Stanford

Varun Goyal, PhD

Postdoctoral Scholar, Otolaryngology - Head & Neck Surgery

Bio

BIO

Dr. Varun Goyal is a Postdoctoral Scholar in Otolaryngology at Stanford University, applying his expertise in nonlinear systems, biomechanics, acoustics, and vibrations to advance the understanding of hearing. He earned his Ph.D. in Mechanical Engineering from the University of Michigan, where he worked at the intersection of mechanics and biological systems to develop computational frameworks for mechanosensory transduction in mammalian ears, with a particular focus on inner-ear hair bundles.

His background spans structural and fluid dynamics, finite element analysis, and control systems, with a strong emphasis on applying these techniques to problems in ear physiology. Dr. Goyal also conducted research at the Center for Nondestructive Evaluation (CNDE) during his bachelor's and master's studies at IIT Madras, where he designed multifunctional acoustic waveguides for ultrasonic energy transmission and temperature sensing.

He has led and contributed to high-impact R&D projects across leading academic institutions, including RWTH Aachen University in Germany, Nanyang Technological University in Singapore, and Nagaoka University of Technology in Japan, as well as industry partners such as Mondelez International and Plasma Giken Co., Ltd. in Japan. Driven by curiosity and a commitment to understanding how complex systems operate, Dr. Goyal's work integrates theory, computation, and experiment to address fundamental questions in auditory biomechanics.

HONORS AND AWARDS

- Psychological and Physiological Acoustics Best Student Poster Award, Acoustical Society of America (2024)
- Leadership Enrichment and Regional Networking (LEaRN) Scholarship, Temasek Foundation, Singapore (2018)

BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Graduate Vice President, Tau Beta Pi, Michigan Gamma (2022 - 2022)

PROFESSIONAL EDUCATION

- Ph.D., University of Michigan, Ann Arbor , Mechanical Engineering (2025)
- Graduate Certificate, University of Michigan, Ann Arbor , Computational Discovery and Engineering (2024)
- M-Tech., Indian Institute of Technology, Madras , Mechanical Engineering (2020)
- B-Tech., Indian Institute of Technology, Madras , Mechanical Engineering (2020)

STANFORD ADVISORS

- Daibhid O Maoileidigh, Postdoctoral Faculty Sponsor

COMMUNITY AND INTERNATIONAL WORK

- International Volunteer, Singapore
- Outreach for NGO, Chennai, TN, India
- Web Development for NGO, India
- Event Management for NGO, Patiala, PB, India

LINKS

- Personal Website: https://sites.google.com/umich.edu/varungoyal/
- LinkedIn: https://www.linkedin.com/in/varungo/
- Google Scholar: https://scholar.google.com/citations?user=6sUsMVcAAAAJ&hl=en
- ResearchGate: https://www.researchgate.net/profile/Varun-Goyal-4?ev=hdr_xprf
- HairBundleLab: https://github.com/vgoyal24/HairBundleLab

Research & Scholarship

LAB AFFILIATIONS

- Daibhid O Maoileidigh, Ó Maoiléidigh Laboratory (12/1/2025)

Publications

PUBLICATIONS

- **Three-row stereocilia model predicts mammalian hair bundle behavior**
  Goyal, V., Grosh, K.
  BioRxiv.
  2025 2025.04. 17.649156
- **Geometric gain approximation dictates the accuracy of hair bundle models** *Acoustical Society of America*
  Goyal, V., Grosh, K.
  2025: A279-A279
- **Predicting Intracellular Calcium Effects through Hair Bundle Dynamic Modeling** *Mechanics of Hearing Workshop*
  Goyal, V., Grosh, K.
  2025
- **Linking fast adaptation, slow adaptation, and mechanical creep in mammalian hair cell mechano-electric transducer channels.** *Acoustical Society of America*
  Goyal, V., Grosh, K.
  2025: A276-A276
- **Hair Bundle Micromechanics Including Stereocilia Kinematics and the Interaction of Stimulus and Bundle Rate Constants**
  Goyal, V., Grosh, K.
  edited by Dong, W., Epp, B.
  AMER INST PHYSICS.2024
- **Cochlear hair bundle dynamics: modeling calcium effects and row-wise interactions** *Acoustical Society of America*
  Goyal, V., Grosh, K.
  2024: A309-A309
- **Modeling the nonlinear mechanics and dynamics of Cochlear Outer Hair Cell Stereocilia**
  Goyal, V., Grosh, K.
  ACOUSTICAL SOC AMER AMER INST PHYSICS.2023

- **CFD and Experimental Analysis of Swirl Type Single-fluid Atomizer for Optimization of Recrystallization Process to make Ultrafine RDX Explosive** *PROPELLANTS EXPLOSIVES PYROTECHNICS*
  Goyal, V., Gupta, S., Kumar, P., Jindal, D., Singh, G., Agarwal, A., Lata, P.
  2020; 45 (1): 9-19

PRESENTATIONS

- Three-Row Mammalian Hair Bundle Model Predicts In Vitro Response Dynamics - Association for Research in Otolaryngology (February 7, 2026 - February 11, 2026)
- Stereocilia Triad as the Blueprint for Hair Bundle Dynamics - Midwest Auditory Research Conference, Northeast Ohio Medical University (June 19, 2025 - June 21, 2025)
- Linking Fast Adaptation, Slow Adaptation, and Mechanical Creep in Mammalian Hair Cell Mechano-Electric Transducer Channels - Acoustical Society of America (May 18, 2025 - May 23, 2025)
- Geometric Gain Approximation Dictates the Accuracy of Hair Bundle Models - Acoustical Society of America (May 18, 2025 - May 23, 2025)
- Does Stereocilia Separation-to-Height Ratio Accurately Define the Geometric Gain? - Association for Research in Otolaryngology (February 22, 2025 - February 26, 2025)
- Predicting Intracellular Calcium Effects through Hair Bundle Dynamic Modeling - Mechanics of Hearing Workshop (June 9, 2024 - June 13, 2024)
- Physiologically-Inspired Mechanical Model of a Cochlear Hair Bundle - Hearing, Balance, and Chemical Senses (HBCS), Kresge Hearing Research Institute, University of Michigan, Ann Arbor (May 31, 2024)
- Cochlear Hair Bundle Dynamics: Modeling Calcium Effects and Row-Wise Interactions - Acoustical Society of America (May 13, 2024 - May 17, 2024)
- Modeling the Effect of Intracellular Calcium on Hair Bundle Adaptation - Association for Research in Otolaryngology (February 3, 2024 - February 7, 2024)
- Nonlinear Model for the Mechanics and Dynamics of Cochlear OHC Stereocilia - Michigan Centre for Applied and Interdisciplinary Mathematics (MCAIM), Department of Mathematics, University of Michigan, Ann Arbor (April 7, 2023)
- Modeling the Nonlinear Mechanics and Dynamics of Cochlear Outer Hair Cell Stereocilia - Acoustical Society of America (May 8, 2023 - May 12, 2023)
- The Nonlinear Mechanics and Dynamics of a Three-Row Hair Bundle Model - Association for Research in Otolaryngology
- Hair Bundle Micromechanics Including Stereocilia Kinematics and the Interaction of Stimulus and Bundle Rate Constants - Association for Research in Otolaryngology (July 24, 2023 - July 29, 2023)
- Interaction between Stimulus and Hair Bundle Rate Constants and a Kinetic Model of Stereocilia with Higher Fidelity Kinematic Relations - Midwest Auditory Research Conference (June 23, 2022 - June 25, 2022)
- Modeling the Interaction of Stimuli and Adaptive Rate Constants on OHC HB Response - Association for Research in Otolaryngology (February 5, 2022 - February 9, 2022)