

## Navneet Rai, Ph.D.

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### Summary

- Specialized in microbiology, molecular biology, fermentation and synthetic biology.
- Extensive knowledge of a wide range of molecular biology techniques such as Cloning, Gene amplification, Random and targeted mutagenesis, Chromosomal gene integration & knock-out, Riboswitch engineering, Gene expression measurement, High throughput screening and Next Generation Sequencing.
- Experience with handling of BSLI & II organisms, including bacteria and mammalian cell lines.
- Always open to collaborating with researchers and industry partners.
- Excellent leadership, and communication skill.

### Technical Skills

- ◆ Cloning (Biobrick assembly, CPEC, LCR, Gibson, SLICE) ◆ Bioreactor (Biostat Q plus & BioFlo 115)
- ◆ Random and targeted mutagenesis ◆ Chromosomal gene integration & knock-out
- ◆ Riboswitch engineering ◆ RT-PCR ◆ Flow cytometry ◆ Microscopy ◆ Fluorimetry
- ◆ Bacterial, animal and plant cell cultures ○ DNA & RNA isolation ◆ Next generation sequencing
- ◆ Matlab, R, Python, CorelDraw, Photoshop, Inkscape, OriginPro

### Research Experience

- **Specialist**, University of California Davis 09/2018-present
  - ◆ Design and characterization of promoter libraries. ◆ Design and characterization of synthetic associative memory in *E. coli*. ◆ Design and characterization of repressible TALE system to control targeted gene expression. ◆
- **Postdoctoral Research Associate**, University of California Davis 09/2012-09/2018
  - ◆ Design and characterization of promoter libraries. ◆ Design and characterization of synthetic associative memory in *E. coli*. ◆ Design and characterization of repressible TALE system to control targeted gene expression. ◆ Evolution of *E. coli* in long-run chemostat. ◆ Multi-omics predictive models. ◆ Design and characterization of transcriptional cascade circuits.
- **Master of Science**, Guru Nanak Dev University, Amritsar, India 01/2005-06/2005  
Project: *Effect of abiotic stress on the expression of phosphatidylglycerol phosphate in wheat.*
- **Internship**, G. S. Khush Laboratories, Punjab Agricultural University, Ludhiana, India 06/2004-04/2004  
Project: *Particle Gun Mediated Genetic Transformation of Rice (Bt-gene).*

### Education History

- **Ph.D. in Synthetic Biology** from Indian Institute of Technology Bombay and National Centre for Biological Sciences (TIFR) Bangalore, India 2012
  - Title: Design and characterization of synthetic transcriptional feedback loops
  - Supervisor: Prof. K.V. Venkatesh, Indian Institute of Technology, Bombay
  - Co-Supervisor: Dr. Mukund Thattai, National Centre for Biological Sciences, Bangalore
- **M.Sc. in Biotechnology** from Guru Nanak Dev University, Amritsar, Punjab, India 2005

### Scholarships and Awards

1. Start-up award from The Extreme Science and Engineering Discovery Environment (2018).
2. Scholarship from the International Workshop on Bio-Design Automation (IWBD) 2015 to attend the workshop in Seattle, USA.
3. Start-up award from The Extreme Science and Engineering Discovery Environment (2015).
4. Advisor of the UC Davis-International Genetically Engineered Machine (iGEM) 2013 team. Team won the **Gold** medal.

5. Advisor of the IIT Bombay-iGEM 2009 team. Team won the **Silver** medal.
6. Advisor of the Arts Science Bangalore-iGEM 2009 team. Team won the **Bronze** medal.
7. Travel grant from the Chalmers University of Technology, Sweden to attend the International Conference on Systems Biology, in Gothenburg, Sweden (2008).
8. Travel grant from the IET (Institution of Engineering and Technology) to attend the IET-BioSysBio conference at Imperial College, London (2008).
9. Travel grant from the Indian Institute of Technology Bombay to attend the IET-BioSysBio conference at Imperial College, London (2008).
10. Advisor of the NCBS Bangalore-iGEM 2007 team. Team won the **Gold** medal.
11. Qualified All India Graduate Aptitude Test in Engineering (GATE), 2005.
12. Qualified All India DBT-JRF programme conducted by the Department of Biotechnology, Govt. of India, 2005.
13. Qualified Joint CSIR-UGC National Eligibility Test (Junior Research Fellowship), 2004.
14. Scholarship for the M.Sc. Biotechnology programme from the Department of Biotechnology Govt. of India (2003-2005).

### Publications

1. Minseung Kim, Nick Joodi, **Navneet Rai**, Beatriz Pereira, and Ilias Tagkopoulos. Automatic knowledge base construction and hypothesis generation: antibiotic resistance mechanisms for *Escherichia coli* (**Under Preparation**).
2. **Navneet Rai**, Minseung Kim, Ilias Tagkopoulos. Understanding the formation and mechanism of anticipatory responses in *Escherichia coli* (**Under Submission**).
3. Ki-Jo Kim, **Navneet Rai**, Minseung Kim, Ilias Tagkopoulos. A network-based model for drug repurposing in Rheumatoid Arthritis. (**Under Review**).
4. Xiaokang Wang, **Navneet Rai**, Beatriz Merchel Piovesan Pereira, Ameen Eetemadi, and Ilias Tagkopoulos. Accelerated knowledge discovery from omics data by optimal experimental design (**Under revision in Nature Communications**)
5. Ameen Eetemadi, **Navneet Rai**, Beatriz Merchel Piovesan Pereira, Minseung Kim, Ilias Tagkopoulos. Discover Microbes You Need, Engineer Diet They Seek (**Accepted Frontiers in Microbiology**, 2020).
6. **Navneet Rai**, Linh Huynh, Minseung Kim, Ilias Tagkopoulos. Population collapse and adaptive rescue during long-term chemostat fermentation. **Biotechnology and Bioengineering** 116 (3), 693-703, 2019. **[IF: 4.5]**.
7. Violeta Zorraquino-Salvo, Minseung Kim, **Navneet Rai**, Ilias Tagkopoulos. The genetic and transcriptional basis of short- and long-term adaptation across multiple stresses in *Escherichia coli*. **Molecular Biology and Evolution**, 34(3):707-717, 2017. **[IF: 13.6]**.
8. Minseung Kim, **Navneet Rai**, Violeta Zorraquino, Ilias Tagkopoulos. Multi-omics integration accurately predicts cellular state in unexplored conditions for *Escherichia coli*. **Nature Communications**, 7: 13090, 2016 **[IF: 11.33]**.
9. **Navneet Rai**, Aura Ferreira, Alexander Neckelmann, Amy Soon, Andrew Yao, Justin Siegel, Marc Facciotti, Ilias Tagkopoulos. RiboTALE: A modular, inducible system for accurate gene expression control. **Scientific Reports**, 10658, 2015 **[IF: 5.27]**.
10. **Navneet Rai\***, Rewa Rai, KV Venkatesh. Quorum Sensing Biosensors. **Springer**, 173-183, 2015. (**\*corresponding author**).
11. **Navneet Rai\***, Rewa Rai, KV Venkatesh. Quorum Sensing in Competence and Sporulation. **Springer**, 61-64, 2015. (**\*corresponding author**).
12. Javier Carrera, Raissa Estrela, Jing Luo, **Navneet Rai**, Athanasios Tsoukalas, Ilias Tagkopoulos. An integrative, multi-scale, genome-wide model reveals the phenotypic landscape of *Escherichia coli*. **Molecular Systems Biology**, 10 (7), 2014 **[IF: 10.5]**.

13. Mahendra P Kashyap, Abhishek K Singh, Dharmendra K Yadav, Maqsood A Siddiqui, Ritesh K Srivastava, Vishal Chaturvedi, **Navneet Rai**. 4-Hydroxy-trans-2-nonenal (4-HNE) induces neuronal SH-SY5Y cell death via hampering ATP binding at kinase domain of Akt1. *Archives of toxicology*, 1-16, 2014 [IF: 6.64].
14. Rajat Anand, **Navneet Rai**, Mukund Thattai. Interactions among quorum sensing inhibitors *PLoS One*; 8(4):e62254, 2013 [IF: 3.54].
15. **Navneet Rai**, Rajat Anand, Krishna Ramkumar, Varun Sreenivasan, Sugat Dabholkar, K. V. Venkatesh, Mukund Thattai. Prediction by promoter logic in bacterial quorum sensing. *PLoS Computational Biology*, 8(1): e1002361, 2012 [IF: 4.59].
16. Rajat Anand, **Navneet Rai**, Mukund Thattai. Promoter reliability in modular transcriptional networks. *Methods in Enzymology*, 497:31-49, 2011 [IF: 2.0].

### Conferences/Workshops

1. Xiaokang Wang, **Navneet Rai**, Beatriz Pereira, Ilias Tagkopoulos, Application of Optimal Experimental Design to Omics Experimentation, the 2019 Synthetic Biology: Engineering, Evolution & Design (SEED), June 23-27, 2019, New York.
2. **Navneet Rai**, Linh Huynh, Ilias Tagkopoulos, An Engineering Approach to Automatically Design, Build and Test Synthetic Gene Circuits, 9th ICBE-International Conference on Biomolecular Engineering, January 6-9, Newport, 2019.
3. **Navneet Rai**, Minseung Kim, Ilias Tagkopoulos, Characterization of microbial anticipatory responses in the mammalian gut, International Conference on Microbiome Engineering November 4-6, Boston, 2018.
4. Xiaokang Wang, Beatriz Pereira, **Navneet Rai**, Minseung Kim, Ilias Tagkopoulos, Predicting evolution of microbial communities under stress. Halloween Symposium, Genome Center UC Davis, 2018 (**Best Poster Award**).
5. **Navneet Rai**, Minseung Kim, Ilias Tagkopoulos, Exploration of bacterial anticipatory responses in the mammalian gut, The 4th Annual UC Davis Postdoctoral Research Symposium, April 23, 2018 at the UC Davis, Davis, USA.
6. Aggie Innovation & Start-Up Symposium, University of California Davis, 2018.
7. KBase Systems Biology Workshop, University of California Davis, 2017.
8. Linh Huynh, **Navneet Rai**, Beatriz Pereira, Ilias Tagkopoulos, Consensus Parameter Inference and Optimal Circuit Design in Cascade Circuits, Synthetic Biology: Engineering, Evolution & Design (SEED), July 18-21, 2016, Chicago.
9. Minseung Kim, **Navneet Rai**, Violeta Zorraquino, Xiaokang Wang, Ilias Tagkopoulos, Multi-omics integration and optimal experimental design accurately predicts cellular and growth dynamics, International Conference on Research in Computational Molecular Biology (RECOMB), April 16- 17, 2016, UCLA Campus, Los Angeles, USA.
10. Minseung Kim, **Navneet Rai**, Violeta Zorraquino, Ilias Tagkopoulos, Multi-omics learning and optimal experimental design for microbial organisms, RECOMB/ISCB conference, November 15-18, 2015, Philadelphia USA.
11. Linh Huynh, **Navneet Rai**, Ilias Tagkopoulos, Parameter inference for gene circuit models” at International Workshop on Bio-Design Automation (IWBD), August 19-21, 2015, Seattle, USA.
12. Participated in WHO-Good laboratory practice workshop, NCBS, India, 2010.
13. **Navneet Rai**, Mukund Thattai, K.V. Venkatesh, Nuts and bolts of iGEM” Biodesign India 1.0. October 7-10, 2010, Trivandrum, India. [Oral and Poster]
14. **Navneet Rai**, Rajat Anand, K. V. Venkatesh, Mukund Thattai, Capabilities and Vulnerabilities of LuxIR-Based Quorum Sensing, CCMB-IISER Pune-NCL National Symposium on Theoretical and Mathematical Biology, August 21-22, 2009, Pune, India.

15. **Navneet Rai**, Sugat Dhabolkar, Krishna Ramkumar, K. V. Venkatesh, Mukund Thattai, Inferring closed-loop responses from open-loop characteristics for a family of synthetic transcriptional feedback systems, The 9th International Conference on Systems Biology, August 23-27, 2008, Gothenburg, Sweden [Oral and Poster].
16. **Navneet Rai**, K. V. Venkatesh, Mukund Thattai, Prediction of the responses of complex gene circuits from the characteristics of their building blocks, The IET Conference on Synthetic Biology, Systems Biology and Bioinformatics (BioSysBio 2008), April 20-22, 2008, Imperial College, London, UK [Oral and Poster].
17. Living Networks 2007, A Summer workshop on Synthetic Biology, June 01-July 15, 2007, NCBS Bangalore, India.
18. Biotechnology Symposium, IIT Bombay, 2005.

### **Teaching Experience**

5 to 6 years. Undergraduate and Graduate students of USA and India.

### **Professional Experience**

#### **(a) Membership of Professional Societies**

1. Microbiology Society.
2. European Federation of Biotechnology.

#### **(b) Editor/editorial board member**

1. Frontiers in Microbiology.
2. Frontiers in Genetics.
3. African Journal of Microbiology Research.
4. African Journal of Biotechnology.
5. EC Microbiology.
6. EC Bacteriology and Virology Research.
7. International Journal of Cell Science & Molecular Biology.

#### **(c) Reviewer**

1. Microbiology.
2. International Journal of Molecular Sciences.
3. Nature Scientific Reports.
4. Frontiers in Microbiology.
5. PeerJ.
6. Systems and Synthetic Biology.
7. Molecular Neurobiology.
8. African Journal of Microbiology Research.
9. Advances in Bioscience and Bioengineering.
10. Gene and Cell Therapy.
11. Microbiology Insights.
12. Gene Regulation and Systems Biology.
13. Microorganisms.
14. Applied Microbiology.
15. Healthcare.
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### **Other Professional Activities**

1. Maintenance Secretary of Hostel-1, IIT Bombay, 2006-2007.
2. General Secretary of Department of Biosciences and Bioengineering, IIT Bombay, 2007.

### **Other Relevant Information**

#### **(a) Major Laboratory Experiments Developed and Optimized**

1. Library preparation and analysis for the Whole Genome Sequencing and RNA-Seq.

2. Real-time cell density, temperature, pH and DO measurements using six-parallel bioreactor, both in chemostat and batch conditions.
3. One step chromosomal integration of the foreign DNA.
4. Optimized several high throughput ligation reactions (CPEC, LCR, Gibson, SLICE) and developed a high throughput cloning method for permutations and combinations libraries.
5. qRT-PCR to quantitate absolute plasmid copy number and gene expression.
6. High throughput single cell and population-level gene expression measurements using cytometer and fluorimeter.
7. DIY Chemostat.

**(b) Computer Packages and Web Management**

1. *Matlab and R (basic) statistical package, and Python.*
  2. Standard MicroSoft Office Software (Word, PowerPoint, Excel, Outlook).
  3. Adobe Photoshop CS2, Adobe Illustrator, Adobe Flash CS4 Professional, and CorelDraw Package.
  4. Origin Pro, Sigma Plot, GraphPad
  5. Snapgene and Vector NTI programs for cloning and sequence assembly.
  6. ImageJ software.
  7. Softwares and programs for the next-generation sequencing data analysis.
  8. Softwares related to the website development and maintenance including, MySQL, Wikipedia and Xara web designer.
  9. Developer and Administrator of the website “Synthetic Biology Resource Hub (SBRH)”, since 2011.  
Link: <http://sbrh.weebly.com/>
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