TAPAN GOEL

Department of Biology ◇ University of Maryland, College Park, MD - 20742
tgoel36@umd.edu ◇ Website ◇ ORCID

EDUCATION

Ph.D. in Physics with a specialization in Quantitative Biology 2022
University of California San Diego, La Jolla
Thesis title: Investigating the effect of mechanical forces on invertebrate behavior and development.
Advisors: Dr. Eva-Maria S. Collins, Dr. Patrick H. Diamond.

B.S. in Physics with a minor in Biology 2016
Indian Institute of Science, Bangalore.
Thesis title: Coarse-grained analysis of a collective movement model motivated by experiments.
Advisor: Dr. Vishwesha Guttal.

RESEARCH EXPERIENCE

Postdoctoral Associate 2023 – present
College of Computer, Mathematical, and Natural Sciences - Dept. of Biology,
University of Maryland, College Park.
Research Advisor: Dr. Joshua S. Weitz.

Research Scientist 2022 – 2023
School of Biological Sciences,
Georgia Institute of Technology, Atlanta.
Research Advisor: Dr. Joshua S. Weitz.

Graduate Research Assistant 2016 – 2022
Department of Physics,
University of California San Diego, La Jolla.
Research Advisors: Dr. Eva-Maria S. Collins, Dr. Patrick H. Diamond.

TEACHING EXPERIENCE

* upcoming teaching assignments; ** as guest instructor

Instructor of Record Spring 2025**, 2026, 2027*
Department of Biology *UMD College Park*

- Course title: Quantitative & Computational Biosciences (BIPH 706/ BSCI 435).
- Class composition: 18 senior undergrad and grad students across physics, CS, math, and bio.
- Taught theory and computational modules on spatial patterning, flocking/collective behavior, enzyme kinetics, neuronal dynamics, and evolutionary game theory.

Instructor of Record Summer 2021
Department of Physics *UC San Diego*

- Course title: Electricity & Magnetism for life science majors (PHYS 1B).
- Class composition: 100 students, primarily life science majors.
- Designed curriculum, homework and assessments, delivered lectures and and supervised graduate teaching assistants.

Instructor of Record* Winter 2027*
Department of Biology *UMD College Park*

- Course title: Confronting Misinformation in Healthcare.
- Designing and teaching a new course on how to use quantitative reasoning and numerical estimation to identify and confront misinformation in healthcare. Course aimed at juniors and seniors in life sciences.

Lab Instructor Summer 2025
Quantitative Phage-Bacteria Dynamics Workshop *UMD College Park*

- Guided 30 early-stage Ph.D. students through ODE/individual-based modeling of virus-host networks and model-data integration on time-series data.

Graduate Writing Consultant Aug 2021 – Aug 2022
Teaching+Learning Commons *UC San Diego*

- Provided one-on-one writing consultations and conducted academic writing workshops for graduate students.

Teaching Assistant 2018 – 2022
Department of Physics *UC San Diego*

- Led discussions, labs, and office hours; developed problem sets and assessments across 10 physics courses.
- **Graduate:** PHYS 210B (Non-equilibrium Stat Mech), PHYS 277 (Physics of the Cell).
- **Upper-Division:** PHYS 110A (Mechanics), PHYS 140B (Stat/Thermal Physics II), PHYS 177 (Physics of the Cell).
- **Introductory:** PHYS 1B, 1C, 1C-Lab (E&M, Waves, Optics), PHYS 2A, 2C-Lab (Mechanics, E&M).

Tutor 2018 – 2020
Department of Physics *UC San Diego*

PUBLICATIONS

ORCID Profile: `https://orcid.org/0000-0002-3212-2008`
* Undergraduate co-authors I mentored,

Pedagogical resources:

2. Hackler, S., **Goel, T.**, Pacis, J. and Collins, E.M.S., 2024. Using published undergraduate biomechanics research on *Hydra* mouth opening to train undergraduates. *The Biophysicist*, 6(2), pp.110–126. |Link||bioRxiv|

1. Stowell, N.C., **Goel, T.**, Shetty, V.*, Noveral, J. and Collins, E.M.S., 2021. Quantifying planarian behavior as an introduction to object tracking and signal processing. *The Biophysicist*, 2(3), pp.1-17. |Link|

Research articles:

8. Tuttle, M.J., Steinbach, G., **Goel, T.**, Weitz, J.S. and Buchan, A., 2026. Prophage induction states drive structural and synergistic outcomes in marine bacterial biofilms. *mSystems* (Accepted, in press).|bioRxiv|

7. Gandon, S., **Goel, T.**, Weitz, J.S. and Lion, S., 2026. The adaptive plasticity of temperate phage λ. *Virus Evolution*, 12(1), veag026. |Link|

6. **Goel, T.**, Beckett, S.J., Weitz J.S., 2025. Eco-evolutionary dynamics of temperate phage in periodic environments. *Virus Evolution*, 11(1), veaf019. |Link||bioRxiv|

5. **Goel, T.**, Adams, E.M.*, Bialas, A.L., Tran, C.M., Rowe, T., Martin, S., Chandler, M.*, Schubert, J.*, Diamond, P.H. and Collins, E.M.S., 2024. Nonlinear elasticity and short-range mechanical coupling govern the rate and symmetry of mouth opening in *Hydra*. *Proceedings of the Royal Society B*, 291(2017), p.20232123. |Link|

4. Wang, R., Bialas, A.L., **Goel, T.** and Collins, E.M.S., 2023. Mechano-chemical coupling in *Hydra* regeneration and patterning. *Integrative and Comparative Biology*, 63(6), pp.1422-1441. |Link|

3. **Goel, T.**, Ireland, D., Shetty, V.*, Rabeler, C., Diamond, P.H. and Collins, E.M.S., 2021. Let it rip: the mechanics of self-bisection in asexual planarians determines their population reproductive strategies. *Physical biology*, 19(1), p.016002. |Link|

2. **Goel, T.**, Wang, R., Martin, S., Lanphear, E.* and Collins, E.M.S., 2019. Linalool acts as a fast and reversible anesthetic in *Hydra*. *PloS one*, 14(10), p.e0224221. |Link||bioRxiv|

1. Wang, R., **Goel, T.**, Khazoyan, K., Sabry, Z.*, Quan, H.J., Diamond, P.H. and Collins, E.M.S., 2019. Mouth function determines the shape oscillation pattern in regenerating *Hydra* tissue spheres. *Biophysical Journal*, 117(6), pp.1145-1155. |Link|

Preprints:

1. Harris, M.J., Arani, A., **Goel, T.**, Zhang, K., Beckett, S.J., Lo, N.C., Dushoff, J., Weitz J.S., 2026. Interpreting breakthrough infections given assortative mixing of partially vaccinated populations. medRxiv, 2026.01. 22.26344544. |medRxiv| (under review at PNAS Nexus)

In Progress:

3. Roswell, M., **Goel, T.**, Beckett, S.J., Dushoff, J. and Weitz, J.S. Emergent dynamical heterogeneity in compartmental disease models and its relation to superspreading.

2. Harris, J.D., **Goel, T.**, Pourtois, J.D. and Weitz, J.S. Coalitions between temperate phages and their lysogenized hosts can lead to phage coexistence.

1. **Goel, T.**, Radov, M., Weitz, J.S. Resource-dependent lysis inhibition drives evolution of temperate phage away from latency.

RESEARCH MENTORSHIP

* indicates co-author on publications

2025 –	**Michelle Radov***, Undergrad in Mathematics and Public Health, UMD College Park Project: Role of resource dependent lysis inhibition in evolution of temperate phage.
2025 –	**Keija Zhang***, Graduate student, Applied Mathematics, UMD College Park Project: Role of heterogeneous susceptibility in epidemiological dynamics.
2024	**Dillon Max**, Postbac student, UMD College Park Project: Coexistence of temperate and lytic phage through split-merge dynamics. Now: Graduate student at UCLA
2022 – 2023	**Maia Chandler***, Undergrad in Biophysics, Swarthmore College Project: Live imaging and image analysis of *Hydra* mouth opening. Now: Intern at the American Institute of Physics
2021 – 2022	**Johanna Schubert***, Undergrad in Physics, Mathematics and Philosophy, Swarthmore College Project: Live imaging of *Hydra* mouth opening. Now: PhD candidate at UC Santa Barbara
2020 – 2021	**Ellen Adams***, Undergrad in Engineering and Biology, Swarthmore College Project: Live imaging of *Hydra* mouth opening. Now: PhD candidate at Caltech
2020 – 2021	**Vir Shetty***, Undergrad in Physics and Mathematics, Swarthmore College Project: Developing a python module to teach basic Fourier analysis to undergraduates. Now: Financial analyst at ImageFIRST.

2018 **Elizabeth Lanphear***, Undergrad in Mathematics and Biology, Swarthmore College.
Project: Validating linalool as a short-term anesthetic for Hydra.
Now: Sustainability and LCA analyst at ERG.

2018 **Ziad Sabry***, Undergrad in Biology, Swarthmore College.
Project: Confocal microscopy of *Hydra* tissue to ascertain actin structures.
Now: PhD candidate at UMich Medical School.

PRESENTATIONS

Invited talks:

1. *Biology by the numbers: How math helps us understand and harness biological phenomena.* Indian Creek High School, Annapolis, MD. (2026)
2. *Eco-evolutionary dynamics of temperate viruses.* University of Southern California, Los Angeles, CA. (2026)
3. *Why be temperate? Sometimes it's better to "live" and let live!* Quantitative Phage-Bacteria Dynamics Across Scales workshop, UMD, College Park, MD. (2025)
4. *Why be temperate? Sometimes it's better to "live" and let live!* Simons Centre for the Study of Living Machines, NCBS, Bangalore, India. (2024)
5. *Why be temperate? Sometimes it's better to "live" and let live!* Center for Ecological Sciences, IISc, Bangalore, India. (2024)

Contributed talks:

1. *Phenotypic plasticity in the life history traits of temperate phage*. Chesapeake Aquatic Viral Ecology Meeting, Baltimore, MD. (2026)
2. *Variation in cases per case is conserved across parameters of the SIR model*. MIDAS network annual meeting, Bethesda, MD. (2025)
3. *How the fate of infected hosts depends on the degree of co-infection*. Quantitative Ecological and Evolutionary Dynamics Seminar, UMD, College Park, MD. (2024)
4. *Mechanical control and coordination of mouth opening in Hydra*. Cnidofest Zoom Seminar Series. (2024)
5. *Eco-evolutionary dynamics of temperate phage in periodically changing environments*. UMD Math Bio Seminar, UMD, College Park, MD. (2023)
6. *Population dynamics of temperate phage and potential emergence of phage-host coalitions*. American Mathematical Society Southeastern Section Meeting, Atlanta, GA. (2023)
7. *How short range forces generate long range order in extreme tissue deformations*. APS March Meeting, Chicago, IL. (2022)
8. *Planarian asexual reproduction via mechanical tearing – one problem, multiple solutions*. APS March Meeting. (virtual, 2021)
9. *A bilayer model of the non-linear elastodynamics of Hydra mouth opening*. APS March Meeting. (virtual, 2020)
10. *Mouth opening dynamics in Hydra*. Cnidofest symposium, Whitney Laboratory for Marine Bioscience, St. Augustine, FL. (2018)

Contributed posters:

1. *Eco-evolutionary dynamics of temperate phage in fluctuating environments*. Ecology and Evolution of Infectious Disease Conference, Virginia Tech, Blacksburg, VA. (2026)

2. *Eco-evolutionary dynamics of temperate phage in fluctuating environments*. Gordon Research Conference on Microbial Population Biology, Proctor Academy, Andover, NH. (2025)
3. *Eco-evolutionary dynamics of temperate phage in fluctuating environments*. Jacques Monod Conference on Virus evolution: the mutualism-antagonism continuum of virus-virus interactions, Station Biologique, CNRS, Roscoff, France. (2024)
4. *Eco-evolutionary dynamics of temperate phages in periodically fluctuating environments*. Qlife Summer School on Quantitative phage-bacteria dynamics across scales, Institut Curie, Paris, France. (2024)
5. *Eco-evolutionary dynamics of temperate phages in periodically changing environments*. Annual Virus Microbe Entanglement Collaboration Meeting, New York. (2024)
6. *Eco-evolutionary dynamics of temperate phage in periodically changing environments*. Confect Symposium by the University of Bergen, Bergen, Norway. (2023)
7. *Eco-evolutionary dynamics of temperate phage in periodically changing environments*. International Physics of Living Systems meeting, Atlanta, GA. (2023)
8. *Eco-evolutionary dynamics of temperate viruses in periodic environments*. Aquatic Virus Workshop, Quebec City, Canada. (2023)

AWARDS, FELLOWSHIPS AND GRANTS

Program Development Award ($1250, Maryland Sea Grant)	2026
Postdoctoral Conference Support Award ($500, University of Maryland)	2025
Summer Graduate Teaching Scholar (UC San Diego)	2021
qBio Fellow (UC San Diego)	2016 – 2017
GSA Travel Award ($500, UC San Diego)	2020
Travel Award ($250, Cnidofest Model Systems Meeting)	2018
KVPY Fellow (National basic science fellowship program, Govt. of India)	2012 – 2016
National Talent Search Scholar (National Council of Educational Research and Training, India)	2008 – 2012

SERVICE AND LEADERSHIP ACTIVITIES

Conferences:

1. Co-organizer and PI, Chesapeake Aquatic Viral Ecology meeting, IMET, Baltimore (Acquired $1250 in funding from Maryland Sea Grant as PI) — 2026
2. Co-organizer Maryland Aquatic Viral Ecology meeting, UMD, College Park. — 2025
3. Founding organizer, Quantitative Ecological and Evolutionary Dynamics Seminar, UMD, College Park. — 2024 – 2025
4. Session co-chair, Non-linear deformations in biology, APS DBIO Virtual Meeting. — 2020

Peer support:

1. Facilitator, Wednesday Work Party, UMD Postdoctoral Office, UMD. — 2024 – 2025
2. Organizer, GradWriteSlack - an online peer support community for graduate students. — 2018 – 2022

Scientific peer review:

Referee for: The Biophysicist, Journal of Theoretical Biology, Theoretical Population Biology, Oikos, Ecology and Evolution, Frontiers in Virology.

CONTINUING EDUCATION AND TRAINING

1. Course Design Retreat, Teaching and Learning Transformation Center, UMD College Park. 2026
2. Doctoral Career Pathways Alumni Mentorship Program, UMD College Park. 2025
3. NPA SmartSkills Workshop. National Postdoctoral Association (virtual). 2024
4. Doctoral Career Design Course. UMD Graduate School, UMD College Park. 2024
5. PSL-Qlife summer school on *Quantitative phage-bacteria dynamics across scales*. Institut Curie, Paris, France. 2024
6. Introduction to College Teaching and Course Design Workshop. Engaged Teaching Hub, UC San Diego. 2020
7. NCBS Physics of Life Monsoon School. NCBS, Bangalore, India. 2014
8. Vijyoshi (National Science Camp) for KVPY fellows. IISc, Bangalore, India. 2012

OUTREACH

1. Guest speaker, Indian Creek High School, Annapolis, MD Sep 2026
   Presented interactive lectures to 9th graders on how math can be used to study living systems.
2. Guest speaker, Indian Institute of Science, Bangalore Nov 2024
   Spoke at QnA session on "Applying to graduate school" for juniors and seniors.
3. Panelist, International Physics of Living Systems meeting, Atlanta, GA Aug 2023
   Spoke at the panel discussion on "Careers after graduate school".
4. Volunteer speaker, Skype-A-Scientist 2018 – present
   Presenting my research and career path as a scientist to K-12 students from 12 schools across the US and counting.

REFERENCES

1. Dr. Joshua S. Weitz
   Professor and Clark Leadership Chair in Data Analytics
   Department of Biology
   University of Maryland College Park
   Email: `jsweitz@umd.edu`
2. Dr. Eva-Maria S. Collins
   Associate Professor
   Department of Biology
   Swarthmore College
   Email: `ecollin3@swarthmore.edu`
3. Dr. Jonathan Dushoff
   Professor, Department of Biology & Department of Mathematics and Statistics
   McMaster University
   Email: `dushoff@mcmaster.ca`