Md Khayrul Islam

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Education

Lehigh University — Pennsylvania, USA
Ph.D. in Mechanical Engineering; GPA: 3.84/4.00 — *Jan 2021 – Current*
- Awarded P.C. Rossin College of Engineering **fellowship**.

Lehigh University — Pennsylvania, USA
M.S. in Mechanical Engineering; GPA: 3.84/4.00 — *Jan 2021 – May 2023*
Thesis Title: Predicting Drug Loading in Extracellular Vesicles through Coarse-Grained Molecular Dynamics Simulation got published on **PCCP**.

IBM — Online
Professional Certificate in Data Science — *Aug 2024*
- Mastered data science competencies including Python, machine learning, SQL, data visualization, and AI, culminating in a capstone project.

Bangladesh University Engineering and Technology — Dhaka, Bangladesh
B.Sc. in Industrial and Production Engineering; GPA: 3.55/4.00 — *Jun 2014 – Oct 2018*
Thesis Title: Molecular dynamics simulation of the mechanical properties of CNT-polyoxymethylene composite with a reactive forcefield got published on **Molecular Simulation**
- Awarded SCEA- PTAK prize global case study competition **scholarship**

Skills

Programming: Python, MATLAB, Bash, SQL
ML and DSA: PyTorch, ImageJ, Pandas, NumPy, OpenCV, ML Algorithms, DSA
Simulation: COMSOL, EspressoMD, ANSYS, LAMMPS, GROMACS, VMD, SolidWorks
Miscellaneous: Docker, Git, High-Performance Computing, Cloud Computing

Work and Research Experience

Lehigh University — Bethlehem, PA
Graduate Research Assistant — *Jan 2021 - Present*
- Collaborated in a multidisciplinary team to publish 11 Q1 journal papers in computational biology and machine learning, featured in prestigious journals including Nature Communications, ACS, and RSC series, with 120++ citations.
- Supervised 4 undergraduate and 1 master's students; led 5 multidisciplinary group projects involving students from Bioengineering, Computer Science, and Mechanical Engineering.
- Designed the official **website** and administered lab's **GitHub**, and Slack; managed computational resources including server setup, management, and resource allocation.

Lehigh University — Bethlehem, PA
High-Performance Computing Server Administrator — *Jan 2023 - Present*
- Administered a high-computing server valued at $500K, funded by **NSF**. Engineered initial setup, optimized for on-demand resource allocation, achieving production-readiness for multi-disciplinary research applications.

GMS Composite Knitting Ind. Ltd. — Dhaka, Bangladesh
Management Trainee — *Feb 2019 - Aug 2019*
- Developed an Excel VBA automated line balancing algorithm, improving line balancing efficiency by 15%.
- Optimized floor efficiency via Excel VBA, achieving an 8-12% efficiency boost by maximizing total floor productivity with minimal machinery.

Projects

Sub-Millisecond Cell Sorting — *May 2023 – Present*
Developed a state-of-the-art FPGA-accelerated label-free machine learning framework for real-time cell sorting. Achieved sub-millisecond latency (14.5 s) and 98% classification accuracy, optimizing hardware-software integration for precision tasks. **CVPR25[Under review]**

Multiplex Image ML — *May 2023 – Present*
Pioneered a Multiplex Image ML framework integrating biomechanical property data with deep learning techniques, achieving 98.3% classification accuracy. Leveraged advanced image denoising and segmentation for rapid clinical decision-making. Preprint available at **Nature Microsyst Nanoeng[Accepted]**.

Stem Cell Classifier — *Jan 2023 – Feb 2024*
Trained deep learning models to classify hematopoietic stem cells and multipotent progenitors using light microscopy, focusing on robust feature segmentation and motion artifact mitigation. Enabled rapid, marker-free cell classification for precision diagnostics. Published in **Stem Cell Research & Therapy**.

Maskless Microfluidic Prototyping — *Jan 2022 – Jun 2023*
Developed computational models in COMSOL to enhance microfluidic device fabrication with maskless lithography, achieving high fidelity and repeatability. **Nature Communications**

Publications

1. **Khayrul Islam**, Ryan F. Forelli, Jianzhong Han, Deven Bhadane, Joshua C. Agar, Nhan Tran, Seda Memik, and Yaling Liu. Real-time sub-millisecond cell sorting with scalable fpga-accelerated deep learning. *CVPR*, 2025. [Under review]

2. **Khayrul Islam**, Ratul Paul, Shen Wang, and Yaling Liu. Miml: Multiplex image machine learning for high precision cell classification via mechanical traits within microfluidic systems. *Microsystems & Nanoengineering*, 2024. [Accepted for publication]

3. Yue Wu, **Islam, Khayrul**, Yaling Liu, and Anand Jagota. Microdroplet resuspension off surfaces. *Langmuir*, 40(52):27206–27215, 2024

4. Mehedi Hasan, **Khayrul Islam**, and AKM Masud. Tailoring polyamide nanocomposites: The synergistic effects of swcnt chirality and maleic anhydride grafting. *ACS Applied Engineering Materials*, 2024

5. Yuwen Zhao, Yue Wu, **Khayrul Islam**, Ratul Paul, Yuyuan Zhou, Xiaochen Qin, Qiying Li, and Yaling Liu. Microphysiologically engineered vessel-tumor model to investigate vascular transport dynamics of immune cells. *ACS Applied Materials Interfaces*, 16(18):22839–22849, 2024

6. Shen Wang, Jianzhong Han, Jingru Huang, **Khayrul Islam**, Yuheng Shi, Yuyuan Zhou, Dongwook Kim, Jane Zhou, Zhaorui Lian, Yaling Liu, et al. Deep learning-based predictive classification of functional subpopulations of hematopoietic stem cells and multipotent progenitors. *Stem Cell Research Therapy*, 15(1):74, 2024

7. Yue Wu, Yuwen Zhao, **Khayrul Islam**, Yuyuan Zhou, Saeed Omidi, Yevgeny Berdichevsky, and Yaling Liu. Acoustofluidic engineering of functional vessel-on-a-chip. *ACS Biomaterials Science Engineering*, 9(11):6273–6281, 2023

8. Ratul Paul, Yuwen Zhao, Declan Coster, Xiaochen Qin, **Khayrul Islam**, Yue Wu, and Yaling Liu. Rapid prototyping of high-resolution large format microfluidic device through maskless image guided in-situ photopolymerization. *Nature Communications*, 14(1):4520, 2023

9. Anshu Raj, Sk Md Ahnaf Akif Alvi, **Khayrul Islam**, Mohammad Motalab, and Shuozhi Xu. An atomistic study of the tensile deformation of carbon nanotube–polymethylmethacrylate composites. *Polymers*, 15(13):2956, 2023

10. Yue Wu, Yuwen Zhao, Yuyuan Zhou, **Khayrul Islam**, and Yaling Liu. Microfluidic droplet-assisted fabrication of vessel-supported tumors for preclinical drug discovery. *ACS Applied Materials Interfaces*, 15(12):15152–15161, 2023

11. **Khayrul Islam**, Meghdad Razizadeh, and Yaling Liu. Coarse-grained molecular simulation of extracellular vesicle squeezing for drug loading. *Physical Chemistry Chemical Physics*, 25(17):12308–12321, 2023

12. Yue Wu, Yuyuan Zhou, Ratul Paul, Xiaochen Qin, **Khayrul Islam**, and Yaling Liu. Adaptable microfluidic vessel-on-a-chip platform for investigating tumor metastatic transport in bloodstream. *Analytical Chemistry*, 94(35):12159–12166, 2022

13. Mehdi Nikfar, Ratul Paul, **Khayrul Islam**, Meghdad Razizadeh, Anand Jagota, and Yaling Liu. Respiratory droplet resuspension near surfaces: Modeling and analysis. *Journal of Applied Physics*, 130(2), 2021

14. **Khayrul Islam**, Sourav Saha, and AKM Masud. Molecular dynamics simulation of the mechanical properties of cnt-polyoxymethylene composite with a reactive forcefield. *Molecular Simulation*, 46(5):380–387, 2020

Conference Presentations

1. **Khayrul Islam**, Yuwen Zhao, Shen Wang, and Yaling Liu. Machine learning based classification of cells by mechanical properties in microfluidic device. *48th Annual Northeast Bioengineering Conference (NEBEC 2022) (April 2022), Columbia University, New York City, New York*, 2022

2. **Khayrul Islam**, Tahreen Nabila, and AKM Masud. Investigation of the mechanical properties of polypropylene /carbon nanotube composite by molecular dynamics simulation. *13th International Conference on Mechanical Engineering, Dhaka, Bangladesh*, 2019

References

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