

Kushal Joshi

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EDUCATION

Toronto Metropolitan University

Toronto, ON

Doctor of Philosophy (PhD) - Mechanical Engineering

Sep. 2020 - Aug. 2024

Advisors: Prof. Scott Tsai and Prof. Warren Lee

Dissertation: *Development and Applications of a Standardized, Versatile Platform for Therapeutic Cargo Delivery using Clinical Ultrasound and Microbubbles*

University of California, Irvine

Irvine, CA

Master of Science (MS) - Biomedical Engineering

Sep. 2018 - Sep. 2020

Advisor: Prof. Rahim Esfandarypour

Dissertation: *Novel, Low-cost, Inkjet-printed Platforms for Microfluidic Impedance Flow Cytometry and Digital Microfluidics*

Birla Institute of Technology and Science

Pilani, India

Bachelor of Engineering (BE (Hons.)) - Mechanical Engineering

Aug. 2013 - July 2017

PUBLICATIONS

Peer-reviewed Journals

- **Joshi, K.**, Sohajrood, A.J., Sanwal, R., Lee, W.L., Tsai, S.S.H. (2024); Improving the efficiency of ultrasound and microbubble-mediated gene delivery by manipulation of microbubble lipid composition; ***Advanced Healthcare Materials*** (in review)
- Ghasemzaie, N., Jeyhani, M., **Joshi, K.**, Lee, W.L., Tsai, S.S.H. (2024); ATPSpin: a single microfluidic platform that produces diversified ATPS-alginate microfibers; ***ACS Biomaterials Science and Engineering***, 10(6), 3896-3908
- **Joshi, K.**, Sanwal, R., Thu, K.L., Tsai, S.S.H., Lee, W.L. (2022); Plug and Pop: A 3D-Printed, Modular Platform for Drug Delivery Using Clinical Ultrasound and Microbubbles; ***Pharmaceutics***, 14, 2516.
- Sanwal, R., **Joshi, K.**, Ditmans, M., Tsai, S.S.H., Lee, W.L. (2021); Ultrasound and Microbubbles for Targeted Drug Delivery to the Lung Endothelium in ARDS: Cellular Mechanisms and Therapeutic Opportunities; ***Biomedicines***, 9, 803.
- **Joshi, K.**, Javani, A., Park, J., Velasco, V., Xu, B., Razorenova, O., Esfandarypour, R. (2020); A Machine Learning-Assisted Nanoparticle-Printed Biochip for Real-Time Single Cancer Cell Analysis; ***Advanced Biosystems***, 4(11), 2000160 (Cover article of ***Advanced Biosystems*** volume 4, issue 11)
- **Joshi, K.**, Velasco, V., Esfandarypour, R. (2020); A Low-Cost, Disposable and Portable Inkjet-Printed Biochip for the Developing World; ***Sensors***, 20, 3593.
- Velasco, V., **Joshi, K.**, Chen, J., Esfandarypour, R. (2019); Personalized Drug Efficacy Monitoring Chip; ***Analytical Chemistry***, 91(23), 14927-14935.

Conference Proceedings

- **Joshi, K.**, Tsai, S.S.H. & Lee, W.L. (2023); Optimization of Genetic and Non-Genetic Cargo Delivery using Clinical Ultrasound and Microbubbles; *45th Canadian Medical and Biological Engineering Conference*, Vancouver, Canada.
- **Joshi, K.** & Esfandarypour, R. (2020); An Inkjet Printed and Reusable Platform for Single Cell Impedance Cytometry; *SPIE Microfluidics, BioMEMS and Medical Microsystems XVIII*, San Fransisco, USA.
- Kotesa, R.S., **Joshi, K.**, Ananthasuresh, G.K., & Sen, P. (2018); A Novel High Throughput Microfluidic Cell Transit Analyzer using Air-Liquid Interface as Localised Pressure Sensor; *31st IEEE International Conference on Micro Electro Mechanical Systems*, Belfast, UK, .
- Munoz, J.J., Mosaffa, P., Ferran, A.R., Singh, A.P., **Joshi, K.**, Blanco, E.M., & Saunders, T.E., (2017); Inverse Analysis and Hybrid Vertex/Cell-Centred Model for Embryo Morphogenesis; *5th International Conference on Computational and Mathematical Biomedical Engineering*, Pittsburg, USA.

POSTER PRESENTATIONS

- Hoshi, R., Lau, A., **Joshi, K.**, Sanwal, R., Hysi, E., Lee, W.L., & Thu, K.L., **(2024)**; Optimizing delivery of anti-cancer therapeutics in lung adenocarcinoma using ultrasound-induced cavitation of microbubbles; *World Conference of Lung Cancer*, Singapore,
- Hoshi, R., **Joshi, K.**, Sanwal, R., Lodyga, M., Hysi, E., Lau, A., Fang, W.Y., Lee, W.L., & Thu, K.L., **(2024)**; Optimizing ultrasound and microbubble-mediated delivery of anti-cancer therapeutics in lung adenocarcinoma; *OICR Translational Research Conference*, Canada,
- Hoshi, R., Lau, A., **Joshi, K.**, Sanwal, R., Hysi, E., O'Reilly, M., Lee, W.L., & Thu, K.L., **(2023)**; Optimizing ultrasound and microbubble-mediated delivery of anti-cancer therapeutics in lung adenocarcinoma; *UHT Cancer Symposium*, Toronto, Canada,
- **Joshi, K.**, Tsai, S.S.H., & Lee, W.L., **(2023)**; Healing with Sound: Optimization of Genetic and Non-Genetic Cargo Delivery using Clinical Ultrasound and Microbubbles; *CRAFT Symposium*, Toronto, Canada,
- **Joshi, K.**, Tsai, S.S.H., & Lee, W.L., **(2021)**; Microfluidically-produced Microbubbles for Ultrasound-mediated Drug Delivery in ARDS; *iBEST Symposium*, Toronto, Canada,
- Karkali, K., Singh, A., Tlili, S., **Joshi, K.**, Munoz, J.J., Blanco, E.M., & Saunders, T.E., **(2017)**; In Toto Quantitative Imaging Tools to Study Drosophila Ventral Nerve Cord Condensation; *18th International Congress of Developmental Biology*, Singapore,

AWARDS AND ACHIEVEMENTS

- **MIE Graduate Studies Award**
Competitive award of of CA\$2000 for excellence in graduate research April 2024
- **2023-2024 Ontario Graduate Scholarship**
Competitive award of of CA\$15000 partially funded by Govt. of Ontario for academic excellence May 2023
- **Best presenter award for 2022-2023 Graduate Seminars (second place)**
Competitive award for excellence in graduate seminar presentation May 2023
- **MIE Graduate Studies Award**
Competitive award of CA\$2000 for excellence in graduate research Apr 2023
- **2022 iBEST Trainee Collaborative Research Fund**
A CA\$5500 research grant awarded by Toronto Metropolitan University & St. Michael's Hospital Oct 2022
- **Nominated for 2021-2022 Vanier Canada Graduate Scholarship**
One of only two students from Ryerson University nominated for the prestigious NSERC Vanier CGS Nov 2021
- **2021-2022 Ryerson Graduate Development Award**
Competitive award of CA\$5000 recognizing academic excellence at the doctoral level Sep 2021
- **2021 iBEST Trainee Collaborative Research Fund**
A CA\$5500 research grant awarded by Ryerson University & St. Michael's Hospital for doctoral research May 2021
- **2021-2022 Ryerson Graduate Scholarship**
A CA\$15000 merit-based, competitive award recognizing research excellence at the doctoral level May 2021
- **2020-2021 Ryerson Graduate Development Award**
Competitive award of CA\$8000 recognizing academic excellence at the doctoral level Oct 2020
- **McGill BBME Recruitment Award (Declined)**
Awarded exclusively to top international applicants for pursuing PhD at McGill University Feb 2020
- **Lockheed Martin Design Challenge Grant**
Received a grant of US\$25000 from Lockheed Martin for completing high-level payload design May 2015
- **DST Inspire Award 2011 - Awarded by Dept. of Science and Technology of India**
Received an award of INR 5000 for excellent performance in Maharashtra SSC exam May 2011

TECHNICAL SKILLS

Microfabrication techniques: Optical lithography, Soft lithography, Thin-film deposition (Sputtering), Wet etching

Manufacturing techniques: Laser cutting, 3D printing

Programming: C, C++, MATLAB, Python, R, Arduino C++

Softwares: CATIA, SolidWorks, AutoCAD, ProEngineer, COMSOL, ANSYS, FlowJo, GraphPad Prizm

Biological techniques: Cell culturing, Flow cytometry, Confocal microscopy

RESEARCH EXPERIENCE

- **Institute for Biomedical Engineering, Science and Technology (iBEST)** Toronto, ON
Doctoral Student (Supervisors: Prof. Scott Tsai and Prof. Warren Lee) *Sep 2020 - Present*
 - Designed a novel, 3D-printed platform for studying ultrasound and microbubble-mediated drug and gene delivery *in vitro*.
 - Utilized the platform to study the effect of various ultrasound exposure settings on efficiency of dextran delivery in HEK293 cells.
 - Developed novel microbubble formulations for improving the efficiency of gene delivery in HEK293 cells *in vitro*.
 - Investigated doxorubicin and siRNA delivery using ultrasound and microbubbles in human lung adenocarcinoma cells *in vitro*.
 - Designed and fabricated microfluidic devices for high-throughput microbubble generation.
 - Initiated collaborations with 10+ students, staff scientists and professors with cross-disciplinary expertise leading to three peer-reviewed journal articles.
 - Actively participated in writing research proposals for securing funding from government agencies and university. Secured CAD\$40000 in grants and scholarships including the prestigious Ontario Graduate Scholarship (OGS) sponsored by the Government of Ontario, Canada.
- **Laboratory for Integrated Nano-Bio Electronics Innovation, UC Irvine** Irvine, CA
Master's Thesis Student (Supervisor: Prof. Rahim Esfandyarpour) *Jan 2019 - Aug 2020*
 - Designed and fabricated a novel, low-cost microfluidic platform for measuring electrical impedance properties of cancer cells.
 - Collaborated with computer scientists to develop machine learning algorithms for classifying different cancer cells based on their electrical impedance properties.
 - Designed and fabricated a novel, low-cost, arduino-controlled digital microfluidic platform for point-of-care diagnostics in remote settings in collaboration with researchers from Stanford University.
 - Mentored one undergraduate researcher, presented research at one international conference and published research articles in two peer-reviewed journals.
- **Centre for Nano Science and Engineering, Indian Institute of Science** Bangalore, IN
Project Assistant (Supervisor: Prof. Prosenjit Sen) *July 2017 - May 2018*
 - Designed and fabricated a novel microfluidic platform for estimating mechanical deformability of single cells using soft lithography and optical lithography techniques.
 - Developed a MATLAB code to analyze multi-dimensional, high-speed imaging data containing 100,000+ frames to quantify mechanical stiffness of cells.
 - Gained hands-on experience in optical lithography and thin-film deposition in a class-100 cleanroom.
- **Mechanobiology Institute, National University of Singapore** Singapore, SG
Undergraduate Research Intern (Supervisor : Prof. Timothy Saunders) *June 2016 - Dec. 2016*
 - Investigated spatio-temporal variation in the size and shape of ventral nerve cord during its development in a *Drosophila Melanogaster* embryo using light-sheet microscopy and image analysis.

VOLUNTEERING AND LEADERSHIP EXPERIENCE

- **Faculty of Engineering Graduate Ambassador**
Toronto Metropolitan University, Toronto, ON *Sep 2022 - Present*
 - Organized and managed events to increase graduate student engagement within the faculty of engineering and architectural sciences at Toronto Metropolitan University
- **Biomaterials, Tissue Engineering and Repair (BTR) Trainee Theme Lead**
Institute for Biomedical Engineering, Science and Technology (iBEST), Toronto, ON *Sep 2021 - Present*
 - Organized and managed events to increase trainee engagement and foster research collaborations between Toronto Metropolitan University and St. Michael's Hospital graduate students pursuing research in biomaterials and tissue engineering
 - Served as liaison between iBEST trainees and senior iBEST management regarding trainee grievances and issues
- **Marketing and Promotions Team Lead**
Centre for Research and Applications in Fluidic Technologies (CRAFT), Toronto, ON *Nov 2020 - Aug 2021*
 - Served as the leader of marketing and promotions team of 2021 Virtual CRAFT Symposium, jointly organized by University of Toronto and National Research Council (NRC) Canada
 - Managed a team of three graduate students to promote the event through various social media channels and university newsletters
 - Successfully increased the number of registrants by 50% compared to previous years

PEER REVIEW ACTIVITIES

- **Computer Methods in Biomechanics and Biomedical Engineering**
Number of articles reviewed: 1
- **Nature Communications**
Number of articles reviewed: 1 (Co-reviewed with Prof. Scott S.H. Tsai)
- **Langmuir**
Number of articles reviewed: 1 (Co-reviewed with Prof. Scott S.H. Tsai)
- **Colloids Interfaces**
Number of articles reviewed: 1 (Co-reviewed with Prof. Scott S.H. Tsai)

PROFESSIONAL CERTIFICATIONS

- **Bioinnovation Scientist Program - Foundations**
Admare Bioinnovations, Canada *Dec. 2023*
- **Lean Six Sigma Yellow Belt**
The Council for Six Sigma Certification (CSSC) *Jun. 2023*
- **US Medical Device Regulatory Affairs Professional Certification**
BioPharma Institute, NJ, USA *Sep. 2019*

REFERENCES

- **Prof. Warren Lee**, University of Toronto, Canada
Email: Warren.Lee@unityhealth.to
- **Prof. Scott Tsai**, Toronto Metropolitan University, Canada
Email: scott.tsai@torontomu.ca
- **Prof. Kelsie Thu**, University of Toronto, Canada
Email: Kelsie.Thu@unityhealth.to
- **Prof. Rahim Esfandypour**, University of California, Irvine, USA
Email: rahimes@uci.edu
- **Prof. Prosenjit Sen**, Indian Institute of Science, Bangalore, India
Email: prosenjits@iisc.ac.in

- **Prof. Timothy Saunders**, University of Warwick, UK
Email: Timothy.Saunders@warwick.ac.uk
- **Prof. Shibu Clement**, Birla Institute of Technology and Science, Goa, India
Email: shibu@goa.bits-pilani.ac.in