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Summary:

I am a Ph.D. from Department of Biochemistry, University of Calcutta, India, currently working as a post-doctoral research associate at the School of Biological Sciences, University of Manchester. I am a microbiologist by training with a sound research expertise in evolutionary microbiology, molecular biology, metagenomics, environmental microbiology, microbial ecology, antibiotic resistance and biochemistry.

As a researcher I am seeking a challenging prospect in an intellectually stimulating environment, which will not only assist my career developments but also contribute significantly to the progress of the lab and the field of knowledge as a whole.

Research Experience:

Post-Doctoral research

The study focuses on the evolutionary paradigm of antibiotic resistance of *E.coli* in changing growth environment and modelling the fitness landscape of the evolved isolates. My current project also involves analyzing the clinical isolates of *E. coli*, specifically focusing on the phenotypic and genotypic basis of antibiotic resistance. Moreover, it aims at exploring the novel plasmids present in the strains that impart different attributes and fitness-cost relations under environmental conditions.

Supervisor: Dr. Christopher Knight (Senior Lecturer, Department of Earth and Environmental Sciences-Academic & Research, Manchester Environmental Research Institute, FSE Research Institutes)

Dr. Danna Gifford (UKRI Innovation/Rutherford Fund Research Fellow, School of Biological Sciences, Faculty of Biology, Medicine & Health, University of Manchester)

Prof. Simon Lovell (Prof Simon Lovell. Director - Evolution, Systems and Genomics Research Domain. Faculty of Biology, Medicine and Health, School of Biological Sciences)

Doctoral Thesis

Title: A study on culture dependent and independent interventions of bacterial and archaeal communities in Sundarbans, the world heritage site

Supervisor: Prof. Maitree Bhattacharyya (Professor, Department of Biochemistry, University of Calcutta; Director, Jagadis Bose National Science Talent search)

Dr. Abhrajyoti Ghosh (Assistant Professor, Department of Biochemistry, Bose Institute, Kolkata)

*The major works done in my doctoral study are summarized in the Annexure at the end of the resume.

Masters' Thesis

Title: Determination of Correlation of Mutation in Precore-Core Gene for HBsAg Negative Hepatitis B Patients.

Under the guidance of Dr. Runu Chakroborty (Assistant Director & Head of the Department ICMR Virus Unit, Kolkata)

*The major works done in my masters' study are summarized in the Annexure at the end of the resume.

Teaching and Professional Experience:

As Assistant Professor

July, 2023 - September, 2023: Institute of Advanced Research, Gandhinagar, Gujarat, India.

Also worked as the coordinator for the post-graduate courses of Microbiology and Microbial Diversity and Systematics for the curriculum of M.Sc. Biotechnology and M.Sc. Microbiology accordingly.

Awarded the highest rated Teacher of the institute according to student feedback and gradation. (9.3 out of 10, average score per student, six factor evaluation, normalized to 10)

October, 2023 – Present: Adamas University, Kolkata, West Bengal, India

As Visiting Faculty

December 2022 – Present: Estuarine and Coastal Studies Foundation (ECSF), Howrah, India.

As Coordinator Research and Development

March, 2023 – July, 2023 – Ecoheritage India Foundation, Kolkata, India.

Publications:

1) Anthropogenic influence shapes the distribution of antibiotic resistant bacteria (ARB) and antibiotic resistance genes (ARGs) in the sediment of Sundarban estuary. *Science of The Total Environment*, Volume 647, 10 January 2019, Pages 1626-1639.

<https://doi.org/10.1016/j.scitotenv.2018.08.038> **Anish Bhattacharyya**, Anwesha Haldar, Maitree Bhattacharyya, Abhrajyoti Ghosh.

2) Diversity and distribution of archaea in the mangrove sediment of Sundarbans, *Archaea*, 2015 , Volume 2015, Article ID 968582, doi.org/10.1155/2015/968582, **Anish Bhattacharyya**, Niladri Majumder, Pijush Basak, Debojyoti Roy, Sudip Nag, Anwesha Haldar, Shayantan Mukherjee, Dhruvajyoti Chattopadhyay, Suparna Mitra, Maitree Bhattacharyya, Abhrajyoti Ghosh.

3) Anthropogenic impact accelerates antibiotic resistome diversity in the mangrove sediment of Indian Sundarban. *Chemosphere*, Volume 309, Part 2, 2022, 136806, ISSN 0045-6535, <https://doi.org/10.1016/j.chemosphere.2022.136806>. Shayantan Mukherji, Madangechanok Imchen, Sangita Mondal, **Anish Bhattacharyya**, Busi Siddhardha, Ranjith Kumavath, Abhrajyoti Ghosh.

4) Bacterial diversity assessment of pristine mangrove microbial community from Dhulibhashani, Sundarbans using 16S rRNA gene tag sequencing, *Genomics Data*, 2016, 7: 76–78. Pijush Basak, Arnab Pramanik, Sohan Sengupta, **Anish Bhattacharyya**, Sudip Nag, Debojyoti Roy, Rudradip Pattanayak, Abhrajyoti Ghosh, Dhruvajyoti Chattopadhyay, Maitree Bhattacharyya.

5) Spatiotemporal analysis of bacterial diversity in sediments of Sundarbans using parallel 16S rRNA gene tag sequencing , *Microbial Ecology* , Volume 69(3) , 500-511 , 2015 Pijush Basak, Niladri Majumdar, Sudip Nag, **Anish Bhattacharyya**, Debojyoti Roy, Arpita Chakrabarty, Sohan Sengupta, Arunava Roy, Arghya Mukherjee, Rudradip Pattonayak, Abhrajyoti Ghosh, Dhruvajyoti Chattopadhyay, Maitree Bhattacharyya.

6) Changing bacterial profile of Sundarbans, the World heritage mangrove: Impact of anthropogenic interventions, *World J Microbiol Biotechnol*, 2015, 31:593–610 (DOI 10.1007/s11274-015-1814-5) Arpita Chakrabarty, Amit Bera, Arghya Mukherjee, Pijush Basak, Arindam Mondal, Imroze Khan, Arunava Roy, **Anish Bhattacharyya**, Debojyoti Roy, Sudip Nag, Abhrajyoti Ghosh, Dhruvajyoti Chattopadhyay, Maitree Bhattacharyya.

7) Microbial diversity and related secondary metabolite gene assortment at an estuarine mangrove ecosystem, *Regional Studies in Marine Science*, Volume 34, 2020, 101051, ISSN 2352-4855, Sohan Sengupta, Arnab Pramanik, Sudip Nag, Debojyoti Roy, **Anish Bhattacharyya**, Pijush Basak, Maitree Bhattacharyya.

8) Molecular and culture-based surveys of metabolically active hydrocarbon-degrading archaeal communities in Sundarban mangrove sediments, *Ecotoxicology and Environmental Safety*, Volume 195, 2020, 110481, ISSN 0147-6513, Shayantan Mukherji, Anandita Ghosh, Chandrima Bhattacharyya, Ivy Mallick, **Anish Bhattacharyya**, Suparna Mitra, Abhrajyoti Ghosh.

9) Mutators drive evolution of multi-resistance to antibiotics. Danna R. Gifford, Ernesto Berríos Caro, Christine Joerres, Marc Suñé, Jessica H. Forsyth, **Anish Bhattacharyya**, Tobias Galla, Christopher G. Knight. 2023, *Plos Genetics*, volume: 19, Issue: 6, doi: <https://doi.org/10.1371/journal.pgen.1010791>

10) Changes in the underlying mutational spectrum underlie mutation rate plasticity. Danna R. Gifford, **Anish Bhattacharyya**, Alexandra Geim, Eleanor Marshall, Rok Krašovec, Christopher G. Knight. 2024 *Microbiology*, Issue 4, Volume: 170, doi: <https://doi.org/10.1101/2023.04.06.535897>

Manuscript under preparation

1) Assessment of the fitness landscape of E.coli under different evolutionary paradigm and changing environmental conditions. **Anish Bhattacharyya**, Danna Gifford, Christopher Knight, Simon Lovell. (Processing)

2) Diversity and the phenotypic implications of novel plasmids in clinically isolated E.coli from Urinary tract infection patients. **Anish Bhattacharyya**, Rosie Clover, Danna Gifford, Christopher Knight. (Processing)

Journals Associated with

As Reviewer: 3 Biotech; Journal of Biomedical Science; The ISME Journal.

As Editorial Manager: Watershed Ecology and Environment

Education:

Post-Graduation

2007-2009: Masters in Biochemistry under University of Calcutta.

Specialization: Cancer immunology, & Industrial microbiology

Graduation

2004-2007: Bachelor in Biochemistry under University of Calcutta(Gurudas College, Kolkata)

General Papers: Physics and Microbiology.

Schooling

2002-2004: Higher secondary Education under

WBCHSE (Kedarnath Institution, Howrah)

Papers: Physics, Chemistry, Mathematics, Biology, English and Bengali Up to 2002: Secondary

Education under WBBSE (Howrah Zilla School, Howrah)

Seminars & Workshops:

Oral Presentations:

- FEMS 2017, Valencia, Spain (only Indian and youngest participant with an oral presentation). Presented in the highly acclaimed program “*One health initiative*” with a talk titled, ‘*Evaluation and assessment of antibiotic resistance in the pristine estuary of Indian Sundarbans, a world heritage site.*’ Also got awarded with a presentation opportunity ceremonial program “*Engage your audience*”.
- *Oral and poster presentation* in MNM (Microbiology in the New Millennium). Kolkata, 2017.

Poster Presentations:

- Society of Biological Chemists (SBC), Kolkata, 2012.
- International Conference on Advances in Biotechnology and Bioinformatics (ICABB), Pune, 2013.
- Society of Biological Chemists (SBC), Odisha, 2014.

Invited Lectures:

- World Ocean day International symposium, ECSF, 2023
- World Mangrove Day National conference, Adamas University, 2024
- National conference on mangrove awareness, Basirhat College, 2024

Workshops (organized and participated):

- Two day National Seminar cum workshop on "Workshop in next gen pyrosequencing Approach - Metagenomic study of Coastal and marine microbial diversity". 5 - 6th October, 2012.
- Seminar cum Workshop on “Microbial Structuring and its role in Marine and other ecosystems functioning” by ICZM Project, Department of Biochemistry, University of Calcutta. 15th Nov, 2014.
- Awareness program cum community workshop on “The diversity and distribution of microbes in Sundarbans estuary and the effect of global warming” at Shibganj, Basanti, West Bengal. 9th February, 2016

Students supervised (As supervisor):

PhD: 1 ongoing at Adamas University.

Students supervised (As Joint supervisor):

During PhD: 6 Post-graduate

During Post-doc: 3 Under-graduate and 2 Post-graduate students

Further Research Interests:

Dynamics, diversity, perseverance and evolution of bacterial antibiotic resistance in bacteria and bacterial biofilm and resistome study. Metagenomics- Metatranscriptomics study in different environments. I wish to devote my future research to unravel the metabolic meshwork that ultimately impart the antibiotic resistance in a bacteria. I have studied the coherent evolutionary mechanism of the genetic modulations that not only imparts antibiotic resistance but also delivers the organism with significant decrease in the metabolic cost of mutations. Moreover, in many case it is found triggering a phase transition from planktonic to biofilm also considerably heighten the antibiotic tolerance of micro-organisms. Though many new pathways of antibiotic resistance have been reported throughout the years, it is still not clear how the metabolic switch works in bacteria that triggers the cascade of signaling to develop such intricate and smart pathways to resist the impending antimicrobials. My primary objective is to find out the metabolic switch and the quorum sensing mechanism of antibiotic resistance which could tie the loose ends of microbial evolution which causes antibiotic resistance through either genotypic (mutation/compensatory mutation, antibiotic resistance gene, plasmids, lysogenic viral incorporation) or phenotypic (biofilm, slime layer) pathways.

Hands on experiences in Analytical Techniques:

PCR.

ELISA.

DNA Sequencing.

Pyrosequencing or Next-gen DNA sequencing. Q-PCR techniques.

Gel Electrophoresis.

Flow Cytometry.

Column Chromatography Southern Blotting.

Western Blotting. Transformation.

Different microscopic techniques (including SEM, TEM, AFM, Confocal etc.) Different sampling techniques and field survey.

Plating Techniques for Different Bacterial Cultures and Isolation of colony.

Biofilm assessment techniques.

DNA Isolation techniques (Ranging from Bacterial Plasmid to Human Genomic DNA). Salting in, Salting out.

Different assay techniques for different proteins and enzymes. Different recombinant DNA techniques.

Spectrometric techniques. (Spectrophotometer, Spectrofluorimeter, CD etc.). Different techniques for isolation and purification of proteins from cells etc.

Extra-Curricular Activities:

Photography with **specialization in nature & wildlife**; a passionate nature lover and have explored many interior and pound places of different forests including reserve forests and heritage sites like Kuldiha and Sundarbans. Also have experiences in ranging and hiking.

Singing; Playing Tabla (the Indian drums); Writing poems, stories & songs; In 2010, I was appointed as the **Chief Field Investigator** for the project "Sample survey of Other Backward Communities in West Bengal" from the **Centre for the Study of Social Exclusion and Inclusive Policy under the Government of West Bengal**. My responsibilities spanned from commencement of primary survey and training of surveyors of different districts to analysis of the results and development of primary note for new policy which needed excellent communicative skills, lecture demonstration skills, statistical Knowledge and skills in handling software like Microsoft excel and CorelDraw.

I was awarded with the **badge for 'Exceptional Service'** from NHS (National Health Services), United Kingdom for the services I provided during the COVID pandemic in Manchester, UK.

Hobbies Photography, travelling, listening to music, reading books.

Strengths Hardworking, honesty, sincerity and analytical thinking.

Annexures:

Masters' thesis:

The study could be summarized as,

The Hepatitis B e antigen is a very important marker of HBV replication. But although in very few patients this particular antigen is not found in their blood samples despite of the presence of active replication of HBV in their body. Studies of the HBV genomic structure revealed that a G to A transition at the nt position 1896 in the pre-core gene of HBV is a major causative mutation for the absence of the HBeAg. Thorough sequencing based analysis of the patient samples revealed that, HBeAg negative samples were of similar genotypes which contained a Uracil residue at nt 1858 which pairs up with the nt 1896 in the hairpin loop structure. A few samples were present there which did not have the nt 1896 G to A transition but the nt 1858 Uracil residue but not the vice-versa.

The study could be concluded as, the base transition at nt 1896 is highly dependent on the base present at nt 1858. The presence of Uracil at 1858 increases the probability of the mutation at nt 1896 and presence of Cytosine (as it is in the other genotypes like A, H, (F2)) at nt 1858, inhibits the G to A transition at nt 1896. Secondly, the HBeAg negativity does not result only from the nt 1896 base transition, it may result from other important mutations in the pre-core-core gene or some other anti HBeAg factors.

Ph.D. Thesis:

Micro-organisms accounts for 50% of the total biomass and 95% of the species diversity on earth. The prokaryotic counterparts of the life or the Monera kingdom consist of two major phyla as Archaea and Bacteria. This study aims to analyze the diversity as well as some functional attributes of the mentioned phyla in the estuary of Indian Sundarbans, a World Heritage Site (IUCN, 1989).

Archaeal community structure in any ecosystem is an important marker of the environmental health. In this study the diversity and distribution of archaeal communities have been evaluated using next- generation sequencing techniques. The environmental parameters were co-appraised with the data obtained from the next-generation sequencing to understand the ecosystem dynamics of this unique estuarine mangrove.

The microbial antibiotic resistance has emerged as an alarming issue in the recent days. In the next part of this research the antibiotic resistance potential of the microorganisms was studied. 18 different multi- drug resistant bacterial strains were isolated, identified and characterized in this study. The possible pathways of the resistance against different antibiotics were also assessed through genetic and biochemical studies. Moreover, the total Ampicillin resistance throughout the estuary of Sundarbans was also evaluated.

Finally, some rhizospheric, halophilic bacterial strains were isolated, identified and characterized. The PGPF (Plant Growth Promoting Factors) production capabilities of these organisms were evaluated and the mechanistic as well as kinetic potential of the PGPF production was assessed for these organisms aiming designing a potent saline environment biofertilizer.

This study ultimately provides an insight to the microbial communities in the estuary of Sundarbans, raising an alarm that both industrial and hospital wastes affected the microbial communities and in turn the environmental health. It is also evident from this study that several microbial communities may be utilized for broader human welfare and sustenance of the extreme environments.

Referees:

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