G, Takiar V, Wise-Draper T, Esfandiari L. (Oct. 2022). Electrical stimulation of head and neck cancer cells using a piezoelectric nanofiber interface. *BMES, San Antonio* – **Poster presentation**

Awards & Fellowships

2024	**Graduate Student Engineer of the Month**	*Univ. of Cincinnati*
2024	**Scientific Excellence Award Nominee** – abstract based nomination	*TERMIS-AM SYIS*
2024	**Excellence in Teaching Award for Graduate Assistants** – honorable mention	*Univ. of Cincinnati*
2020	**Mechanical Engineering Summer Research Fellowship**	*Purdue Univ.*

Mentoring & Teaching

Research Mentorship
Greg Macke, MS student, University of Cincinnati — Aug. 2023 – Aug. 2025

Adjunct Lecturer, Mechanics of Materials
Biomedical Engineering, University of Cincinnati — May 2022 – Aug. 2022
Led a class of 70 students, managing all aspects of instruction, including lectures, assignments, and assessments, while fostering an engaging learning environment using a flipped classroom approach.

Graduate Teaching Assistant, University of Cincinnati

Biomedical Microsystems	Aug. 2024 – Dec. 2024
Functional Tissue Engineering	Aug. 2023 – Dec. 2023
Statics and Dynamics	Jan. 2022 – May 2022
Intro to BME in a Clinical Environment	Aug. 2021 – Dec. 2021

Summer High School Research Mentor, University of Cincinnati — July 2023, July 2024

Purdue Mechanical Engineering Mentor — July 2020 – May 2021

Undergraduate Teaching Assistant, Transforming Ideas to Innovation I & II
First Year Engineering, Purdue University — Jan. 2019 – May 2021

Organizations & Positions

Founding President
University of Cincinnati Student Chapter of the Biophysical Society — Jan. 2023 – Jan. 2025
Launched a platform to connect researchers across UC's College of Engineering, College of Medicine, and Cincinnati Children's Hospital, promoting interdisciplinary collaboration in biophysical research.

Early Career Member

- International Society for Extracellular Vesicles (ISEV) — Jan. 2023 – Present
- Student Network for Extracellular Vesicles (SNEV) — May 2023 – Present
- Biophysical Society (BPS) — Oct. 2022 – Oct. 2024
- Biomedical Engineering Society (BMES) — May 2022 – Present
- Tissue Engineering and Regenerative Medicine International Society (TERMIS) — Jan. 2024 – Present