

# Kaustav Pal

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## RESEARCH INTERESTS

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My research interests lie at the intersection of mechanobiology and statistical physics, focusing on two key areas:

- **Mechanotransduction:** My research focuses on applying statistical mechanics to unravel how cells respond to mechanical stimuli at the molecular level. I aim to develop biophysical models that explore cellular sensing mechanisms, emphasizing energy landscapes and force distribution within cellular structures.
- **Cellular Channel Dynamics:** I am keenly interested in investigating the functionality of cellular channels across diverse cell types, leveraging insights from statistical mechanics. My aim is to understand the dynamic alterations within these channels, employing statistical mechanics to discern the underlying mechanisms of change.

My goal is to bridge the gap between these disciplines, leveraging statistical physics' theoretical frameworks to deepen our understanding of complex biological processes, potentially unlocking new insights into cellular mechanics and behavior.

## EXPERIENCE

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### Cellular Biophysics Lab, IISER Kolkata

*Undergraduate Intern*

Mohanpur, Nadia, India

*Jan 2024 – Present, Full-time*

### Soft Matter & Biophysics Laboratory, Jadavpur University

*Undergraduate Intern*

Jadavpur, Kolkata, India

*Jul 2023 – Present, Part-time*

- Engaged in a computational project under Dr. Sanat Karmakar involving the solution of the non-linear Poisson-Boltzmann Equation for diverse charged membrane systems. This effort aims to simulate and analyze alterations in electrical potentials arising from surface and bulk charges within the membrane.
- Altering various conditions and observing the changes in various system of biological system (eg. Spherical charged surface, Flat charged membrane.)

### Biophysical Chemistry Laboratory, University of Calcutta

*Undergraduate Intern*

Kolkata, India

*May 2023 – Jul 2023, Full-time*

- Collaborated with Prof. Dr. Sudipta Bhowmik and his team of PhD scholars on the research project titled 'Investigating the Interactions Between Human Hemoglobin and Polyethylene Microplastics Using Multi-Spectroscopic Approaches'.
- Employed a range of spectroscopic techniques, including UV, Circular Dichroism, as well as steady-state and time-resolved fluorescence methodologies. These approaches were applied to elucidate the interactions induced by polyethylene microplastics, as evidenced by observable spectral shifts.

## EDUCATION

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### Indian Institute of Science Education & Research Kolkata

*5 Year BS-MS Majoring in Biological Sciences, Semester 5 GPA: 7.86/10.00*

Mohanpur, India

*Aug 2021 – Present*

### St. Xavier's Institution

*High School Diploma, GPA: 9.3/10*

Sodpur, India

*Jun 2019 – May 2021*

## SKILLS

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**Programming:** I have intermediate-level proficiency in C programming, substantiated by a library management project. In Python, I am at an intermediate level and proficient in using packages like matplotlib, numpy, pandas, and others. I extensively apply numerical methods in both Python and MATLAB, specifically within the Soft Matter Lab. Furthermore, tasks related to image analysis are primarily carried out in MATLAB within the Soft Matter Lab and the Cell Biophysics Lab.

**Machine Learning:** Experienced in various machine learning techniques including regression, classification, clustering, and neural networks. Actively applying learned algorithms for data analysis and predictive modeling. Engaged in ongoing cellular biophysics research, utilizing deep learning frameworks like TensorFlow and PyTorch to develop neural networks for image analysis and interpretation.

**Languages:** Bengali (Native), English (Professional)

## RELEVANT COURSEWORK

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**Biophysics & Biochemistry:** Fundamental understanding of molecular mechanisms in biological systems.

**Spectroscopic & Microscopy Techniques:** Adept in applying theoretical principles of techniques for molecular and cellular analysis.

**Cell Biology & Biostatistics:** Advanced knowledge of cellular processes and data analysis methods.

**Introductory Quantum Physics:** Basic insight into nano-scale particle behavior.

**Statistical Physics:** Grasping the thermodynamics of complex systems and gaining an initial understanding of phase transitions.

**Mathematical Methods of Physics I, II & III:** Providing a strong grasp of foundational mathematical concepts essential for application across diverse areas within the physical sciences.