

## Dr. Pintu Patra

Assistant Professor Grade-I

Department of Physics

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## About Me

I am a physicist working in the area of theoretical biophysics and active matter. I use theoretical and computational methods based on statistical physics and non-linear dynamics to study collective dynamics in living systems at different levels of complexity.

## Education

Degree	Institute	Year
Ph.D. Theoretical Biological Physics	Max Planck Institute of Colloids and Interfaces, Potsdam, Germany	2013
M.Sc. Physics	Indian Institute Of Technology Madras, India	2010
B.Sc.(Hons) Physics	Asutosh College, Calcutta University, India	2008

## Research Experience

Position	Organization	Group	Year
Scientist - Image Data Analysis	Resolve Biosciences Gmbh, Germany	Data Science Team (Industry Position)	May 2023 - Aug 2023
Postdoctoral Researcher	Institute for Theoretical Physics, Heidelberg University, Germany	Prof. Dr. Ulrich S Schwarz	Nov 2017 - Apr 2023
Postdoctoral Researcher	Department of Bioengineering, Rice University, USA	Prof. Dr. Oleg A Igoshin	Jan 2015 - Oct 2017
PhD student + Postdoc	Max Planck Institute of Colloids and Interfaces, Germany	Prof. Dr. Stefan Klumpp	Aug 2010 - Oct 2014
Summer Internship	Department of Physics, National University of Singapore, Singapore	Prof. Dr. Jian-Sheng Wang	May 2009 - Jun 2009

## Computational Skills

- Programming languages: C, C++, Python, Matlab, Mathematica
- Techniques: Gillespie Simulations, Molecular Dynamics, Active Brownian Dynamics, Agent-Based Simulations, Evolutionary Algorithms, Computer Vision

## Teaching Experience

### Instructor

- **Computational Physics Lab** (PH39209) - (2 Semesters)
- **Condensed Matter Physics** (PH30204) - (1 Semester)
- **Physics Laboratory** (PH19003) - (1 Semester)
- **Computational Physics Lab** (PH39209) - (1 Semester)
- **Physics of Active Matter** (PH60223) - (1 Semester)
- **Physics of Waves** (PH11003) - Ongoing

### Teaching Assistant

- **Theoretical Biophysics** (M.Sc. course) at **Heidelberg University**. Teacher: Prof. Dr. Ulrich Schwarz
- **Introduction to Stochastic Modeling** (M.Sc. course) at the **University of Potsdam**. Teacher: Dr. Angelo Valleriani

## Mentoring Experience

- 2 Bachelor's and 1 Master's Thesis Project (Completed in joint supervision)
- 4 Bachelor's and 6 Master's Thesis Project (Ongoing, 2 MTPs are joint)
- 2 PhD thesis (Ongoing)

## Funding Sponsored

- **Investigating the role of shape and heterogeneity in active matter using agent-based simulations.**  
Agency - SRIC. IIT Kharagpur, Grant - INR 24,98,000, Role - Principal Investigator

## Academic Achievements

- Selected for CellNetworks Postdoc Fellowship 2017 at Heidelberg University, Germany
- Travel fellowship for Summer Graduate Program from Mathematical Biosciences Institute, Ohio State University, USA
- Institute Merit-cum-Means Scholarship by IIT Madras during M.Sc. Physics
- Summer Internship Fellowship from National University of Singapore

## Reviewer for following Journals

PLOS Computational Biology, Soft Matter, Nature Scientific Reports, BMC Systems Biology, Physical Biology, Journal of Theoretical Biology, Bulletin of Mathematical Biology, Physical Review Research, Physical Review E

## Theses

1. ***P.h.D. Thesis 'Population dynamics of bacterial persistence'*** 2013.  
Max Planck Institute of Colloids and Interfaces and University of Potsdam, Germany.  
Supervisor: **Prof. Stefan Klumpp**
2. ***M.Sc. Thesis 'Bidirectional transport by molecular motors'*** 2010.  
Indian Institute of Technology Madras, India. Supervisor: **Prof. Manoj Gopalakrishnan**

**List of Publications** ([Google Scholar](#): Citations=263, h-index=8, i10-index=8)

1. **Patra, P.**, Sanchez, C., Lanzer, M., Schwarz, U.S., *Pair cross-correlation analysis for assessing protein co-localization. [Biophysical Journal](#) 0006-3495, 2025.*
2. **Patra, P.**, Beyer, K., Jaiswal, A., Ripp, J., Battista, A., Rohr, K., Frischknecht, F., Schwarz, U.S. *Collective migration reveals mechanical flexibility of malaria parasites. [Nature Physics](#) 18 (5), 586-594, 2022. (Featured in [Nature News & Views](#))*
3. Jäger, J., **Patra, P.**, Sanchez, C.P., Lanzer, M., Schwarz, U.S. *A particle-based computational model to analyse remodelling of the red blood cell cytoskeleton during malaria infections. [PLoS Computational Biology](#) 18 (4), e1009509, 2022.*
4. Sanchez, C.P., **Patra, P.**, Chang, S., Karathanasis, C., Hanebutte, L., Kilian, K., Cyrklaff, M., Heilemann, M., Schwarz, U.S., Kudryashev, M. and Lanzer, M., *KAHRP dynamically relocalizes to remodeled actin junctions and associates with knob spirals in Plasmodium falciparum-infected erythrocytes. [Molecular Microbiology](#) 1-19, 2021.*
5. **Patra, P.**, Klumpp, S., *Role of bacterial persistence in spatial population expansion. [Physical Review E](#) 104 (3), 034401, 2021.*
6. Spreng, B., Fleckenstein, H.\*, Kübler, P.\*, DiBiaggio, C.\*, Benz, M.\*, **Patra, P.\***, Schwarz, U.S., Cyrklaff, M. and Frischknecht, F., *Microtubule number and length determine cellular shape and function in Plasmodium. [The EMBO Journal](#), 38(15), e100984, 2019. (\*equal contributions)*
7. Saha, S., **Patra, P.**, Igoshin, O., & Kroos, L., *Systematic analysis of the Myxococcus xanthus developmental gene regulatory network supports posttranslational regulation of FruA by C-signaling. [Molecular Microbiology](#), 111(6), 1732-1752, 2019.*
8. **Patra, P.**, Vassallo, C.N., Wall, D. and Igoshin, O.A., *Mechanism of Kin-Discriminatory Demarcation Line Formation between Colonies of Swarming Bacteria. [Biophysical Journal](#), 113(11), pp.2477-2486, 2017.*
9. **Patra, P.**, Kisson, K., Cornejo, I., Kaplan, H.B. and Igoshin, O.A., *Colony Expansion of Socially Motile Myxococcus xanthus Cells Is Driven by Growth, Motility, and Exopolysaccharide Production. [PLoS Computational Biology](#), 12(6), p.e1005010, 2016. (Cover Article: Issue Jul 2016)*
10. **Patra, P.** and Klumpp, S., *Emergence of phenotype switching through continuous and discontinuous evolutionary transitions. [Physical Biology](#), 12(4), p.046004, 2015.*
11. **Patra, P.** and Klumpp, S., *Phenotypically heterogeneous populations in spatially heterogeneous environments. [Physical Review E](#), 89(3), p.030702, 2014.*
12. **Patra, P.** and Klumpp, S., *Population dynamics of bacterial persistence. [PLoS One](#), 8(5), p.e62814, 2013.*
13. Lechner, S., **Patra, P.**, Klumpp, S. and Bertram, R., *Interplay between population dynamics and drug tolerance of Staphylococcus aureus persister cells. [Journal of Molecular Microbiology and Biotechnology](#), 22(6), pp.381-391, 2012.*

## Invited Talks

- Virtual Seminar as part of Soft, Living, Active, and Adaptive Matter (SLAAM) seminar series organized by Department of Physics, UC Merced, USA, 22 May 2023
- Early Career Seminar at Centre for Mechanochemical Cell Biology, Warwick Medical School, UK, 08 March 2023
- Invited Lecture in an one day seminar at Department of Physics, **Vidyasagar University**, Midnapore, India, 6th Oct, 2023
- Invited Lecture at MeetStatphysIndia 24 meeting on “Statistical Physics and Complex Systems” held at **IIT Kharagpur**, 1-3 July 2024
- Invited Lectures at Refresher Course on “Advanced Concepts in Biophysics and Soft Matter: Foundations and Frontiers” held at **IIT Dhanbad**, 24th October 2024
- Invited Talk in Online Faculty Development Programme (FDP) titled “Empowering the Future with AI/ML: Models Design and Development” organized by E & ICT Academy, **NIT Warangal and School of Artificial Intelligence, Amrita Vishwa Vidyapeetham**, 26th Feb 2025