

Thomas Minh Nguyen

Davis, CA

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<https://thomasmhnguyen.github.io>

RESEARCH INTERESTS

Fluid mechanics; biological fluid dynamics; transport phenomena; Multiphysics computational modeling and simulations; mathematical modeling; algorithm development

EDUCATION

University of California-Davis

Davis, CA

Ph.D. in Chemical Engineering | GPA: 3.69/4.00

Sep. 2019 - Jun. 2025

Thesis: *Morphological Dynamics and Transport of elastic and rigid fibers for engineering applications*

Coursework: Advanced Transport Phenomena: Coupled Physics, Fluxes, and Fields, Foundations of Colloidal Science, Advanced Transport Phenomena: Transport Phenomena in Biological Systems, Acquisition & Analysis of Biomedical Signals, Techniques in Molecular and Cellular Mechanics, Membrane Biology

North Carolina State University

Raleigh, NC

B.S. in Chemical & Biomolecular Engineering | GPA: 3.77/4.00

Aug. 2013 - May 2017

RESEARCH EXPERIENCE

University of California-Davis; Davis, CA

Department of Chemical Engineering

Principal Investigator: Harishankar Manikantan, Ph.D.

Jan. 2020 - Jun. 2025

- Developed highly efficient computational fluid dynamics (CFD) code using finite difference methods to simulate and predict the dynamics of elastic/rigid fibers in low-Reynolds number systems. The Fluid-structure interaction (FSI) problem was solved using slender-body framework coupled to Euler-Bernoulli elasticity theory. Simulation phenomena were corroborated through various statistical tools and analytical frameworks.

Research Project: *Transport and clogging of rigid fibers in milli-scale fluidic channels*

- Developed slender-body theory reduced-order computational model to simulate and predict transport of rigid fibers around milli-scale flow bends. Collaborated with experimental team from UCSB to validate simulations with their experiments of stiff nylon fibers flowing past milli-scale 3D-printed fluidic channels & bends.
- The likelihood of fibers clogging at the flow bend is governed through flow bend geometry/configuration, fiber length, and fiber positioning. Developed clogging probabilistic model to account for these parameters and predict friction factor of material used for 3D-printed fluidic channels.

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Research Project: *Steric/Shear-Induced migration of elastic fibers in confined micro-channel flows*

- Established method to model contact dynamics and steric interaction effects between fibers and micro-channel walls with a variety of background flow profiles.
- Fibers are shown to effectively migrate across flow streamlines, preferring to move towards regions of high shear rates when placed in non-uniform shear rate flows (e.g.: pressure-Driven Poiseuille flow). This shear-induced effect competes with wall exclusion effects in confined flows, where micro-channel walls act to drive fiber migration away from the flow boundaries. This competition

Research Project: *Investigation of Flow-induced instabilities due to filament non-uniform rigidity profiles*

- Established method to model filament dynamics due to non-uniform structural properties across length of fiber. Investigated fiber deformation patterns using 2 rigidity profiles that strengthen or weaken filament's structural properties, mimicking protein adsorption patterns onto microtubules.
- Deterministic simulations of fibers in simple shear flows showed that fibers with localized regions of reduced rigidity are more prone to flow-induced bending and buckling. Both linear stability analysis and linear-adjoint operator theory predicted reduced filament rigidity destabilized fundamental filament shapes arising from viscous compression.

National Institute on Aging; Baltimore, MD

Laboratory of Immunology & Molecular Biology

Principal Investigator: Nan-ping Weng, M.D., Ph.D.

Oct. 2017 - Aug. 2019

Research Focus: *Bioinformatics characterization of CD4+ and CD8+ T-cells in humans and mice*

- Developed computational tools and employed open-source software to process high-throughput sequencing (HTS)/next-generation sequencing (NGS) data from methods such as ChIP-Seq, ATAC-Seq, bulk RNA-Seq, and scRNA-Seq. Leveraged National Institutes of Health (NIH)'s high-performance computing (HPC) systems to process HTS datasets (25 GB+).
- Applied statistical analysis techniques through t-tests, non-linear mixed effects, ANOVA, regression analysis, etc. to identify significant features within high-dimensional datasets.
- Applied **Agile software-development practices** to redesign **Python/Bash HPC system** computational pipelines, reducing **resource utilization by 65%** and increasing **project delivery completion speeds by 22%**.

Research Project: *Development of Computational tools and analysis of CD8+ scRNA-Seq data*

- Performed large-scale (188 human patients) study of CD8+ T-cells through multi-colored flow cytometry analysis. Developed self-organizing map (SOM) ML model and leveraged linear regression analysis to validate flow cytometry data with scRNA-Seq data.
- ML model identified 13 distinct populations within flow cytometry data, with each population showing distinct protein expression signatures and distinct changes in expression with human aging. Spearman's rank correlation showed several flow cytometry populations matched well with scRNA-Seq counterparts in terms of protein expression and age-associated changes.

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Research Project: *Longitudinal Analysis and age-associated changes in TCRs from CD4+ and CD8+ T-cells from adult humans*

- Applied ecological diversity measurements and statistical analysis methods to identify and predict changes to TCR repertoire of naïve and memory CD4+ and CD8+ T-cells in longitudinal study of 15 human patients.
- TCRs from naïve CD8+ T-cells were found to have the most attrition, but most expansion compared to TCRs from other subsets. Demonstrated TCR repertoire attrition is subset specific and helped explain increased susceptibility of novel infections for older adults.

Research Project: *Characterization of CD4+ Conventional and Regulatory T-cells from mice*

- Determined distinct features between T-cell receptor (TCR) repertoire of the different CD4+ T-cell populations from mice through statistical analysis and data science methods. Trained classification machine learning (ML) model to distinguish TCRs from CD4+ Conventional and CD4+ Regulatory cells.
- Identified 23K+ TCR sequences shared between different CD4+ cells. ML model was able to distinguish distinct TCRs easily (ROC = 0.72 – 0.82).

TEACHING EXPERIENCE

Teaching Assistant: Bioseparation Processes

Davis, CA

UC Davis Department of Chemical Engineering

Jan. 2021 – Mar. 2021

- Instructed, held office hours, and graded assignments for ~24 students. Prepared materials for extended discussion during office hours related to processing operations commonly found in the life sciences/biotech industries (e.g.: ultrafiltration/diafiltration, protein chromatography).

Teaching Assistant: Chemical Engineering Thermodynamics Laboratory

Davis, CA

UC Davis Department of Chemical Engineering

Jan. 2023 – Mar. 2023

- Instructed, held office hours, and graded assignments for ~50 students. Prepared laboratory sessions related to data acquisition of temperature readings from thermocouples, pressure readings from pressure sensors-DAQ systems, and ethanol concentration from distillation column processes.
- Prepared and troubleshooted Python scripts for data post-processing and analysis for students, leading to a 30% faster turnaround times for class assignments.

Teaching Assistant: Numerical Methods in Engineering

Davis, CA

UC Davis Department of Chemical Engineering

Apr. 2023 – Jun. 2023

- Instructed, held office hours, proctored quizzes, and graded assignments for ~50 students. Prepared and worked through 15 sample Python programming problems related to data analysis, differential equation solvers, and finite differences during discussion sections.

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Teaching Assistant: Material Balances

Davis, CA

UC Davis Department of Chemical Engineering

Sep. 2023 – Dec. 2023

- Instructed, held office hours, proctored exams, and graded assignments for ~110 students. Prepared sample problems and HW solutions for students during office hours, helping them gain understanding of material balance problem workflows.

Teaching Assistant: Process Economics and Green Design

Davis, CA

UC Davis Department of Chemical Engineering

Jan. 2024 – Mar. 2024

- Instructed, held office hours, and graded assignments for ~50 students. Prepared sample problems and answered assignment-related questions during office hours.

Teaching Assistant: Numerical Methods in Engineering

Davis, CA

UC Davis Department of Chemical Engineering

Apr. 2025 – Jun. 2025

- Instructed, held office hours, proctored quizzes, and graded assignments for ~50 students. Prepared and worked through 15 sample Python programming problems related to data analysis, differential equation solvers, and finite differences during discussion sections.
- Gave lecture on finite differences for 3 class sessions, filling in for instructor's absence.

FELLOWSHIPS, GRANTS, & AWARDS

- UC Davis Graduate Student Association Research Travel Award (2023)
- UC Davis GAANN Fellowship (2019)
- UC Davis TOPS Fellowship (2019)

LEADERSHIP, SERVICE, OUTREACH

Vice President/Treasurer

Davis, CA

Equity in Science, Technology, Engineering, Math, and Entrepreneurship (ESTEME) at UC Davis

Sep. 2021 – Jun. 2023

- Applied for **4 student organization grants**, receiving **\$2000** to fund and support STEM outreach activities at local elementary schools. Managed **\$4K budget** for 36 STEM outreach activities and 4 professional development workshops.
- Developed engagement strategies for graduate student members, leading to **13% increase** in participation and engagement.

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Secretary

Davis, CA

CHMS Graduate Student Organization

Jun. 2021 – Jun. 2023

- Developed and maintained **300+ document** database spanning 4 years of notes, photos, and other important documents for student organization use, establishing framework for future organization use.
- Coordinated organization and event logistics between 12+ organization officers, resulting in **14% increase** in task completion rate compared to prior years.

President

Raleigh, NC

International Society for Pharmaceutical Engineers (ISPE) at NC State

Jul. 2016 – Jun. 2017

- Directed **6-member officer team**, delegating responsibilities for operations, finances, events, and member engagement.
- Organized **8 events** with **400+ attendees**, built partnerships with **5 biotech/life science companies**, and hosted **3 professional development workshops**.

Secretary

Raleigh, NC

International Society for Pharmaceutical Engineers (ISPE) at NC State

Jul. 2015 – Jun. 2016

- Took detailed minute meetings for **12+ officer meetings** across academic year, identifying strategies to increase student participation and actionable tasks.
- Applied Eisenhower Decision Matrix to categorize specific tasks based on urgency and importance, leading **88% completion** of all identified tasks.

PERSONAL PROJECTS

Physics-based Machine Learning for Differential Equation Solvers

2025

- Built a **physics-informed neural network (PINN) model** for heat & mass transfer phenomena. Achieved **70% accuracy** when compared to actual results.

Machine Learning Prediction of All-Star Players from 2019 NBA Draft

2025

- Built and evaluated **four machine-learning classifiers** (logistic, SVM, random forest, gradient boost) to predict All-Star outcomes from the 2019 NBA Draft, achieving strong predictive performance and model interpretability through SHAP analysis.

INDUSTRY WORK EXPERIENCE

Flexible Volume Manufacturing Intern

Durham, NC

Biogen

Jun. 2017 - Aug. 2017

- Collaborated with engineers to audit and streamline reagent usage across manufacturing production, identifying **37 critical chemical reagents** for purchasing and reducing preparation time by **~16 hours/week**.
- Evaluated integration of third-party materials into existing manufacturing workflows, identifying cost-saving opportunities and reducing manufacturing expenses by **\$500/month**.

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- Conducted **3 process development studies**, to support clinical trial material production, complying to **FDA cGMP (21 CFR Part 210/211)** regulations.
- Conducted sensitivity analysis on process parameters for chemical mixing processes, identifying parameters that eliminated **13 hours/week** in labor.

Small Scale Manufacturing Intern

Holly Springs, NC

Seqirus

May. 2016 - Aug. 2016

- Diagnosed production bottlenecks associated with **2x scale-up** in production of vaccine manufacturing, identifying inefficiencies contributing to a **45% drop** in overall productivity.
- Conducted **risk assessment** of process materials to determine safety impact on employees. Authored regulatory documents to execute change of process materials, minimizing **safety risk and hazards**.
- Worked with manufacturing employees to properly commission/decommission manufacturing equipment. Worked with supply chain employees to update SAP supply chain software for manufacturing processes and inventory management.

Biomanufacturing Intern

Raleigh, NC

BTEC at North Carolina State University

Aug. 2015 - May 2016

- Applied design of experiments (DOE) methods to optimize protein chromatography purification of inactivated influenza virus. Operated and troubleshooted **lab-scale downstream bioprocessing equipment** including UF/DF systems, centrifuges, chromatography columns, and lab equipment sensors to support protein purification and harvest workflows.
- Applied protein characterization and laboratory screening methods (phage display, ELISA, peptide sequencing, etc.) to screen peptides with highest affinity for host cell protein (HCP), identifying potential candidates/ligands for affinity chromatography columns.

Process Engineer Intern

Morrisville, NC

Integrated Project Services (IPS)

May 2015 - Aug. 2015

- Optimized workflow to review and modify **engineering schematics** (P&IDs, PFDs) for senior-level PEs and other engineers.
- Validated process components (valves, instruments, etc.) against master equipment lists to ensure design intent for client manufacturing projects.

PUBLICATIONS (* indicates co-first author)

Justin Maddox, **Thomas Nguyen**, ... (2025). "Transport and Clogging of Fibers in Millifluidic Channels". *In Prep*.

Thomas Nguyen, Harishankar Manikantan (2024). "Cross-Streamline Migration and near-Wall Depletion of Elastic Fibers in Micro-Channel Flows". *Soft Matter* (DOI: 10.1039/D3SM01499A)

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Thomas Nguyen, Harishankar Manikantan (2023). "Flow-induced buckling of elastic microfilaments with non-uniform bending stiffness". *Frontiers in Soft Matter* (DOI: 10.3389/frsfm.2022.977729)

Jaekwan Kim, **Thomas Nguyen**, ... (2023). "Lysine Methyltransferase Kmt2d regulates Naive CD8+ T-cell activation-induced survival". *Frontiers in Immunology* (DOI: 10.3389/fimmu.2022.1095140)

Jian Lu, Guobing Chen, Arina Sorokina, **Thomas Nguyen**, ... (2022). "Cytomegalovirus infection reduced CD70 expression, signaling and expansion of viral specific memory CD8+ T Cells in healthy human adults". *Immunity and Ageing*. (DOI: 10.1186/s12979-022-00307-7)

Xiaoping Sun*, **Thomas Nguyen***, ... (2022). "Longitudinal analysis reveals age-related changes in the T cell receptor repertoire of human T cell subsets". *Journal of Clinical Investigation* (DOI: 10.1172/JCI158122)

Jian Lu, Raheel Ahmad, **Thomas Nguyen**, ... (2022). "Heterogeneity and transcriptome changes of human CD8+ T Cells across nine decades of life". *Nature Communications* (DOI: 10.1038/s41467-022-32869-x)

Achouak Achour, Xiaoping Sun, **Thomas Nguyen**... (2019). "Subset distinct richness reduction and clonal expansion of human CD4+ and CD8+ $\alpha\beta$ TCR repertoires with aging". *The Journal of Immunology*. (DOI: 10.4049/jimmunol.206.Supp.98.16)

Annette Ko, Masashi Watanabe, **Thomas Nguyen**, ... (2020). "TCR Repertoires of Thymic Conventional and Regulatory T Cells: identification and characterization of both unique and shared TCR sequences". *The Journal of Immunology* (DOI: 10.4049/jimmunol.1901006)

Achouak Achour, Guobing Chen, Alexei Sharov, **Thomas Nguyen**... (2019). "Identification of age-related changes in chromatin accessibility and gene expression in T cells from thymus to periphery". *The Journal of Immunology*. (DOI: 10.4049/jimmunol.202.Supp.65.14)

CONTRIBUTED CONFERENCE/RESEARCH PRESENTATIONS

Thomas Nguyen, Justin Maddox, ... (Oct. 2024). "Transport and Clogging of Fibers in Millifluidic Channels". *American Institute of Chemical Engineers Annual Meeting*. San Diego, CA.

Thomas Nguyen, Harishankar Manikantan (Nov. 2023). "Signatures of cross-streamline migration of elastic fibers in microscale flows". *76th Annual Meeting of the APS Division of Fluid Dynamics*. Washington D.C.

Thomas Nguyen, Harishankar Manikantan (Oct. 2022). "Buckling and Transport of Heterogeneously Stiff Elastic Fibers in Microscale Flows". *American Institute of Chemical Engineers Annual Meeting*. Phoenix, AZ.

Thomas Nguyen, Harishankar Manikantan (Oct. 2021). "Structural Instability and Transport of Flexible Fibers with Non-Uniform Rigidity". *American Institute of Chemical Engineers Annual Meeting*. Boston, MA.

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Thomas Nguyen, ... (2019) "Longitudinal analysis of the Alpha/Beta TCR repertoire reveals distinct features of CD4+ and CD8+ T cells and their changes with age." National Institutes of Health Post-Bac Poster Day. Bethesda, MD.

Thomas Nguyen, ... (2019) "Longitudinal analysis of the Alpha/Beta TCR repertoire reveals distinct features of CD4+ and CD8+ T cells and their changes with age." National Institute on Aging Post-Bac Poster Day. Bethesda, MD.

Thomas Nguyen (2019). "Longitudinal analysis of alpha-beta TCR Repertoire of Human CD4+ and CD8+ T-cells reveal distinct age-associated changes." Laboratory of Molecular Biology and Immunology-National Institute on Aging. Baltimore, MD.

Jian Lu, Raheel Ahmad, **Thomas Nguyen**, ... (2019) "Single Cell RNA-Seq and Multi-Color Flow Cytometry analyses reveal fine composition of human CD8+ T cells." Cold Spring Harbor Laboratory Systems Immunology Conference. Cold Spring Harbor, NY.

Thomas Nguyen, ... (2018). "TCR Sequences of mouse conventional and regulatory CD4+ T cells are similar in the periphery, but distinct in the thymus." National Institutes of Health Immunology Interest Group Workshop. Leesburg, VA.

Thomas Nguyen, ... (2018). "TCR Sequences of mouse conventional and regulatory CD4+ T cells are similar in the periphery, but distinct in the thymus." National Institutes of Health Post-bac Poster day. Bethesda, MD.

Thomas Nguyen, ... (2018). "TCR Sequences of mouse conventional and regulatory CD4+ T cells are similar in the periphery, but distinct in the thymus." National Institute on Aging Post-bac Poster day. Baltimore, MD.

TECHNICAL SKILLS

Programming/Data Science: Python, MATLAB, R

Scripting: Bash/Linux Shell, High-Performance Computing (HPC) Systems, slurm

Modeling and Simulations: Physics-based (CFD, FSI, thermal), numerical methods (FDM), ODE/PDE solvers, predictive modeling, ML (classification, physics-based)

Data Analysis: time-series analysis, statistical analysis, signal processing, bioinformatics, data science

Modeling Applications, Tools: COMSOL Multiphysics, Ansys Fluent, GitHub, Git, GraphPad Prism, AutoCAD, AutoDesk Inventor, Solidworks, Docker, Microsoft Office

Laboratory & Instrumentation: Mammalian/bacterial cell culture, FPLC, ELISA, SDS-PAGE, analytical assays (BCA Protein, PicoGreen, Bradford protein), pipetting, HPLC, PCR thermocyclers, brightfield/fluorescent microscopy, solution/buffer preparation, BSL-2 cabinets, fluorescence protein readers, DOE

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REFERENCES

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Bob Guy, Ph.D.: Ph.D. Dissertation Committee Member & Mentor

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Jennifer Curtis, Ph.D.: Ph.D. Dissertation Committee Member & Mentor

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