

Pranav Vyas

Postdoctoral Fellow | Center for Living Systems | Molecular Genetics and Cell Biology | University of Chicago

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Employment

- **University of Chicago, Illinois USA**

- Center for Living Systems Postdoctoral Fellow and Biological Sciences Division Chicago Fellow (Apr 25 – Aug 26)
- Helen Hay Whitney Foundation Postdoctoral Fellow (Sep 26 - Present)
- Department of Molecular Genetics and Cell Biology, Center for Living Systems
- *Mentors: Prof. Noah Mitchell, Prof. David Pincus*

- **Stanford University, California, USA**

- Postdoctoral Researcher, Prakash Lab, Bioengineering (Jan 25 – Mar 25)
- *Mentor: Prof. Manu Prakash*

Education

- **Stanford University, California, USA**

- Doctor of Philosophy, Prakash Lab, Bioengineering, **CGPA – 3.92/4.00** (Sep 17 – Jan 25)
- *Advisor: Prof. Manu Prakash*
- *Thesis Committee: Prof. Christopher Lowe, Prof. Bo Wang, Prof. Manu Prakash*

- **Indian Institute of Technology (IIT) Kanpur, India**

- Master of Technology, Mechanical Engineering, **CGPA – 10.0/10.0** (July 16 – June 17)
- Bachelor of Technology, Mechanical Engineering, **CGPA – 8.8/10.0** (Aug 12 – Jun 16)

Research Interests

Soft Matter Physics | Complex Systems | Evolution | Morphogenesis | Geometry | Design

Current Work

Using *Drosophila* and experimentally evolved multicellular yeast as complementary model systems, I am studying the emergence and stabilization of collective organization across developmental and evolutionary timescales. In parallel, I am developing theoretical frameworks for understanding the evolution of complex multicellularity and the emergence of higher-order organization in society.

Publications and Ongoing Work

- **Vyas, P.**, Li, E. and Prakash, M, Hyperuniformity in 2D disordered lattices of adult Ophiuroids in Arctic benthos (Under Preparation)
- Lim, S., **Vyas, P.**, Zhang, Q., Zhong, G., Arrigo, K. and Prakash, M. Sinking dynamics of under ice plankton blooms in Chukchi Sea, Arctic. (Under Preparation)
- **Vyas, P.**, Brannon, C., Formery, L., Lowe, C., and Prakash, M. Algorithmic construction of topologically complex biomineral lattices via cellular syncytia. *bioRxiv*, 2024-02.
- **Vyas, P.***, Molina, A.*, Khlystov, N., Kumar, S., Kothari, A., Deriso, D., Liu, Z., Banavar, S., Flaum, E. and Prakash, M., 2022. Low-cost centrifugal melt spinning for distributed manufacturing of non-woven media. *PLoS One*, 17(4), p.e0264933. (*co-first author)
- Li, H., Krishnamurthy, D., Li, E., **Vyas, P.**, Akireddy, N., Chai, C. and Prakash, M., 2020. Squid: simplifying quantitative imaging platform development and deployment. *bioRxiv*, pp.2020-12. (Under Submission)
- **Vyas, P.**, Kumar, P.S. and Das, S.L., 2022. Sorting of proteins with shape and curvature anisotropy on a lipid bilayer tube. *Soft Matter*, 18(8), pp.1653-1665.
- Shayak, B. and **Vyas, P.**, 2017. Krylov Bogoliubov type analysis of variants of the Mathieu equation. *Journal of Applied Nonlinear Dynamics*, 6(1), pp.57-77.

Conference Presentations and Invited Talks

- **Vyas, P.**, Can we become a planetary adaptive society? Emergence, social learning, and the next architecture of democratic coordination.
Short talk, Society and Democracy Consultations, Hubballi, India (Sep 26)
- **Vyas, P.**, Lattices across scales: From Sea Cucumber Biomineral Ossicles to Arctic Brittle Star Assemblages
Invited talk. Complex systems seminar, Department of Physics and Astronomy, Northwestern University (May 26)

- **Vyas, P.**, Li, E. and Prakash, M, Hyperuniformity in 2D disordered lattices of adult Ophiuroids in Arctic benthos
Short Talk. APS Global Physics Meeting, Denver, CO (Mar 26)
Poster Presentation. Society of Integrative and Comparative Biology (SICB), Atlanta (Jan 25)
- **Vyas, P.**, Brannon, C., Formery, L., Lowe, C., & Prakash, M., Branching Morphogenesis of sea cucumber ossicles in multi-cellular syncytial confinement
Poster Presentation. Lake Conference: Modelling Life from Cells to Tissues, Seattle (Apr 26)
Short Talk. Society of Integrative and Comparative Biology (SICB), Atlanta (Jan 25)
Short Talk. APS March Meeting, Minneapolis (Mar 24)
Poster Presentation. Computing with Physical Systems, Aspen Center for Physics (Jan 24)
Short Talk. ASCB / EMBO Cell Bio, Boston (Dec 23)
Poster Presentation. 2nd Physics of Life Symposium, CZI Biohub (Oct 23)
Poster Presentation. Stanford Bio-X Seed Grants Symposium and Poster Session (Sep 23)
Short Talk. Bioengineering Department Retreat (May 23)
Short Talk. APS March Meeting, Las Vegas (Mar 23)
- **Vyas, P.**, Brannon, C., Formery, L., Lowe, C., & Prakash, M., How cells program mineral shape in sea cucumbers: Part 1
Short Talk. ASCB / EMBO Cell Bio, Washington DC (Dec 22)
- Brannon, C., **Vyas, P.**, Formery, L., Lowe, C., & Prakash, M., How cells program mineral shape in sea cucumbers: Part 2
Poster Presentation. ASCB / EMBO Cell Bio, Washington DC (Dec 22)
- **Vyas, P.**, Brannon, C., Formery, L., Lowe, C., & Prakash, M., Branching morphogenesis of sea cucumber ossicles in multi-cellular syncytial confinement.
Poster Presentation. 4D Cellular Physiology Symposium, Janelia Research Campus (Oct 22)
- **Vyas, P.**, Prakash, M., Physical scaling of size and shape in an early diverging animal
Short talk. APS March Meeting. Online (Mar 21)
- **Vyas, P.**, Bull, M.S., Li, H.Q., Prakash, M., Size and Shape Control in an early diverging metazoan
Poster presentation, Society of Developmental Biology (SDB) 79th Annual Meeting, Online (Jul 20)
- **Vyas, P.**, Li, H. Q., Prakash, M., 3D life of a flat animal: tissue reaggregation as a tool to investigate developmental mechanisms in Placozoa
Poster presentation, Society of Integrative and Comparative Biology (SICB), Tampa (Jan 19)
- Chai, C., Kroo, L., Aiello, C., **Vyas, P.**, Prakash, M., Information processing in an animal lacking neurons and muscles: Phototaxis in *Trichoplax adhaerens*
Poster presentation, ASCB / EMBO Cell Bio, San Diego (Dec 18)
- **Vyas, P.**, Das, S.L., Curvature Induced Protein Sorting in Lipid Bilayer Membranes
Poster presentation, International Conference on Complex Fluids (CompFlu), Hyderabad (Dec 16)
- **Vyas, P.**, Kurele, N., Ranjan, R., Pedal Driven Multi-tool Carpenter Bench
16th National Conference on Mechanisms and Machines (iNaCoMM), IIT Roorkee (Dec 13)

Research Projects

Ph. D. Research

- **Physiology of multi-cellular collaboration and biophysics of biomineralization-induced morphogenesis of multi-hole topologies in sea cucumbers** (Jul 21 – Jan 25)
- **From cells to organisms: Morphogenesis, Repair and Size Control as emergent properties of cell-scale interactions in an early diverging metazoan *Trichoplax adhaerens*** (May 18 – Jan 25)
Mentors: Dr. Manu Prakash, Living Soft Matter and Frugal Science Lab, Bioengineering Department, Stanford University
Dr. Christopher Lowe, Lowe Lab, Department of Biology, Stanford University

Fieldwork and Expeditions

- **The Tale of Three Systems: Fate of Primary Production in the Chukchi Sea** (Jun – Jul 23)
Arctic Ocean on-board RV Sikuliaq (Research Vessel)
Collaboration between Dr. Manu Prakash and Dr. Kevin Arrigo, Stanford University
- **Project DaVINCI: Diatom Virus Infection of Natural Communities in the Gulf of Naples** (Apr – May 22)
Stazione Zoologica Anton Dohrn, Napoli, Italy
Collaboration between Dr. Manu Prakash, Stanford University and Dr. Kim Thamatrakoln and Dr. Kay Bidle from Rutgers University

Graduate Rotation Projects

- **Growth and development of inner-ear organoids** (Spr 18)
Mentor: Dr. Stephan Heller, Otolaryngology Department, Stanford University
- **Gut branching morphogenesis and dispersion of gut microbial communities in planaria** (Fall 17)
Mentor: Dr. Bo Wang, Bioengineering Department, Stanford University

Co-term Research

- **Domain diffusion dynamics and curvature-based protein sorting on lipid membranes** (Dec 15 – July 17)
Mentor: Dr. Sovan Lal Das, Membrane Biophysics Lab, Dept. of Mechanical Engineering, IIT Kanpur

Undergraduate Thesis Project

- **Modular Morphing Soft Robot** (Aug 15 – Apr 16)
Mentor: Dr. Anupam Saxena, Compliant and Robotics Systems Lab, Dept. of Mechanical Engineering, IIT Kanpur

Undergraduate Research

- **Role of physical forces in joint site patterning during vertebrate limb development** (Jun 16 – Jul 17)
Mentors: Dr. Amitabha Bandyopadhyay, Developmental Biology Lab, Dept. of Biological Sciences and Bioengineering, IIT Kanpur, Dr. Sovan Lal Das, Membrane Biophysics Lab, Dept. of Mechanical Engineering, IIT Kanpur
- **Bessel Beam based optical tweezer for direct optical manipulation of living tissues** (May – Jul 15)
Mentor: Dr. Pierre-François Lenne, Physical approaches to cell dynamics and tissue morphogenesis, Institute of Developmental Biology (IBDM), Marseille, France
- **Effect of topographical anisotropies of fibrous substrate on cell response** (May – Jul 14)
Mentor: Dr. Dharendra S. Katti, Tissue Engineering Lab, Dept. of Biological Sciences and Bioengineering, IIT Kanpur

Design Projects

- **Low cost centrifugal melt spinning for distributed manufacturing of non-woven media** (Apr 20 – Aug 21)
Mentor: Dr. Manu Prakash, Bioengineering, Stanford University in collaboration with BiC, France
- **Pedal driven multi – tool carpenter bench** (Nov – Dec 13)
Mentor: Dr. Ashish Dutta, Dept. of Mechanical Engineering, IIT Kanpur
- **Syringe-ballast based autonomous underwater vehicle** (May – Jun 13)
Mentor: Dr. K. S. Venkatesh, Dept. of Electrical Engineering, Robotics Club, IIT Kanpur

Awards, Scholarships and Achievements

- Awarded **Helen Hay Whitney Foundation Postdoctoral Fellowship 2026**. Amongst 25 fellows selected out of ~600 applicants.
- Awarded and accepted **University of Chicago, Biological Sciences Division, Chicago Fellows Program Fellowship 2025**.
- Awarded and accepted **University of Chicago, Center for Living Systems Fellowship 2025**.
- Selected for the **final interview round** of **Schmidt Science Fellowship 2024**.
- Awarded best talk award for the talk "Branching Morphogenesis of sea cucumber ossicles in multi-cellular syncytial confinement" at Bioengineering Department Annual Retreat, Stanford University, 2023.
- Awarded BioX travel award for presentation of the talk "Branching Morphogenesis of sea cucumber ossicles in multi-cellular syncytial confinement" at APS March Meeting, Las Vegas 2023.
- Awarded and accepted **Siebel Scholars Fellowship for year 2022-2023**. Recognizes exceptional graduate students in the field of business, computer science, bioengineering, and energy science.
- Awarded and accepted **BioX – Stanford Interdisciplinary Graduate Fellowship, 2019 for three years**. Recognizes pursuit cutting-edge interdisciplinary research at Stanford University.
- Awarded and accepted **Stanford Graduate Fellowship, 2017 (Smith Fellow) for two years**. Recognizes outstanding incoming graduate students at Stanford University.
- Among 30 students selected for **Charpak Research Scholarship 2015**. Scholarship Program for Research Internship in France by Embassy of France in India.
- Awarded and accepted KVPY Scholarship (SA Stream) 2011 with all India rank 80. National Fellowship Program for Basic Sciences by Department of Science and Technology and Indian Institute of Science.
- Tarun Sondhi Memorial Scholarship 2015 recipient. Given to meritorious students from Mechanical Engineering department.
- First Position, Innovation and Manufacturing Practices (IMP) 2014, Techkriti 2014, Inter College Technology Festival, IIT Kanpur. Project: "Pedal Driven Multi – Tool Carpenter Bench". Awarded cash prize of Rs. 100,000.
- Overall Best Project Award from over 60 projects. Course: Secondary Manufacturing (2014). Project: "Tentacle Crane".
- All India rank 632 out of ~500,000 candidates in IIT JEE 2012, equivalent to 99.9 percentile.
- All India Rank 26 in National Science Talent Search Examination 2010, conducted by Unified Council.

Skills

- Python, MATLAB, C • Discrete and Continuum Physics simulations • FE Analysis
- Mechatronics • Soft Fabrication, Prototyping • Optics engineering
- Microscopy / Imaging • Tissue culture • Wet-lab work • Ocean Science • Fieldwork

Teaching

- **Section Teaching Assistant: MBL Physiology Course** (July 24)
Marine Biology Laboratory, Woodshole
Proposed and conducted experiments with students with sea cucumber system for two weeks.
- **Invited Speaker: Biology with non-model organisms** (Feb 24)
Biology Department, Stanford University
Presented a lecture on building sea cucumbers as a model system for studying complex biomineral morphogenesis.
- **Course Creator and Lead Instructor: Geometry for Biologists** (Aug 23)
Bioengineering Department, Stanford University
Designed and instructed a 3-week short course to introduce differential geometry and discrete differential geometry with numerical implementations to biologists along with another post-doc instructor.
- **Teaching Assistant, Course: Physical Biology of the Cell** (Spr 19)
Bioengineering Department, Stanford University
Prepared course content, assignments, and exams. Interacted with and evaluated around 35 students.
- **Teaching Assistant, Course: Vibration and Control** (Jan – Apr 17)
Department of Mechanical Engineering, IIT Kanpur
Conducted lab exercises and quizzes, prepared course material and evaluated performance of over 100 students.
- **Teaching Assistant, Course: Theory of Mechanisms and Machines** (Aug 16 – Nov 17)
Department of Mechanical Engineering, IIT Kanpur
Conducted lab exercises and quizzes, prepared course material and evaluated performance of over 100 students.
- **Academic Mentor, Course: Introduction to Life Sciences** (Session 13–14)
Institute Counselling Service, IIT Kanpur
Assisted 50 academically underperforming students through remedial lectures and one-to-one doubt solving sessions.

Community Work and Outreach

- **Citizen School Record, India** (Aug 26)
Built an online platform for citizen driven audit of public schools in India
- **Session Chair – The Society for Integrative and Comparative Biology, SICB 2025** (Jan 25)
Chaired a session named “Stressed Out” with 7 talks on effects of stress on organismal behavior and physiology
- **SERIO – Stanford Engineering Research Introductions, Stanford University member** (Jan 23 – Jan 24)
Mentoring undergraduates from diverse backgrounds towards building careers in STEM
- **Department Graduate Admissions Committee, Bioengineering, Stanford University** (Session 21-22, 22-23)
Interviewed and shortlisted potential candidates from over 600 applications with a team of 13 students and 10 faculties for two consecutive years.
- **Head - Research, Academics and Research Cell, Students’ Gymkhana, IIT Kanpur** (Session 16 – 17)
Implementing policies at institute level to facilitate and promote student research activities on the university campus
- **Team Leader, Autonomous Underwater Vehicle Group, IIT Kanpur** (May 13 – Dec 14)
Recruited the team and managed resources. Conducted institute level seminars. Led a team of 15 to develop two vehicles

Other Interests

- **Music** – amateur Bansuri (Indian Bamboo Flute) player and vocalist
- **Photography** – macro photography, microscopy
- **Science outreach** – microscopy workshops for teachers and students in low-resource settings in India, US and Puerto Rico

Students Mentored

- **Chloe Maalouf** – undergraduate researcher in Mitchell Lab, UChicago – Summer 2021 – currently an undergraduate at UChicago
- **Urša Uršič** – MBL Physiology course 2024, currently a graduate student, Jan Brugués Lab, Max Planck Institute of Molecular Cell Biology and Genetics, Dresden
- **Ximena Garcia Arceo** – MBL Physiology course 2024, currently a postdoctoral scholar at Gladstone Institutes, University of California, San Francisco
- **Charlotte M. Brannon** – rotation student and collaborator – Winter 2021 – currently a graduate student with Dr Manu Prakash Lab
- **Zhiru Liu** – rotation student and collaborator – Spring 2020 - currently a graduate student with Dr Benjamin Good Lab
- **Joy Pojim** – visiting research student – Summer 2020 – recent graduate from Cornell University
- **Hannah D. Rosenblatt** – rotation student – Spring 2019 - currently a graduate student in Maria Barna Lab

References

- **Prof. Noah Mitchell**, npmitchell@uchicago.edu, Assistant Professor, Molecular Genetics and Cell Biology, University of Chicago
- **Prof. David Pincus**, pincus@uchicago.edu, Associate Professor, Molecular Genetics and Cell Biology, University of Chicago
- **Prof. Manu Prakash**, manup@stanford.edu, Associate Professor, Bioengineering and Senior Fellow, Stanford Woods Institute for the Environment, Stanford University
- **Prof. Christopher Lowe**, clowe@stanford.edu, Professor, Biology, Stanford University
- **Prof. Bo Wang**, wangbo@stanford.edu, Associate Professor, Bioengineering, Stanford University
- **Prof. Zev Bryant**, zevry@stanford.edu, Associate Professor, Bioengineering, Stanford University
- **Prof. Sovan Das**, sovan@iitpkd.ac.in, Associate Professor, Mechanical Engineering, IIT Palakkad