

Dr. Deepti (Appukuttan) Harinder

Post-Doctoral Researcher



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ACADEMIC QUALIFICATIONS

- 2008 **Ph.D. (Microbiology)**, Mumbai University, Maharashtra.
Thesis Title: Genetic Engineering of *Deinococcus radiodurans* for bioremediation of nuclear waste.
Guide: Dr. Shree Kumar Apte, Director Bio-Medical Group, Bhabha Atomic Research Centre, India.
- 2002 **M.Sc. (Microbiology)** : 70%, Mumbai University, Maharashtra, India
- 2000 **B.Sc. (Microbiology)** : 72.37%, Mumbai University, Maharashtra, India
- 1997 International Baccalaureate (IB) : Danube International School, Vienna, Austria
- 1995 International General Certificate for Secondary Education (IGCSE), Cambridge University: Danube International School, Vienna, Austria

CAREER PROFILE AS A RESEARCHER

Mar 2015 to present: IIT Post-doctoral fellow, IITB Bombay

Genome scale metabolic model cross-linking stress resistance and metabolic pathways.

- Phenotypic characterization of multi-stress resistant strain to link its stress resistance to metabolic pathways.
- Study the metabolic flux through such strains and compare them to wild-type and thus identify the important metabolic nodes which function differentially between them.

Jun-Dec 2014: Research Associate at IIT Bombay

Metabolic engineering of a model cyanobacterium *Synechococcus* sp. PCC 7002 for enhanced bio-fuel production

- Physiological characterization of *Synechococcus* sp. PCC 7002 in terms of its protein and lipid content.

- Developing GC-MS based method for detection of metabolites (organic acids, sugar phosphates etc).

Dec 2011-Dec 2013: Post-doctoral fellow at Korea Atomic Energy Research Institute (KAERI), South Korea.

Project 1: Expression and Mutational Analysis of DinB-Like Protein DR0053 in *Deinococcus radiodurans*.

Deinococcus radiodurans is a poly-extremophilic organism, capable of tolerating a wide variety of different stresses like gamma/UV radiation, desiccation and oxidative stress. However its radiation resistance mechanism remains unknown. This study involved characterization of one of the highly radiation-induced genes, namely DR0053 to determine its contribution to radiation resistance.

Project 2: Characterization of the two-component signal transduction system (TCS) of *Deinococcus radiodurans*.

TCS helps an organism to recognize and transduce signals thereby enabling it to respond to diverse environmental conditions. A study was initiated to understand the TCS of this unique organism. Several histidine kinase and response regulator mutants were constructed and its effect on various stresses was studied, followed by their characterization using microarray analysis, enzymatic assays and Chromatin Immunoprecipitation.

Project 3: Engineering stress tolerance in sensitive strains.

Our studies with TCS and other regulatory components led to the identification of certain key regulators which could be used for engineering stress tolerance in sensitive strains like *E. coli*, thereby greatly increasing their tolerance to survive certain stresses. The mechanism of stress tolerance was explored in detail using several different techniques like microarray analysis, RT-PCR, zymography, EMSA, mutational studies, among others.

Jan 2009-Jan 2011: Research Scientist at Saf Labs Pvt. Ltd., Mumbai, India.

SAF Labs operates as a supplier for scientific products and services to the Indian research and clinical markets.

Key Responsibilities:

- Functionally set up the lab for cloning, sub-cloning, site-directed mutagenesis and DNA sequencing services

- Standardized DNA sequencing for the lab and took it to DNA sequencing service provider level.
- Set up 16s rDNA sequencing facility for identification of organisms
- Trained M.Sc. level entrants for carrying out cloning, sub-cloning, site-directed mutagenesis and DNA sequencing
- Overall supervision of the lab in terms of both administrative and scientific work
- Also worked as a Technical Specialist, providing pre- and post-sales support for all our products (ORF/expression clones, DNA polymerases, transfection reagents, purification kits, cDNA library construction kits etc.)
- Assisting the sales and back office team to understand various aspects of the products in a scientific manner so that they can serve the scientists better.

Dec 2002-May 2008: Worked as PhD Research Scholar in Molecular Biology Division, BARC, Mumbai.

Summary of doctoral thesis: The study was conceived to develop a genetically engineered bacterial strain for bioremediation of radioactive waste. The key results are listed below.

- An acid phosphatase (*phoN*) gene from *Salmonella* was cloned and expressed under the influence of a strong deinococcal promoter (*groESL*) in both *E. coli* and *Deinococcus radiodurans* (a highly radiation resistant organism).
- *E. coli* and *D. radiodurans* recombinant clones were able to precipitate >90% uranium in approximately three hours from 1mM uranyl nitrate solution.
- The superiority of *Deinococcus* clone was demonstrated under high radiation background. The clone could efficiently precipitate uranium even after exposures to 6 kGy of gamma radiation.
- The precipitated uranium was characterized using energy dispersive X-ray fluorescence (EDXRF) and X-ray diffraction (XRD) analyses. The precipitate was identified as hydrogen uranyl phosphate (HUO_2PO_4). The precipitate remained tightly associated with the cell surface, thus facilitating easy recovery.
- The recombinant clones were also subjected to lyophilization. Lyophilization could achieve extended shelf-life (up to six months at room temperature) for the recombinant clones in terms of both PhoN activity and uranium precipitation ability apart from increasing the ease of handling by converting it into powdered form.

LABORATORY PROFICIENCY/OTHER SKILLS

- PCR (Simple/Gradient/Nested/Touch-down), primer designing and optimization, primer walking, RTPCR
- Plasmid / Genomic DNA / RNA isolation from bacterial cultures
- Gene Cloning, Signal peptide engineering, Site-directed mutagenesis
- DNA Sequencing, Identification of bacterial strain using 16s rDNA sequencing
- Microarray Analysis
- Chromatin Immunoprecipitation assays
- Protein Purification
- GC-MS: Sample preparation, derivatization and analysis
- Agarose gel electrophoresis, SDS-PAGE, western blotting, RNA blotting and hybridization
- Cell disruption methods like Sonication and French press
- *In vivo* and *in vitro* (Zymogram) enzyme activity studies
- Immobilization of whole cells in polyacrylamide gels
- Uranium precipitation studies
- Lyophilization of bacterial cultures
- EDXRF and XRD studies
- SEM Image Analysis
- Proficient in commonly used bioinformatic tools (Clustal Analysis, BLAST Analysis, DNAMAN, Serial Cloner, Chromas, Swissprot, String, Phyre, etc)
- Efficient organizational, verbal and written communication skills

PUBLICATIONS

1. **Deepti Appukuttan** *et al.*, (2015) Expression and mutational analysis of DinB-like protein DR0053 in *Deinococcus radiodurans*. *PLoS One.*, 10(2): e0118275.
2. Singh H, **Deepti Appukuttan** and Lim S (2014) Hsp20, a small heat shock protein of *Deinococcus radiodurans*, confers tolerance to hydrogen peroxide in *Escherichia coli*. *J Microbiol Biotechnol.*, Vol. 24: 1118-22.
3. Misra CS*, **Deepti Appukuttan*** *et al.* (2012) Recombinant *D. radiodurans* cells for bioremediation of heavy metals from acidic / neutral aqueous wastes. *Bioengineered Bugs*, Vol. 3: 44-48.

*Equal contribution authors

4. **Deepti Appukuttan et al.** (2011) PhoN-expressing, lyophilized, recombinant *Deinococcus radiodurans* cells for uranium bioprecipitation. *J Biotechnol*, Vol. 154: 285-290.
5. **Deepti Appukuttan et al.** (2010) Natural and Recombinant bacteria for bioremediation of uranium from acidic/alkaline aqueous solutions in high radiation environment. *J Biotechnol*, Vol. 150S: S53.
6. **Deepti Appukuttan et al.** (2006) Engineering of *Deinococcus radiodurans* R1 for bioprecipitation of uranium from dilute nuclear waste. *Appl Environ Microbiol*, Vol. 72: 7873–7878.

POSTER PRESENTATIONS IN SYMPOSIUM/CONFERENCE

- **D. Harinder et al.**, 2013. Enhanced stress tolerance of *Escherichia coli* harboring a response regulator of *Deinococcus radiodurans*, Bioenergy Korea Conference International Symposium, 12-14th November 2013, Jeju Island, South Korea.
- **D. Harinder et al.**, 2013. Role of *Deinococcus radiodurans* response regulator in maintaining homeostasis of the cell, 40th Anniversary International Symposium and Annual Meeting (ISAM), The Korean Society for Microbiology and Biotechnology, 3-5th July 2013, Alpensia, Pyeongchang, South Korea.
- H. Singh, **D. Harinder et al.**, 2013. The effect of Deinococcal Hsp20 on Oxidative Stress Tolerance of *Escherichia coli*, ISAM, KSMB, 3-5th July 2013, Alpensia, Pyeongchang, South Korea.
- **D. Harinder et al.**, 2012. Involvement of two-component system in stress tolerance of *Deinococcus radiodurans*, Korean Society for Molecular and Cellular Biology (KSMCB) Annual Meeting, 10-12th October 2012, COEX, Seoul, South Korea.
- H. Singh, **D. Harinder et al.**, 2012. Effect of the *Deinococcus radiodurans* HSP20 and pprM on the resistance of *E. coli* to DNA damaging agents, ISAM, KSMB, 27-29th June 2012, BEXCO, Busan, South Korea.
- **D. Appukuttan et al.**, 2005. Bioprecipitation of Uranium by Genetically Engineered *Deinococcus radiodurans*, 46th Annual conference, Association of Microbiologists of India (AMI), 8-10th December, 2005, Osmania University, Hyderabad, India.
- S. K. Apte, A. S. Rao, **D. Appukuttan et al.**, 2005. Genetic Engineering Microbes for Bioremediation/Biorecovery of Uranium in Indian Nuclear Society (INS) conference, 9-10th September, 2005 at BARC, Mumbai, India.

SEQUENCE SUBMISSION TO NCBI

Deepti A., Rao, A. S. and Apte, S. K. (2004). *Sphingomonas* sp. BSAR-1 16S ribosomal RNA gene. **AY764287** (Direct submission).

AWARDS AND HONOURS

- **First prize** in the Ph.D category for the paper entitled “Engineering of *Deinococcus radiodurans* R1 for bioprecipitation of uranium from dilute nuclear waste” at **Dr. Dhala’s Felicitation Fund (DFF) Fifteenth Annual Research Paper Presentation Competition**, held in Mumbai on March 1, 2007.
- Gave **demonstration on “PhoN-based bio-precipitation of uranium”** to **Director, BARC** on 11th March 2008 at Modular Labs, BARC.
- **DAE-Mumbai University Collaborative Research Fellowship** for pursuing Ph.D. in December 2002.
- **Qualified for the research fellowship** from Tata Institute of Research Centre (TIFR) for pursuing Ph.D. in Aug 2002.

MEMBERSHIP OF PROFESSIONAL SOCIETIES

- American Society for Microbiology (ASM) : Postdoc Member
- Korean Society for Molecular and Cellular Biology : Member

PERSONAL DETAILS

Date of Birth	3 rd April, 1980
Nationality	Indian
Sex	Female
Marital Status	Married
Languages	English, Hindi and Malayalam

REFERENCES

Dr. S. K. Apte (Ph.D. Guide)

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