Stanford



Suman Patra

Postdoctoral Scholar, Chemistry

Bio

BIO

Dr. Suman Patra is a postdoctoral researcher in the Department of Chemistry at Stanford University, working under the mentorship of Prof. Edward I. Solomon. His research focuses on uncovering the mechanistic intricacies of non-coupled binuclear copper (NBC) enzymes, particularly tyramine β-monooxygenase (TBM), which catalyzes oxygen activation and selective C–H bond hydroxylation.His work integrates high-resolution spectroscopy, transient kinetics, and protein biochemistry to probe the formation, structure, and reactivity of short-lived copper-oxygen intermediates. As part of this effort, he performs cell culture and protein purification, enabling the isolation of active, recombinant copper enzymes for detailed spectroscopic and mechanistic studies. Through a multi-spectroscopic approach, primarily UV-Vis, CD, MCD, EXAFS, EPR, resonance Raman, and stopped-flow absorption spectroscopy, he investigates how the geometric and electronic structure of the active sites modulate reactivity and enable O# activation without direct Cu–Cu coupling.

Dr. Patra earned his Ph.D. in Chemistry from the Indian Association for the Cultivation of Science (IACS), Kolkata, under the supervision of Prof. Abhishek Dey, where he developed iron porphyrin-based electrocatalysts for the selective reduction of CO#. His research emphasized mechanistic analysis using electrochemical methods coupled with in situ spectro-electrochemistry to monitor redox transitions and catalytic intermediates under applied potentials. These studies were complemented by density functional theory (DFT) calculations, which he used to model key intermediates, protonation pathways, and redox energetics, thereby providing molecular-level insight into how second-sphere interactions and ligand environments influence catalytic behaviour. His integrative experimental–computational approach provided a detailed understanding of structure-function relationships in multi-electron CO# reduction.

The mechanistic perspective and technical skillset developed during his doctoral work, particularly in combining spectroscopy, electrochemistry, and computation, now form the foundation of his postdoctoral research. His current studies extend those same principles to more complex metalloenzyme systems, addressing similar core questions about the role of electronic structure, metal-ligand coordination, and local environment in controlling reactivity. His long-term goal is to bridge synthetic and biological catalysis through a mechanistic lens, contributing to the development of efficient, selective systems for small-molecule activation and sustainable energy transformations.

Dr. Patra received his M.Sc. in Chemistry from the Indian Institute of Technology (IIT) Guwahati after qualifying the national IIT-JAM examination and completed his B.Sc. in Chemistry at St. Xavier’s College, Kolkata. Over the course of his academic training, he has cultivated a multidisciplinary research identity that spans coordination chemistry, spectroscopy, electrochemical catalysis, and theoretical modelling. His scientific vision centres on using spectroscopic and computational insight to guide the rational design of catalysts for environmentally relevant redox chemistry.

STANFORD ADVISORS

- Edward Solomon, Postdoctoral Faculty Sponsor

Publications

PUBLICATIONS

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