PRERANA R SINGH

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Career Summary

Bioengineer with immense understanding in tissue engineering, drug delivery and nanotechnology. I also have special curiosity towards the interdisciplinary amalgamation of drug delivery and bioengineering for healthcare therapeutics. My long-term goal is to be an independent academician contributing towards cutting-edge science.

Academic qualifications:

- PhD; Department of Biological Sciences and Bioengineering, Indian Institute of Technology Kanpur, India [7.6 CPA/10] 2013-2020
- M.Sc. Botany (Honours); Ramnarain Ruia College, University of Mumbai, Department of Botany, Mumbai, India [83.4%] 2010-2012
- B.Sc. Botany; Ramnarain Ruia College, University of Mumbai, Department of Botany, Mumbai, India [78.0%] 2007-2010

Research Experience:

1. **Doctor of Philosophy, Department of Biological Science and Bioengineering, Indian Institute of Technology Kanpur, India (July, 2016-December, 2020)**

   Research Topic: Development of bio-inspired *in vitro* skin equivalents for tissue engineering applications

   Research Advisor: Dr. Sri Sivakumar, Professor, Department of Chemical Engineering, IIT Kanpur

   Work Performed:

   Fabricated functional *in vitro* skin models with extracellular matrix (ECM) mimicking characteristics by-

   - Developing algal polysaccharide coated cellulose acetate nanofibers as dermal skin substitute
     - ✓ Coating of bioactive sea weed κ-carrageenan to mimic sulfated polysaccharides of skin
     - ✓ Enhanced formation of ECM proteins due to presence of an ECM cue thus, forming a function dermal skin substitute
   - Fabricating bio-mimetic hybrid paper based nano-composite as an artificial *in vitro* epidermal substitute
     - ✓ Tuning precise gradient of hydrophobicity and variation in macro, micro and nano-topography to mimic native human epidermis
     - ✓ Developed paper based artificial epidermal substitute by electrospining polycaprolactone and dip coating PDMS nanoparticles
   - Utilizing naturally printed nano-topographic features of floral bracts for developing artificial *in vitro* skin substitute
     - ✓ Explored a cross-kingdom approach to mimic native skin micro/nano environment by employing decellularized petaloid bract

2. **Doctor of Philosophy, Department of Biological Science and Bioengineering, Indian Institute of Technology Kanpur, India (July, 2013-2016)**

   Research Topic: Understanding dynamics of chromatin regulation and remodelling during DNA damage and repair

Research Advisor: Dr. Saravanan Matheshwaran, Department of Biological Science and Bioengineering, IIT Kanpur

Work Performed:

- To study structure-function relationship of nuclear actin related proteins (ARPs) from *S. cerevisiae* and *Ustilago maydis* in chromatin recognition and DNA repair.
  - ✓ Cloning, overexpression and purification of *U. maydis* Actin, ARP4 and ARP8 in *E.coli* using T7 expression vector system
  - ✓ Co-expression and purification of Actin, Arp4 and Arp8
  - ✓ Biochemical characterization of the recombinant proteins and mutants of recombinant proteins (Actin, Arp4 and Arp8)
- Chromosomal passenger complex (CPC) and INo80 chromatin remodelling complex: connection in DNA repair
  - ✓ Cloning, over-expression and purification of *S. cerevisiae* IPL1 and ARP8 in E. coli using T7 expression vector system
  - ✓ Co-expression and purfication of IPL1 and ARP8 for *in vitro* studies
  - ✓ Pull down assays to analyse IPL1 and ARP8 interaction
- To understand the molecular role of ***Caenorhabditis elegans*** Actin Related Protein 6 (Arp6) in chromatin remodelling
  - ✓ Cloning and over-expression of ARP 6 in ***C. elegans*** by gene bombardment protocol
  - ✓ RNA interference studies for ARP6 in *C. elegans*
  - ✓ Understanding the interaction of different histone proteins (H1, H2A, H2B, H3, H4) and ARP 6 in *C. elegans* in relation to DNA damage and repair

3. **Master of Science, Department of Botany, Ramnarain Ruia College, Mumbai University, Mumbai, Maharashtra, India (July, 2010 – June, 2012)**

Research Topic: Exploitation of agricultural wastes for the production of value-added products

Research Advisor: Dr. Jessy Pius, Department of Botany, Ranmnarain Ruia College, Mumbai

Work Performed:

- The main objective of the work was to manage waste agricultural biomass and convert it into a material resource useful for sustainable environment

Manuscripts:

- "Biomimetic Algal Polysaccharide Coated 3D Nanofibrous Scaffolds Promote Skin Extracellular Matrix Formation", **Prerana Singh**, Auhin Kumar Maparu, Savita Shah, Beena Rai and Sri Sivakumar, ***Materials Science and Engineering: C***, 2021, DOI: 10.1016/j.msec.2020.111580

- "Stable Sub-100 nm PDMS Nanoparticles as an Intracellular Drug Delivery Vehicle", Auhin Kumar Maparu, **Prerana Singh**, Beena Rai, Ashutosh Sharma and Sri Sivakumar, ***Materials Science and Engineering: C***, 2021, DOI: 10.1016/j.msec.2020.111577

- "Luminescent EuIII and TbIII bimetallic complexes of N, N′-heterocyclic bases and tolfenamic acid: structures, photophysical aspects and biological activity", Zafar Abbas, **Prerana Singh**, Srikanth Dasari, Sri Sivakumar and Ashis K. Patra, ***New Journal of Chemistry***, 2020, DOI: 10.1039/D0NJ03261A

- "Blended Polar/Nonpolar Peptide Conjugate Interferes with Human Insulin Amyloid-Mediated Cell Apoptotic Events", Shantanu Sen, **Prerana Singh**, Narendra Kumar Mishra, Sri Sivakumar, Subramanium Ganesh and Sandeep Verma, ***Bioorganic Chemistry***, 2021, DOI: 10.1016/j.bioorg.2021.104899

- "Kinetically Labile Ruthenium (II) Complexes of Terpyridines and Saccharin: Effect of Substituent's on Photoactivity, Solvation Kinetics, and Photocytotoxicity", Priyaranjan Kumar,

Prerana Singh, Sanjoy Saren, Sandip Pakira, Sri Sivakumar and Ashis K. Patra, ***Dalton Transactions***, 2021, DOI:10.1039/D1DT00246E

- "Harnessing Nanotopographic Decellularized Plant Scaffold for Skin Tissue Engineering Applications", **Prerana Singh**, Auhin Kumar Maparu, Mohil Mishra, Beena Rai and Sri Sivakumar (manuscript under review in ***Journal of Biomedical Materials Research Part A***)
- "A Simple, Robust and Scalable Route to Prepare Sub-50 nm Soft PDMS Nanoparticles for Intracellular Delivery of Anticancer Drugs", Auhin Kumar Maparu, **Prerana Singh**, Beena Rai, Ashutosh Sharma and Sri Sivakumar (manuscript under review in ***Colloids and Surfaces A: Physicochemical and Engineering Aspects***)
- "Quaternary Ru (II) Complexes of Terpyridines, Saccharin and 1, 2-Azoles: Effect of Substituents on Molecular Structure, Speciation, Photoactivity, and Photocytotoxicity", Priyaranjan Kumar, **Prerana Singh**, Sanjoy Saren, Juhi Sayala, Sri Sivakumar and Ashis K. Patra (manuscript under review in ***Inorganic Chemistry***)
- "Bioinspired Hybrid Paper Composite as an Artificial *In Vitro* Epidermal Substitute", **Prerana Singh**, Auhin Kumar Maparu, Beena Rai and Sri Sivakumar (manuscript ready for submission)
- "Coating of PDMS Surface with PDMS Nanoparticles for Enhanced Adhesion, Proliferation and Differentiation of Skin Cells", Auhin Kumar Maparu, **Prerana Singh**, Beena Rai, Ashutosh Sharma and Sri Sivakumar (manuscript ready for submission)
- "PDMS Nanoparticles Impregnated Paper as a 3D Bioactive Scaffold for Skin Tissue Engineering", Auhin Kumar Maparu, **Prerana Singh**, Beena Rai, Ashutosh Sharma and Sri Sivakumar (manuscript ready for submission)

Book Chapter:

- Soneya Majumdar, **Prerana Singh**, Abhishek Iyer, Matheshwaran Saravanan, Functional epigenomics. *Current developments in biotechnology and bioengineering, 1st edition, Functional genomics and metabolic engineering;* Elsevier publications (ISBN No. 9780444636782), September 2017

Applied Patents

- "PAPER BASED MULTI-LAYERED EPIDERMAL EQUIVALENT AND METHODS FOR THE PRODUCTION THEREOF", **Prerana Singh**, Auhin Kumar Maparu, Sri Sivakumar and Beena Rai, Indian Patent Application 202011005818 (2020)
- "AN IMPROVED TISSUE ENGINEERING SCAFFOLD AND A METHOD FOR FABRICATION THEREOF", **Prerana Singh**, Auhin Kumar Maparu, Sri Sivakumar and Beena Rai, Indian Patent Application 201911038980 (2019)
- "TISSUE ENGINEERING SCAFFOLD DERIVED FROM PLANT BASED MATERIAL", **Prerana Singh**, Auhin Kumar Maparu, Sri Sivakumar and Beena Rai, Indian Patent Application 201911021185 (2019)
- "POLYDIMETHYLSILOXANE NANOPARTICLES COATED SCAFFOLDS FOR CULTURING CELLS AND TISSUE ENGINEERING", Auhin Kumar Maparu, **Prerana Singh**, Sri Sivakumar and Beena Rai, Indian Patent Application 201911043062 (2019)

Conference Presentations:

- "Ternary and Quaternary Ruthenium (II) Anticancer Agents: Design, Structures, Photoactivity and Biological Assessment", Priyaranjan Kumar, **Prerana Singh**, Sanjay Saren, Sri Sivakumar and Ashis Kumar Patra, ***National Conference on Modern Trends in Inorganic Chemistry,*** 11-14 December, 2019, Indian Institute of Technology Guwahati and Tezpur University, India

- "Isostructural Bimetallic Lanthanide Complexes of N, N'- Hetereocyclic Bases and Tolfenamic Acid: Structures, Photophysical Aspects and Biological Activity", Zafar Abbas, **Prerana Singh**, Sri Sivakumar and Ashis Kumar Patra, ***National Conference on Modern Trends in Inorganic Chemistry***, 11-14 December, 2019, Indian Institute of Technology Guwahati and Tezpur University, India

- "Organelle Specific Intracellular Localization of Bare PDMS Nanoparticles for Drug Delivery Applications", Auhin Kumar Maparu, **Prerana Singh**, Beena Rai, Ashutosh Sharma and Sri Sivakumar, ***International Conference on Biomaterial-Based Therapeutic Engineering and Regenerative Medicine***, 28 -01 December, 2019, Indian Institute of Technology Kanpur, India

- "Naturally Bio-Printed Scaffolds for Skin Tissue Engineering Applications", **Prerana Singh**, Auhin Kumar Maparu, Beena Rai and Sri Sivakumar, ***International Conference on Biomaterial-Based Therapeutic Engineering and Regenerative Medicine***, 28 -01 December, 2019, Indian Institute of Technology Kanpur, India
- "Organelle Specific Localization of Ultra-Soft PDMS Nanoparticles for Drug Delivery", Auhin Kumar Maparu, **Prerana Singh**, Beena Rai, Ashutosh Sharma and Sri Sivakumar, ***ACS Publications Symposium: Innovation in Materials Science & Technology***, 17-19 November, 2019, Nanyang Technological University, Singapore
- "Naturally Bio-Printed Artificial Skin: A Cross-Kingdom Approach", **Prerana Singh**, Auhin Kumar Maparu, Beena Rai and Sri Sivakumar, ***ACS Publications Symposium: Innovation in Materials Science & Technology***, 17-19 November, 2019, Nanyang Technological University, Singapore
- "A Simple Route for Large-Scale Synthesis of Stable PDMS Nanoparticles", Auhin Kumar Maparu, **Prerana Singh**, Beena Rai, Ashutosh Sharma and Sri Sivakumar, ***International Conference on Advances in Polymeric Materials and Human Healthcare***, 16-18 October, 2019, International Centre Goa, India
- "Artificial Skin: An Inspiration from Nature", **Prerana Singh,** Auhin Kumar Maparu**,** Beena Rai and Sri Sivakumar, ***International Conference on Advances in Polymeric Materials and Human Healthcare***, 16-18 October, 2019, International Centre Goa, India
- "Mitochondria-Targeted Drug Delivery via PDMS Nanoparticles", **Auhin Kumar Maparu,** Prerana Singh, Beena Rai, Ashutosh Sharma and Sri Sivakumar, ***Nanobioteck 2018***, 24-27 October, 2018, AIIMS, New Delhi, India
- "Towards Understanding the Molecular Role of *Caenorhabditis elegans* Actin Related Protein 6 (Arp6)", **Prerana Singh**, Amaresh Chaturbedi, Kuppuswamy Subramanium and Matheshwaran Saravanan, ***1st C. elegans meet***, 30 January - 2 February, 2016, TIFR Mumbai, Mahabaleshwar, India
- "Solid State Fermentation for the Production of Industrial Enzymes from *Aspergillus niger* and Its Purification using Activated Charcoal", **Prerana Singh**, Jessy Pius, Sunil Shankhadarwar, Bhavna Narula, Behnaz B. Patel and Shrutika Kumthekar, ***National Conference on Fungi and Human***

Welfare, 8 -9 February, 2013, Ramnarain Ruia College and Mycological society of India, Mumbai, India

- "A Comparative Study on Vermicomposting of Agricultural Wastes", **Prerana Singh**, Dhwani Shah, Jessy Pius, Behnaz B. Patel, Bhavna Narula and Sunil Shankhadarwar, ***National Conference on Sustainable Crop Productivity through Pharmacological Interventions***, 24-26 November, 2011, Indian Society for Plant physiology, PUSA, New Delhi, India
- "Preparation of Activated Carbon from Agro-Industrial Waste", **Prerana Singh**, Jessy Pius, Behnaz B. Patel, Bhavna Narula and Sunil Shankhadarwar, ***National Conference on Sustainable Crop Productivity through Pharmacological Interventions,*** 24 -26 November, 2011, Indian Society for Plant physiology, PUSA, New Delhi, India

Awards/ Academic achievements:

- Qualified CSIR-NET in Life Sciences held in December 2013
- Qualified GATE 2013 in Life Sciences held in March 2013
- Qualified UGC-NET in Environmental sciences held in December 2012
- Awarded Government Daxina Fellowship for M.Sc. degree in 2010-2011 by Mumbai University
- Awarded meritorious achievement recognition at B.Sc. degree examination in 2010 by Mumbai University
- Awarded with the prestigious 'The Professor K. Shrikumar Trophy for excellent performance in the academic field in 2010 by Ramnarain Ruia College, Mumbai, India

Media Coverage:

- https://www.thehindubusinessline.com/news/national/medical-research-blooms-with-paper-flower/article33835266.ece
- https://twitter.com/karandi65/status/1360115183272693761
- https://up.punjabkesari.in/uttar-pradesh/news/iit-kanpur-invented-3d-artificial-skin-animals-1127927
- https://navbharattimes.indiatimes.com/state/uttar-pradesh/kanpur/kanpur-iit-chemical-engineering-dept-developed-artificial-3-d-skin-to-stop-clinical-trial-on-animals/articleshow/74219586.cms
- https://twitter.com/karandi65/status/1229812333360242689
- https://www.facebook.com/105081544240545/photos/pcb.182260773189288/182260289856003/?type=3&theater
- https://www.etvbharat.com/hindi/uttar-pradesh/state/kanpur/kanpur-iit-made-artificial-skin-from-bougainvellia-flowers/up20210210174247651

Technical skills:

[1] Bioengineering: Synthesis of nanoparticles, drug delivery, biomaterial design and characterization, Electrospining, Electrospraying, Decellularization, Cell viability and proliferation assays, Immunofluorescence studies, Fluorescence microscopy, Confocal microscopy, *In vitro* mammalian cell culture, Microtomy, Cryo-microtomy, Lyophilization, Air-lift culture, 3D spheroid culture

[2] Cell & Molecular Biology: Cloning, Protein over-expression and purification, Proficient in using AKTA start and AKTA Pure (UNICORN-GE Healthcare), RNA/DNA isolation, PCR, RT-PCR, Protein isolation, Cellular uptake studies, Bacterial cell culture

[3] Analytical skills: Electron microscopy (FESEM, TEM and EDX), AFM, Agarose and SDS-PAGE electrophoresis, UV/Vis spectroscopy, Zetasizer, DLS, X-ray diffraction, FTIR, Goniometer.

[4] Computer applications: Proficient in fundamentals of Image J, Adobe Photoshop, Graph Pad, Origin

[5] Others: *C. elegans* culture and handling, RNA interference studies in *C. elegans*, Drosophila developmental biology, Basics of Mice handling

Personal Information:

Name: Prerana R Singh

Father's Name: Raj Pal Singh

Nationality: Indian

Date of Birth: 08th August, 1990

Gender: Female

Permanent Address: C1, Shivalay Apartment, Hatpukur
P.O: G.I.P. Colony, Dist: Howrah
West Bengal: 711112

Interests: Gardening, Reading, Cooking, Travelling

Linguistics: English, Hindi, Bengali

Referees:

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