Dr. Utpal Mohan, Ph.D.

Assistant Professor,
Department of Biotechnology,
NIPER Guwahati.

Passion drives creativity and creativity drives innovation. This has been my source of inspiration throughout my scientific journey so far. My entire research experience starting from Ph.D. to current position, has prepared me well to establish myself as a Synthetic Biologist to harness the power of creating/engineering the biomolecules to create novel enzymes, gene regulation tools & biopharmaceuticals.

Education

2005-2009 - **Ph.D.; National Institute of Pharmaceutical Education & Research (NIPER) Mohali.**
Research Advisor: **Dr. Uttam Chand Banerjee**

2002 - **M.Sc. (Biotechnology); Punjabi University, Patiala.**

2000 - **B.Sc. (Biotechnology); Punjab University, Chandigarh.**

Research Experience:

2012-2013 **Research Associate, NIPER Mohali**

Initiated and led research: Generation of Template Independent Coding Sequences (GeneTICS) for the creation of entirely novel gene and protein libraries for the development of biopharmaceuticals and novel industrial enzymes.

2009-2012 **Postdoctoral Fellow, Colorado State University**
Fort Collins, USA
Research Advisor: Dr. Brian R. McNaughton

Initiated and led research: Worked on three different projects. First project was on developing an approach for down regulating cancer genes via their 5' untranslated region (UTR). Targeting 5' untranslated region (UTR) for oncogene regulation has a great potential as a therapeutic approach against cancer. The second project was to develop deoxyribozymes by directed evolution, which can catalyze a Friedel Crafts reaction. The ability to use DNA as a catalyst for organic reactions could be a huge turning point in increasing the repertoire of green processes available to us. Third project was on the development of Cell penetrating peptides using phage surface display, which can target specific cancer cell targets.

2005-2009 **National Institute of Pharmaceutical Education and Research (NIPER), Mohali, Punjab**
Research Advisor: Dr. Uttam Chand Banerjee

Initiated and led research: My PhD work focused on directed evolution approaches using *Pseudomonas aeruginosa* lipase as model enzyme and involved development of two novel approaches for random chemical mutagenesis. I developed a novel Dual Approach to Random Chemical Mutagenesis (DuARCheM) to introduce random mutations in a defined DNA fragment. DuARCheM involves in vivo chemical mutagenesis and in vitro genetic manipulations. I also developed and optimized a PCR based system where oxidized nucleotides are misincorporated to result in a highly efficient random chemical mutagenesis approach.

2002-2004 **Junior Research Fellow – Central Drug Research Institute, Lucknow**

I worked on *Mycobacterium Tuberculosis* proteins responsible for the pathogenesis of the organism. I was involved in the cloning, expression and antibody generation of proteins of *Mycobacterium Tuberculosis*.

Research Interest:

Development of Biopharmaceuticals using Synthetic Biology approaches


- Development of synthetic riboswitches to suppress gene expression in case of various life-threatening diseases.
- Development of deoxyribozymes, which could degrade RNA of various oncogenes.
- Generation of various novel protein coding sequences, which could be further developed as biopharmaceuticals.
- Suitability of G-quadruplexes as gene regulation tool in cancer and other diseases.
- Directed evolution of therapeutic proteins for enhanced activity and least immunogenicity.

Ongoing research:

- We are interested in Generation of Template Independent Coding Sequences (GeneTICS) for the creation of entirely novel gene and protein libraries for the development of biopharmaceuticals and novel industrial enzymes. We would further like to utilize this tool to develop synthetic ribozymes and deoxyribozymes for antiviral activity and anticancer activity.

- We are interested in gene regulation of oncogenes and genes crucial for pathogenesis or survival of infectious microorganisms through Untranslated regions (UTRs) of mRNA. 5' UTR mediated gene regulation is a possible way to stop/decrease disease progress and pathogenesis.

- We are utilizing CRISPR-Cas9 genome engineering system to target various targets in acute myeloid Leukemia. We are also interested in generating G-quadruplex based synthetic riboswitches and their introduction in 5'UTR of oncogenes to downregulate them through CRISPR-Cas9 genome engineering tool in live cells.

List of Publications:

1. Ghosh S.; **Mohan U.**; Banerjee U.C. "Studies on the production of shikimic acid using the aroK knockout strain of *Bacillus megaterium*". World J. Microbiol. Biotechnol., 2016, 32(8):127.

2. Mohan, U.; Burai, R.; McNaughton, B.R. "Reactivity Between Acetone and Single-Stranded DNA Containing a 5'-Terminated 2'-Fluoro-N7-Methyl Guanine". Tetrahedron Letters, 2014, 55:3358.

3. Utpal Mohan, Ritwik Burai, Brian R. McNaughton. "*In vitro* evolution of a Friedel-Crafts Deoxyribozyme". Org. Biomol. Chem. 2013, 14:2241-2244.

4. Sandra M. DePorter, Irene Lui, **Utpal Mohan,** Brian R. McNaughton. "A protein transduction domain with cell uptake and selectivity profiles that are controlled by multivalency effects". Chem. Biol. 2013, 20:434-444.

5. Shubhangi Kaushik, **Utpal Mohan,** U.C. Banerjee. "Exploring residues crucial for nitrilase by site directed mutagenesis to gain better insight into sequence-function relationships". Int. J. Biochem. Mol. biol. 2012, 3:384-391.

6. Brett D. Blakeley, Sandra M. DePorter, **Utpal Mohan**, Ritwik Burai, Blanton S. Tolbert, Brian R. McNaughton. "Methods for identifying and characterizing interactions involving RNA". Tetrahedron. 2012, 68:8837.

7. Utpal Mohan, Shubhangi Kaushik and Uttam Chand Banerjee. "PCR Based Random Mutagenesis Approach for a Defined DNA Sequence Using the Mutagenic Potential of Oxidized Nucleotide Products". Open Biotechnol. J. 2011, 5:21-27.

8. Shubhangi Kaushik, Sonali Rohamare, **Utpal Mohan,** U.C. Banerjee. "Screening strategy for high throughput selection of nitrilase producing microorganisms and mutants for the production of pharmaceutically important drugs and drug intermediates". Intl. J. Pharm. Sci. Tech. 2011.

9. Kumar S, **Mohan U,** Kamble AL, Pawar S, Banerjee UC. "Cross-linked enzyme aggregates of recombinant *Pseudomonas putida* nitrilase for enantioselective nitrile hydrolysis". Biores. Technol. 2010, 101:6856-8.

10. Mohan U, Banerjee UC. "Molecular evolution of a defined DNA sequence with accumulation of mutations in a single round by a dual approach to random chemical mutagenesis (DuARCheM)". Chembiochem. 2008, 9:2238-43.

11. Tekewe A, Singh S, Singh M, **Mohan U,** Banerjee UC. "Development and validation of HPLC method for the resolution of drug intermediates: DL-3-Phenyllactic acid, DL-O-acetyl-3-phenyllactic acid and (+/-)-mexiletine acetamide enantiomers". Talanta. 2008, 75:239-45.