Xuan-Quoc Vo, Ph.D.

Research Instructor (Organ-on-Chip, Complex Fluids, Pulmonary Mechanobiology)
School of Medicine, University of Pittsburgh, Pittsburgh, PA, USA

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Research Interests

Organs-on-chip and stem cell–derived microphysiological systems; human disease modeling; pulmonary and vascular bioengineering; Down syndrome–associated immune dysfunction; translational bioengineering; soft matter and interfacial physics.

Research Program Summary

I develop **physics-informed organ-on-chip systems** that integrate soft matter mechanics, transport phenomena, and autologous human cell biology to build **predictive models of pulmonary diseases**. My work establishes quantitative design principles linking force transmission, geometry, and flow to inflammatory signaling and immune dynamics, and leverages high-dimensional multiomics and machine learning to enable mechanistically interpretable therapeutic discovery.

My independent program is organized around a unified intellectual framework with two complementary components:

- **Core Science:** *Physics-informed human mechanobiology at physiological interfaces*
- **Translational Engine:** *Data-driven predictive pulmonary platforms for therapy discovery*

Selected Publications

1. **Q. Vo**, K. A. Carlson, P. M. Chiknas, C. N. Brocker, L. DaSilva, E. Clark, S. K. Park, A. S. Ajiboye, E. M. Wier, K. H. Benam, On-Chip Reconstitution of Uniformly Shear-Sensing 3D Matrix-embedded Multicellular Blood Microvessels, *Advanced Functional Materials 34*, 2304630, 2024 (*Featured as Inside Front Cover*).
2. **Q. Vo**, and K. H. Benam, Advancements in Preclinical Human-Relevant Modeling of Pulmonary Vasculature On-Chip, *European Journal of Pharmaceutical Sciences 195*, 106709, 2024.
3. **Q. Vo**, and T. Tran, Mediation of Lubricated Air Films using Spatially Periodic Dielectrophoretic Effect, *Nature Communications* 12, 4289, 2021.
4. **Q. Vo**, and T. Tran, Dynamics of Droplets under Electrowetting Effect with Voltages Exceeding the Contact Angle Saturation Threshold, *Journal of Fluid Mechanics* 925, A19, 2021, (*co-corresponding author*).
5. **Q. Vo**, and T. Tran, Critical Conditions for Jumping Droplets, *Physical Review Letters* 123, 024502, 2019.

Academic Appointments

Research Instructor
School of Medicine, University of Pittsburgh | Nov 2023 – Present

Postdoctoral Research Associate
School of Medicine, University of Pittsburgh | Dec 2021 – Nov 2023

Postdoctoral Research Fellow
Nanyang Technological University, Singapore | Dec 2018 – Dec 2021

Education

Ph.D. in Mechanical Engineering (Physics of Fluids)
Nanyang Technological University, Singapore | 2019
Dissertation: *Contact Line Dynamics of Electrowetting Droplets*

M.Eng. in Mechanical Engineering (Mechatronics)
Ho Chi Minh City University of Technology, Vietnam | 2013
First Class Honors

B.Eng. in Mechanical Engineering (Mechatronics)
Ho Chi Minh City University of Technology, Vietnam | 2010

Research Experience

University of Pittsburgh – School of Medicine | Dec 2021 - Present

Research Instructor / Postdoctoral Research Associate
Mentor: Dr. Kambez H. Benam

- Led development of **Next-generation personalized Small Airway-Chip, ECM-embedded Microvascular-Chip**, and stem-cell-based airway models
- Human disease modeling, drug discovery, and toxicity testing using **next-generation iPSC-derived** organs-on-chip systems, focusing on **Down syndrome–associated** immune and tissue pathologies.
- Publication: **three peer-reviewed articles**, including **Advanced Functional Materials** (featured cover); **three provisional patents** related to organ-on-chip technologies; authored a **book chapter** on lung-on-chip models for cigarette smoke exposure
- Key personnel in two federal **NIH R01 grants**: on pulmonary microphysiological systems and vascular mechanobiology

Nanyang Technological University – Singapore | March 2019 – Dec 2021

Postdoctoral Research Fellow
Mentor: Dr. Tuan Tran

- Led a major project on **dynamic wetting and three-phase contact line physics**, exceeding project milestones by ~200%
- Designed and patented **laser interferometry methods** for 4D surface profiling
- Published **11 journal articles**, including Nature Communications, ACS Nano, and Journal of Fluid Mechanics
- **Supervised and mentored** Ph.D. and undergraduate researchers
- **Managed laboratory** operations and experimental infrastructure

Honors & Awards

- NTU Ph.D. Research Scholarship (2014–2018)
- Best Paper Award, Physical Review E (Editor's Suggestion)
- Best Paper Award, UK Heat Transfer Conference (2022)
- Co-PI, 3-year Research Grant (Vietnam Ministry of Science & Technology)

Full Publication List (* indicates co-first author)

1. **Q. Vo**, S. Okawa, R. J. Valdes, B. Niemeyer4, F. J. Hawkins, K. D. Sullivan, J. M. Espinosa, and K. H. Benam, Autologous Stem Cell–derived Lung Airway-on-a-Chip for Down Syndrome. To be submitted.
2. **Q. Vo** and K. H. Benam, Protocol for characterizing airway epithelial ciliary beating and mucociliary transport using image processing and particle imaging velocimetry, Star Protocols 6, 103674, 2025.
3. B. F. Niemeyer*, **Q. Vo***, T. Saleh, H. Mahvizani, D. Hu, E. M. Pietras, C. T. Jordan, K. H. Benam, On-Chip Reconstitution of Hematopoietic Niche for Real-time Leukocyte Mobilization Analysis, *under review*, Sep 2025.
4. **Q. Vo**, M. Lin, and T. Tran, Soft Materials Deform Anisotropically at the Onset of Wetting, *Nature Communication, under revision,* Sep 2025.
5. **Q. Vo***, S. Mitra*, M. Lin, and T. Tran, Unsteady Wetting of Soft Solids, *Journal of Colloid and Interface Science 664,* 478-486*,* 2024.
6. **Q. Vo**, and K. H. Benam, Advancements in Preclinical Human-Relevant Modeling of Pulmonary Vasculature On-Chip, *European Journal of Pharmaceutical Sciences 195*, 106709*,* 2024.
7. **Q. Vo**, K. A. Carlson, P. M. Chiknas, C. N. Brocker, L. DaSilva, E. Clark, S. K. Park, A. S. Ajiboye, E. M. Wier, K. H. Benam, On-Chip Reconstitution of Uniformly Shear-Sensing 3D Matrix-embedded Multicellular Blood Microvessels, *Advanced Functional Materials 34*, 2304630, 2024 (*Featured as Inside Front Cover*, DOI: 10.1002/adfm.202470054).
8. **Q. Vo**, and T. Tran, Droplet Jumping by Modulated Electrowetting, *Journal of Fluid Mechanics* 977, A24, 2023.
9. TB Nguyen, **Q. Vo**, X Shang, F Buang, T Tran, Film Boiling Suppression and Boiling Heat Transfer Enhancement by Dielectrophoretic Effect, *Thermal Science and Engineering Progress* 40, 101796, 2023.
10. M. Lin, **Q. Vo**, S. Mitra, and T. Tran, Viscous Droplets Impingement on Soft Substrates, *Soft Matter* 18, 5474-5482, 2022.
11. TB Nguyen, **Q. Vo**, X Shang, F Buang, T Tran, Bypassing Film Boiling State for Maintaining High Boiling Heat Transfer Efficiency by Dielectrophoretic Effect, *17th UK Heat Transfer Conference* (UKHTC2021), Manchester, UK, 4-6 April 2022. Full paper available here.
12. **Q. Vo**, and T. Tran, Mediation of Lubricated Air Films using Spatially Periodic Dielectrophoretic Effect, *Nature Communications* 12, 4289, 2021.

13. **Q. Vo**, and T. Tran, Dynamics of Droplets under Electrowetting Effect with Voltages Exceeding the Contact Angle Saturation Threshold, ***Journal of Fluid Mechanics*** **925**, A19, 2021, (*co-corresponding author*).
14. S. Mitra, **Q. Vo**, and T. Tran, Bouncing-To-Wetting Transition for Water Droplets Impacting Soft Solids, *Soft Matter* 17, 5969, 2021, (*co-corresponding author*).
15. **Q. Vo**, and T. Tran, Droplet Ejection by Electrowetting Actuation, *Applied Physics Letters* 118, 16160, 2021, (*co-corresponding author*).
16. **Q. Vo**, Y. Fujita, Y. Tagawa, and T. Tran, Anisotropic Behaviours of Droplets Impacting on Dielectrowetting Substrates, *Soft Matter* 16, 2621-2628, 2020.
17. **Q. Vo**, and T. Tran, Critical Conditions for Jumping Droplets, *Physical Review Letters* 123, 024502, 2019.
18. T.-S. D. Le, J. An, Y. Huang, **Q. Vo**, J. Boonruangkang, T. Tran, S.-W Kim, G. Sun, and Y.-J. Kim, Ultrasensitive Anti-Interference Voice Recognition by Bio-Inspired Skin-Attachable Self-Cleaning Acoustic Sensors, *ACS Nano* 13, 13293-13303, 2019.
19. **Q. Vo**, and T. Tran, Contact Line Friction of Electrowetting Actuated Viscous Droplets, *Physical Review E* 97, 063101, 2018, *Editor's Suggestion Award*.
20. **Q. Vo**, H. Su, and T. Tran, Universal Transient Dynamics of Electrowetting Droplets, *Scientific Reports* 8, 836, 2018.
21. **XQ. Vo**, and T. Tran, Transient Electrowetting-On-Dielectric for Activating Droplets in Bioprinting Applications, *Proc. of the 2nd Intl. Conf. on Progress in Additive Manufacturing*, 228-233, 2016. Full paper available here.

Patents

- **X.-Q. Vo**, Benam, K.H. *Next-Generation Airway-on-a-Chip*, Provisional Patent filed 2022
- K.H. Benam, **X.-Q. Vo,** *Non-PDMS Multi-Organ-Chip Platforms*, PCT application filed 2024
- **X.-Q. Vo.**, T. Tran, *Surface Profile Inspection Methods and Systems*, US Patent No. US12018931B2, issued 2024.
- K. H. Benam, H. Mahvizani, B. F. Niemeyer, and **X.-Q. Vo**, *System and Method for Bone Marrow Hematopoesis and Leukocyte Mobilization*, PCT application filed 2025.

Teaching Experience

Teaching Assistant, Nanyang Technological University

- Fluid Dynamics, Heat Transfer, Solid Mechanics and Vibration, Fluid Mechanics

Lecturer, National Key Laboratory of Digital Control & System Engineering, Vietnam

- Microcontroller Programming, Electronic Circuit Design and Fabrication

Mentorship

- Supervised **2 Ph.D. students** (graduated 2021, 2023)
- Mentored **15+ undergraduate researchers**