YAMINI **JANGIR**

Microbial Electrochemistry | Astrobiology | Anaerobic Microbiology | Bioinformatics | Geomicrobiology

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I am an early career researcher (visiting assistant professor) in the department of **Space, Planetary, Astronomical Sciences and Engineering (SPASE) at Indian Institute of Technology (IIT) Kanpur**.

The focus on fundamental and translational research into the impact of spaceflight on biological systems is of paramount importance for advancing human space exploration and ensuring the sustainability of long-term habitation in both low-Earth orbit and beyond. As a dedicated researcher with a profound passion for **microbes that thrive in extreme environments**, I am eager to deepen my understanding of the physiological and biological challenges posed by space environments and contribute to the development of innovative solutions that will support future sustainable space missions around the world. I have used various microbiological, electrochemical and molecular biological tools including DNA / RNA sequencing, fluorescent in situ hybridization imaging (FISH) coupled with stable isotopic probing (SIP), fluorescent in situ hybridization imaging (FISH) coupled with bioorthogonal non-canonical amino acid labeling (BONCAT), and metabolic modeling to obtain a **deeper understanding of microbe-microbe and microbe-environment interactions**.

I continue to investigate the fundamental underpinnings of electron transfer within synthetic syntrophic microbial communities. Moreover, I am **developing an astrobiology and space biology research program** to undertake : 1) laboratory- and field-based experiments to study lifeforms in extreme and space-like environments, 2) CubeSat- and LEO-payload-based experiments to study the effect of space environment on Earth-based lifeforms, and 3) lab-based experiments to analyze prebiotic compounds that may be present in extraterrestrial rock samples (e.g. asteroid, Moon, Mars).

Publications

2025 Redox conduction facilitates direct interspecies electron transport in anaerobic methanotrophic consortia | Science Advances, Accepted

2025 Deep sea anaerobic microbial community couples the degradation of insoluble chitin to extracellular electron transfer | Nature Microbiology, In Review

2025 Planetary analog sites in the Indian subcontinent and the Indian ocean are underexplored environments suited for astrobiological and space research | Frontiers in Astronomy and Space Sciences, To be Submitted

2019 In situ Electrochemical Studies of the Terrestrial Deep Subsurface Biosphere at the Sanford Underground Research Facility, South Dakota, USA | Frontiers in Energy Research

2016 Isolation and characterization of electrochemically active subsurface *Delftia and Azonexus species* | Frontiers in Microbiology

2016 Disentangling the roles of free and cytochrome-bound flavins in extracellular electron transport from *Shewanella oneidensis MR-1* | Electrochimica Acta

2014 *Shewanella oneidensis* MR-1 nanowires are outer membrane and periplasmic extensions of the extracellular electron transport components | Proceedings of the National Academy of Sciences

Professional Experience

Today – Feb 2024 | **Visiting Assistant Professor, SPASE, IIT Kanpur**

Developing an astrobiology and space biology research laboratory.

- Lab- and field-based experiments to study lifeforms in extreme environments on Earth
- CubeSat- and LEO-payload-based experiments to study the effect of space environment on Earth-based lifeforms
- Lab-based experiments to analyze physiological changes in microbes under simulated microgravity)
- Identifying non-invasive biomarkers suitable for space environment

Spaceflight stressors | Microgravity | Biomarkers

July 2023 – Sept 2021 | **Postdoctoral Research Associate, BBE, Caltech**

Unlocking stable co-existence at the aerobic and anaerobic transition in facultative anaerobes.

- Initiated continuous bioreactor to grow denitrifying bacteria at steady state
- Study the effect of environmental fluctuations on microbes

Chemostat | metagenomics and metatranscriptomics | single-cell mRNA-FISH | particle size analysis

Sept 2021 – May 2018 | **Postdoctoral Trainee, GPS,Caltech**

Kinetic investigations of microbial degradation of insoluble chitin degradation coupled with mineral respiration.

- Designed and built anaerobic bioelectrochemical reactor
- Enriched a stable microbial community degrading complex insoluble biopolymers and producing electricity
- Identified active microbes, chitin-degrading genes, and redox-active processes present in the complex community.

16S metagenomics | electrochemistry | anaerobic microbiology | 16S rRNA-FISH | Nano-SIMS | BONCAT

May 2016 – Mar 2012 | **Graduate Research Assistant, Physics, USC**

Electrochemical studies of subsurface microorganisms.

- In-situ and ex-situ electrochemical enrichment of electrochemically active microbes from the deep terrestrial subsurface.
- Disentangling extracellular electron tansport in extensively studied mineral-reducing bacteria.

Chronoamerometry | pulsed voltammetry | flourescence microscopy | microfluidics | electron microscopy | nanolithography

Education

2016 **Ph.D. (Biophysics)**, University of Southern California, Los Angeles, USA.
2009 **MS (Physics)**, Indian Institute of Technology, Bombay, Maharashtra, India
2007 **BS (Physics)**, University of Delhi, Delhi, India

Selected Conferences/ Invited Talks

2025 It takes two to tango : active crossfeeding in anoxic marine subsurface | International Microbiome Symposium, IIT Madras

2024 Tale of marine subsurface microbial interaction | American Society for Microbiology (ASM) Microbe

2022 From chitin degradation to breathing rocks – living in subseafloor sediments | International Society for Microbial Electrochemistry and Technology

2021 Stable coexistence at the aerobic and anaerobic transition - an experimental validation | Goldschmidt Conference

2019 Investigating chitin degrading microbial community in bioelectrochemical reactors | American Geophysical Union (AGU), Fall Meeting

2018 Investigating continental subsurface biosphere with in situ electrochemical colonization | North-America International Society for Microbial Electrochemistry and Technology (NA-ISMET)

2017 In situ electrochemical enrichment of subsurface bacteria at the Sanford Underground Research Facility | Astrobiology Science Conference (AbSciCon)

2015 Laboratory and In Situ Cultivation of Subsurface Microorganisms | Astrobiology Science Conference (AbSciCon)

2014 Electrode Cultivation of Subsurface Microorganisms | nternational Symposium on Subsurface Microbiology (ISSM)

Academic Service

NASA STAR Fellow

2024 - 2025

NASA STAR Program

Engaged with hands-on coursework, workshops, and collaborative research designed to bridge microbiology, astrobiology, and space biology.

Research Expert

2024

SSRF URSC ISRO

Active domain expert in astrobiology and space biology. Helped frame science priorities and timelines (near/mid/long-term) for India's space biology and astrobiology sectors. Co-authored a white paper, titled AASHA, capturing splinter-group recommendations and thematic priorities.

Research Expert

2024 - Today

PROTOPLANET

Developed an astrobiology and space biology collaboration across the globe. Designed purpose-driven training and immersive platform, focused on Climate Conscious Space Exploration. Providing expertise in geomicrobiology and subsurface microbial ecology to Protoplanet's educational and public outreach.

Review Editor

2019 - Today

Frontiers in microbiology GRL, AGU ScienceDirect Electrochimica Acta iScience, Cell Press

Certified the quality, validity, and clarity of submitted manuscripts. Provided constructive feedback to improve scientific rigor and presentation.

Mentoring and Science Outreach

2025 **Project Mentor (IIT Kanpur, India)**, Led summer internship project for undergraduate students and co-PI for two graduate students

2021 **Mentor (California Institute of Technology, USA)**, Trained graduate and SURF undergraduate students on designing research questions in microbial electrochemistry field

2016 **Demonstrator (Computing Lab, Department of Physics, University of Oxford, Oxford, UK)**, Introduced first-year physics undergraduate students to programming languages : R, Python, and MATLAB.

2016 **Volunteer (Oxford University Museum of Natural History, Oxford, UK)**, Led mineralogy activity within the 'Science Saturday' volunteer group aimed to introduce skills needed to examine and test naturally-occurring mineral specimens.

2015 **Mentor (Physics, University of Southern California, USA)**, Advised undergraduate and high school students as part of the Student Opportunities for Academic Research, SOAR-USC, and the Young Research program, YRP-USC, respectively.

Awards and Recognition

2025 Travel grant to attend and present at SAMHITA meeting held at SAC, ISRO, Ahmedabad, India

2025 Internal IIT Kanpur CARE grant to procure terrestrial microgravity simulator

2024 Travel grant to attend and present at the Space Science Roadmap Formulation meeting held at URSC, ISRO, Bangalore, India

2018 Travel grant by Center for Environmental Microbial Interactions (CEMI), Caltech, Pasadena, USA

2015 Women in Science and Education (WiSE) Merit Fellowship for Current Doctoral Students, USC, Los Angeles, USA

2013 Scholarship to attend the International Summer School in Astrobiology in Santander, Spain

2009 Research Scholarship by National Institute of Material Sciences, Japan and National University of Singapore, Singapore (Waived)

2009 Junior Research Fellowship of the Council of Scientific and Industrial Research (CSIR), India