

Amal Nath

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SUMMARY

I am an interdisciplinary researcher specializing in the development of lab-on-a-chip systems with a focus on acoustofluidics and acoustic particle manipulation. My expertise lies in designing, developing, and validating microfluidic platforms for clinically relevant applications, particularly blood plasma separation.

In my postdoctoral research project, I worked on designing a device for separation of blood plasma from healthy human donor blood samples. I performed quality assessment of the separated plasma through hemolysis testing and clinical chemistry analyte measurements. Hemolysis was evaluated by photometric measurement of free hemoglobin and statistical comparison of analyte results were performed using Bland-Altman analysis and Wilcoxon signed-rank tests.

Over the course of the project, I used COMSOL Multiphysics and MATLAB to model fluid flow and optimize the design of two microfluidic components: a micromixer for heparin mixing and a pulsation dampener for smoothing peristaltic pump flow pulsations. The optimized designs were translated into 3D models in Autodesk Fusion 360 and fabricated using CNC micromilling and BMF 3D printer.

I also have experience working with animal blood, in particular, sow and piglet samples, as part of early investigations into in vivo testing of the acoustofluidic blood plasma separation device. My work integrates engineering design, computational modeling, experimental validation, and clinical assessment.

EDUCATION

Indian Institute of Technology Madras

Ph.D., Mechanical Engineering, July 2022

Thesis: Acoustofluidic Manipulation of Particles and Cells

Indian Institute of Technology Gandhinagar

M.Tech., Mechanical Engineering, July 2017

National Institute of Technology Calicut

B.Tech., Mechanical Engineering, July 2014

SKILLS

- Experimental : Microfluidic device design, Acoustic instruments (Function Generator, RF amplifier, Oscilloscope), Optical & fluorescence imaging, Confocal microscopy, Flow cytometry, Microfabrication (Photolithography, Soft lithography, Micromilling, 3D printing)
- Software : MATLAB, COMSOL Multiphysics, ImageJ, OriginLab, RStudio, STAR CCM+, Ansys Fluent

GRANTS RECEIVED

- Technology grant, 2025 - Sten K Johnsons Stiftelse, Sweden, 200 000 SEK, role: main PI
- Endowments for Natural Sciences, Medicine and Technology – Technology grant, 2025 - The Royal Physiographic Society , Sweden, 156 010 SEK, role: main PI

TEACHING ROLES

As Main Teacher

- Theoretical Acoustics (Master's level course, Lund University, 2025), was one of three teachers for the course

As Teaching Assistant

- Microfluidics and Microfabrication (Master's level course, IIT Madras, 2017–2020)
- Introduction to Thermodynamics (Undergraduate level course, IIT Madras, 2021)
- Fluid Mechanics and Machinery Lab (Undergraduate level course, IIT Madras, 2019)

Student Supervision

- Supervised 1 Bachelor's and 5 Master's theses at IIT Madras and Lund University

ACADEMIC SERVICE

- Reviewer for more than 15 manuscripts for journals published by RSC, AIP, MDPI, and ASME (e.g., Lab on a Chip, Physics of Fluids, Micromachines, Journal of Fluids Engineering)
- Part of evaluation committee for Acoustofluidics 2025 conference, Dresden and Engineering Health conference, Helsingborg, 2025

INVITED TALKS

- 'Design of an Efficient Pumping System with Flow Pulsation Dampeners', Acousort AB, Lund
- 'Whole Blood Acoustophoresis Maintains Platelet Function', Klinisk kemi, Skånes universitetssjukhus, Malmö

JOURNAL PUBLICATIONS

Affiliated with Lund University

- JII. Nath, A., Larsson S.M., Lenshof A., Qiu, W., Baasch, T., Nilsson, L., Thymann, T., Pankratova, S., Gram, M., Ley, D., Laurell, T., *Analytical Chemistry*, 2025. Acoustofluidic Plasmapheresis System Designed for Ultralow Blood Volume Applications, [DOI](#)
- JIO. Nath, A., Larsson S.M., Lenshof A., Qiu, W., Baasch, T., Nilsson, L., Gram, M., Ley, D., Laurell, T., *Clinical Chemistry and Laboratory Medicine*, 2025, 63(II), 2218-2225. Acoustophoresis-based blood sampling and plasma separation for potentially minimizing sampling-related blood loss, [DOI](#)

Affiliated with IIT Madras

- J9. Nampoothiri, K. N., Nath, A., Satpathi, N. S., Sen, A. K., *Langmuir*, 2023, 39(II), 3934-3941. Deicing of Sessile Droplets Using Surface Acoustic Waves, [DOI](#)
- J8. Nath, A., Sen, A. K., *Physical Review Fluids*, 2022, 7(10), 104201. Flow of Bidisperse Suspensions under the Influence of Standing Bulk Acoustic Waves, [DOI](#)
- J7. Nath, A., Sudeepthi, A., Sen, A. K., *Langmuir*, 2022, 38(15), 4763-4773. Trapping of aqueous droplets under surface acoustic wave-driven streaming in oil-filled microwells, [DOI](#)
- J6. Malik, L., Nath, A., Laurell, T., Sen, A. K., *Physical Review E*, 2022, 105(3), 035103. Acoustic trapping of particles in microfluidic shaped-traps exposed to bulk acoustic standing waves, [DOI](#)
- J5. Hoque, S. Z., Nath, A., Sen, A. K., *Journal of the Acoustical Society of America*, 2021, 150(1), 307–320. Dynamical motion of a pair of microparticles at the acoustic pressure nodal plane under the combined effect of axial primary radiation and interparticle forces, [DOI](#)

- J4. Hazra, S., Nath, A., Mitra, S. K., Sen, A. K., *Physics of Fluids*, 2021, 33(5), 052001. Dynamics of rigid particles in a confined flow of viscoelastic and strongly shear-thinning fluid at very small Reynolds numbers, [DOI](#)
- J3. Nath, A., Malik, L., Sen, A. K., *Physical Review Fluids*, 2021, 6(4), 044201. Combined acoustic relocation and acoustophoretic migration for particle transfer between co-flowing fluids in a microchannel, [DOI](#)
- J2. Sudeepthi, A., Nath, A., Yeo, L. Y., Sen, A. K., *Langmuir*, 2021, 37(4), 1578–1587. Coalescence of Droplets in a Microwell Driven by Surface Acoustic Waves, [DOI](#)
- J1. Nath, A., Sen, A. K., *Physical Review Applied*, 2019, 12(5), 054009. Acoustic behavior of a dense suspension in an inhomogeneous flow in a microchannel, [DOI](#)

BOOK CHAPTERS

Affiliated with Lund University

- B3. M. Gerlt, T. Baasch, A. Nath, W. Qiu, A. Lenshof, T. Laurell. *Acoustofluidic Blood Component Sample Preparation and Processing in Medical Applications*, in *Applications of Microfluidic Systems in Biology and Medicine*, Springer, 10.1007/978-981-97-6540-9_1

Affiliated with IIT Madras

- B2. A. K. Sen, U. Banerjee, S. K. Jain, A. Nath, A. Sudeepthi. *Microfluidic device for isolation of circulating tumour cells in blood*, in *Advanced Microfluidics Based Point-of-Care Diagnostics: A Bridge Between Microfluidics and Biomedical Applications*, CRC Press Taylor & Francis, 10.1201/9781003033479-5
- B1. A. K. Sen, A. Nath, A. Sudeepthi, S. K. Jain, U. Banerjee. *Microfluidics based point-of-care diagnostic devices*, in *Advanced Microfluidics Based Point-of-Care Diagnostics: A Bridge Between Microfluidics and Biomedical Applications*, CRC Press Taylor & Francis, 10.1201/9781003033479-4

CONFERENCE PRESENTATIONS

Affiliated with Lund University

- C15. Nath, A., Norström, E., Gram, M., Malm, J., Ley, D., Laurell, T., Whole blood acoustophoresis maintains platelet function with pre-activation similar to transfusion concentrates, Acoustofluidics 2025, Dresden, Germany, poster
- C14. Nath, A., Norström, E., Gram, M., Malm, J., Ley, D., Laurell, T., Whole blood acoustophoresis maintains platelet function with pre-activation similar to transfusion concentrates, SMILS 2025, Lund, Sweden, oral pitch presentation
- C13. Nath, A., Qiu, W., Baasch, T., Lenshof, A., Larsson, M., Nilsson, L., Gram, M., Ley, D., Laurell, T., Integrated Plasmapheresis System for Blood Sampling in Neonatal Care, microTAS 2024, Montréal, Canada, oral presentation
- C12. Nath, A., Qiu, W., Baasch, T., Lenshof, A., Larsson, M., Nilsson, L., Gram, M., Ley, D., Laurell, T., Acoustofluidic Blood Plasma Separation for Neonatal Care, Acoustofluidics 2024, Uppsala, Sweden, oral presentation
- C11. Nath, A., Lenshof, A., Larsson, M., Nilsson, L., Gram, M., Ley, D., Laurell, T., Acoustofluidic Blood Plasma Separation for Neonatal Care, SMILS 2024, Gothenburg, Sweden, oral pitch presentation

Affiliated with IIT Madras

- C10. Nath, A., Sen, A. K., Acoustic focusing of bidispersed suspensions in microchannel flows, iCOM 2023, Chennai, India, oral presentation
- C9. Hoque, S. Z., Nath, A., Sen, A. K., Understanding the acoustic radiation forces and dynamics of a pair of equal-sized microparticles, IHMTC 2021, online

- C8. Malik, L., Nath, A., Sen, A. K., Drop trap, release and coalescence using multinodal standing wave acoustic trapping unit, IHMTC 2021, online
- C7. Hoque, S. Z., Nath, A., Sen, A. K., Effect of axial primary radiation force on the dynamical motion of a pair of microparticles along the pressure nodal plane, Acoustofluidics 2021
- C6. Malik, L., Nath, A., Sen, A. K., Particle trapping in microfluidic shaped traps exposed to bulk acoustic standing waves, Acoustofluidics 2021, online
- C5. Sudeepthi, A., Nath, A., Yeo, L. Y., Sen, A. K., Surface acoustic wave driven droplet coalescence in a microwell, Droplets 2021, online
- C4. Sudeepthi, A., Nath, A., Yeo, L. Y., Sen, A. K., Coalescence of droplets in a microwell by surface acoustic wave (SAW)-induced streaming, microFIP 2021, online
- C3. Nath, A., Malik, L., Sen, A.K., Particle migration under the combined influence of relocation and acoustophoretic force in a microchannel, IHMTC 2021, online
- C2. Nath, A., Sen, A.K., Trapping and 'bouncing' of water droplets in oil filled microwells under SAW-induced streaming, Acoustofluidics 2021, online
- C1. Nath, A., Sen, A.K., Acoustophoretic manipulation of particles in impedance mismatched systems, Acoustofluidics 2020, online