Sandhya Rai (Ph.D.)
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RESEARCH EXPERIENCE

11/2023-03/2024

Postdoctoral Associate

Baylor College of Medicine, Houston, Texas, United States.

Work Involved:

- Functional study of cohesin gene and their involvement in colorectal cancer progression.
- Drug treatment to the induced colon cancer cell line to study the impact of the drug on different biological processes such as DNA repair and DNA replication pathway.
- SNPs identification using publicly available databases.

Research Area: Colorectal cancer, SNPs, Drug target, Biomarker, Cohesin, DNA repair and replication, GWAS-ensembl.

07/2016-04/2023

Ph.D. Research fellow

Motilal Nehru National Institute of Technology, Prayagraj, India.

Project Title: Functional Insights of Potential Fusion Gene Transcript(s) in Colorectal Cancer.

Work involved:

- Identifying and evaluating fusion genes as potential biomarkers for colorectal cancer detection.
- Discovered the novel fusion gene CTNND1-RAB6A and elucidated its role in promoting cancer cell expansion.
- Through in vitro experiments, we demonstrated the function of RAB6A on cell proliferation, migration, cell cycle regulation, apoptosis, and invasion. These findings highlight its potential as a therapeutic target and underscore its significant involvement in the development of colorectal cancer.
- Additionally, confirmed and characterized the COMMD10-AP3S1 fusion gene, contributing valuable information to the field of colorectal cancer research.
- Utilized molecular docking to identify a candidate inhibitor (Ditercalinium Chloride) for this fusion protein, paving the way for targeted therapies.

Research Area: Colorectal cancer, Biomarkers, Molecular Biology, Cell Biology, Bioinformatics.

01/2016-08/2017

Project Junior Research Fellow (DBT Sponsored project)

Motilal Nehru National Institute of Technology, Prayagraj, India

Project title: Characterization of epigenetically deregulated genes in colorectal adenomas/carcinomas using Next-generation technologies for the development of novel biomarkers.

Work Involved:

- Collected colorectal tumor samples and gathered histopathological and demographic data from study participants to investigate gene and epigenetically deregulated pathways in colorectal carcinogenesis.
- Conducted comprehensive analysis of gene methylation status and expression in an exclusive cohort of colorectal carcinomas and adenomas.

Research Area: Colorectal cancer, Epigenomics, Biomarkers, Molecular Biology.

01/2013-06/2013

Internship

CSIR-National Botanical Research Institute-Lucknow, India

Project Title: Functional characterization of miR858 promoter from *Arabidopsis thaliana*

Work involved:

- Cloned and constructed the miRNA858 promoter in a suitable plant expression vector, followed by successful transformation and development of transgenic Arabidopsis thaliana (Col-0) lines, designated as Pro: miR858 Arabidopsis transgenic lines.
- Conducted functional characterization of miR858a in Arabidopsis, including histochemical GUS reporter gene analysis at various time intervals and under different stress conditions.
- Employed Real-Time PCR for precise expression analysis of the transgenic lines.

Research Area: Plant biotechnology, Molecular biology, miRNA, Reporter gene assay, Stress induction.

05/2012-06/2012

Internship

MRD Life Sciences Pvt. Ltd.-Lucknow, India

Techniques learned: It involves Hands-on Training in advanced instrumentation.

- Molecular biology and biochemical techniques, Genomic DNA and RNA isolation from cell lines, Plasmid DNA isolation, SDS-PAGE, Restriction Digestion and Ligation, Competent Cell Preparation, Transformation-Blue-White Screening, Antibiotic Sensitivity Test.
- Multi-drug resistance (MDR) Test, Minimum Inhibitory Concentration (MIC) Test.

06/2012-07/2012

Internship

MRD Life Sciences Pvt. Ltd.-Lucknow, India

Project Title: A Study on antibacterial properties of *Madhuca longifolia*.

Work Involved:

- Antibacterial activity test, Minimum Inhibitory, Concentration test, Plant Extraction.

Research Area: Plant Biotechnology, Molecular Biology.

ACADEMIC SYNOPSIS

2016 -2023

Doctor of Philosophy (Ph.D.) (Cancer Biology)

Motilal Nehru National Institute of Technology, Prayagraj, UP.

Thesis Title: Functional insights of potential fusion gene transcript(s) in colorectal cancer.

2011 -2013

Master of Science: Biotechnology (9.57 CGPA)

Sam Higginbottom Institute of Agriculture Technology, Prayagraj

Dissertation: Functional characterization of miR858 promoter from *Arabidopsis thaliana.*

2008 -2011

Bachelor of Science (63.9%)

Ewing Christian College, Prayagraj, UP

TECHNICAL SKILLS

Cell culture

- Cell line transfection
- Scratch assay
- Trans-well Migration assay (Invasion)
- Flow cytometer
- Drug treatment
- MTT Assay
- Fluorescence and light microscopy
- Primary and secondary mammalian cell culture
- Confocal microscopy
- Immunofluorescence assay

Animal handling & maintenance

- Breeding
- Genotyping
- Dissection

Bioinformatics

- Python (Learning)
- Modeling, Molecular Docking
- Cytoscape, R language (Learning)
- TCGA, c-Bio portal, COSMIC, Star-Fusion, GWAS-ensemble, etc.
- Multiple Alignments etc.

Molecular biology

- RNA extraction from Tissue and cells
- Plasmid DNA isolation
- Reverse transcription (cDNA Conversion)
- Primer designing
- Restriction Digestions and Ligation
- Gene Cloning, Transformation (Blue-White Screening)
- Real-Time PCR
- Electrophoretic Techniques
- Quantification and Purification
- Denaturing-PAGE
- Western Blotting
- COMET assay
- DNA Fibre Assay
- Protein extraction

HONORS AND CONFERENCES

- **Council of Scientific & Industrial Research (CSIR-NET/JRF),** with All India Ranked **71th** in 2016.
- Attended workshop on "**Genomics, Proteomics and Personalized Medicine- GiAN**" and got an **Excellence Student Award**.
- Presented poster on "**RNA-Seq. analysis reveals novel fusion gene transcripts in laterally spreading tumours**" at "International Conference on Nextgen genomics, biology, Bioinformatics, and Technologies" held Taj Lands' End, Mumbai, India (September 30th - October 2nd, 2019). Got the **Gyan scholarship award** for participation and an **honourable mention award** for poster presentation.
- Volunteered as a student coordinator in organizing the international conference- Bio Sangam 2022, from March 10-12, 2022, at the Department of Biotechnology, MNNIT Allahabad, Prayagraj, India.
- Attended a national seminar on **'Impact of Physics on Biological Sciences'** held on August 26th, 2010, at Ewing Christian College, Allahabad.
- Attended a one-day seminar on **'Recent Advances in Polymer Sciences with Special References to Biodegradable Polymers'** held on September 25th, 2010, held in Ewing Christian College, Allahabad.
- Attended National seminar on **'Recent Advances and New Inclinations in Biological Sciences'** held on April 18th, 2012, in SHIATS, Allahabad.
- Attended National Workshop on "Biotechnological Interventions for Societal Development' from March 21-23, 2017.
- Presented poster on "**Meta-Analysis of Fusion Gene and their correlation in the progression of Colorectal cancer**" at National conference "Accelerating Biology 2018- Digitizing Life" held at IISER Pune from 9th - 11th January 2018.
- Participated in the "International Conference on Biotechnology Interventions for Societal Development (Bio Sangam 2020)" from 21st February 2020 to 23rd February 2020.
- Presented poster on "**Identification of novel fusion gene transcripts using NGS analysis in laterally spreading tumors**" at "International Conference on Molecular Basis of Diseases & Therapeutics" held at Central University of Rajasthan from 8th -10th March 2019.

RESEARCH ARTICLE & BOOK CHAPTERS

Research papers:

- ***Sandhya Rai***, Manish Pratap Singh, Abhipsa Sinha, Ankit Srivastava, Dipak Datta, Sameer Srivastava (2023), Unravelling a novel CTNND1-RAB6A fusion transcript: Implication in colon cancer cells migration. (https://doi.org/10.1016/j.ijbiomac.2024.129981).
- ***Sandhya Rai***, Manish Pratap Singh, Shikha Kushwaha, Shweta Srivastava, Ashutosh Mani, & Sameer Srivastava. (2023). Ditercalinium chloride: A potential inhibitor targeting recurrent in-frame COMMD10-AP3S1 fusions in CRCs. ***Gene Reports***, 101739.
- ***Sandhya Rai***, Manish Pratap Singh, & Sameer Srivastava, (2022) Integrated Bioinformatics analysis identifies novel fusion transcripts in laterally spreading tumor of colorectum. ***Journal of Gastrointestinal Cancer (Springer Nature)*** DOI: 10.1007/s12029-022-00881-5.

- Manish Pratap Singh, ***Sandhya Rai***, Sarvesh Kumar Gupta, Nand Kumar Singh, & Sameer Srivastava. (2023). Unsupervised machine learning-based clustering identifies unique molecular signatures of colorectal cancer with distinct clinical outcomes. **Genes & Diseases.**
- Manish Pratap Singh, Shraddha Suyal, ***Sandhya Rai***, Saumya Yadav, Alka Singh, Manisha Sachan, Nand K. Singh, & Sameer Srivastava, (2022). Investigation of BRCA1 methylation and FAT3 mutation as a potential biomarker in ovarian cancer samples. **Human Gene**, 33, p.201032.
- Manish Pratap Singh, ***Sandhya Rai***, Nand Kumar Singh, & Sameer Srivastava. (2021). Transcriptomic landscape of early age onset of colorectal cancer identifies novel genes and pathways in Indian CRC patients. **Scientific Reports**, (2021) 11:11765.
- Manish Pratap Singh, ***Sandhya Rai***, Ashutosh Pandey, Nand Kumar Singh, & Sameer Srivastava (2019). Molecular subtypes of colorectal cancer: an emerging therapeutic opportunity for personalized medicine. **Genes & Diseases**.
- Manish Pratap Singh, ***Sandhya Rai***, Shraddha Suyal, Nand Kumar Singh, Akash Agarwal, & Sameer Srivastava. (2017). Genetic and epigenetic markers in colorectal cancer screening: recent advances. **Expert Review of Molecular Diagnostics**.

Book chapters:

- Ankit Srivastava, ***Sandhya Rai***, Deepa Bisht, Manisha Sachan, Bimal Prasad Jit, Sameer Srivastava (2022). Targeting the altered tyrosine kinases in colorectal cancer: From inhibitors to drugs. **In Protein Kinase Inhibitors** (pp. 361-391). Academic Press.
- Ankit Srivastava, ***Sandhya Rai***, Manish Pratap Singh & Sameer Srivastava (2022). Computational Intelligence-Based Gene Expression Analysis in Colorectal Cancer: A Review. **Computational Intelligence in Oncology**, 387-410.

Conference papers:

- ***Sandhya Rai,*** Manish Pratap Singh, & Sameer Srivastava, (2019). **"Identification of novel fusion gene transcripts using NGS analysis in laterally spreading tumours"**. International Conference on Molecular Basis of Diseases & Therapeutics, Central University of Rajasthan.
- ***Sandhya Rai,*** Manish Pratap Singh, & Sameer Srivastava, (2019). **"RNA seq. analysis reveals novel fusion gene transcripts in laterally spreading tumours"**. International Conference on Nextgen Genomics, Biology, Bioinformatics, and Technologies held Taj Lands' End, Mumbai, India.
- ***Sandhya Rai,*** Manish Pratap Singh, & Sameer Srivastava, (2018). "**Meta-Analysis of Fusion Gene and their correlation in the progression of Colorectal cancer"**. Accelerating Biology 2018- Digitizing Life IISER Pune.
- Manish Pratap Singh, Shraddha Suyal, Ankit Singh, ***Sandhya Rai***, Manisha Sachan, Nand Kumar Singh, & Sameer Srivastava, (2018) **"Methylation status of promoter of six tumour suppressor genes in ovarian cancer**", BioSangam 2018.
- Manish Pratap Singh, ***Sandhya Rai,*** Shraddha Suyal, Nand Kumar Singh, & Sameer Srivastava, (2017). **"A simple Q-PCR test to evaluate various molecular subtypes in CRC for better prognosis & treatment"**. 3rd E.A.C.R. Conference on cancer genomics.
- Manish Pratap Singh, ***Sandhya Rai,*** Shraddha Suyal, Nand Kumar Singh, & Sameer Srivastava (2017). **"Molecular profiling & Colorectal cancer in Indian population"**. 3rd international Conference on new frontiers in Industrial & Applied Biotechnology.

REFERENCES

1. **Dr. Sameer Srivastava** (Associate Professor) (Thesis Supervisor)
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