

RENU VERMA, Ph.D.

Stanford University, School of Medicine, Division of Infectious Diseases and Geographic Medicine

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PROFESSIONAL QUALIFICATION

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| Current status | Postdoctoral Scholar, Division of Infectious Diseases and Geographic Medicine | June 2018- Present |
| Supervisor | Jason Andrews, M.D; Ph.D. Assistant Professor, Medicine - Infectious Diseases Assistant Professor (By courtesy), Health Research & Policy | |
| Institute/University | Stanford University School of Medicine | |
| Degree | Doctor of Philosophy | Jan 2012 - Nov 2017 |
| Field of study | Biotechnology | |
| Supervisor | Akhilesh Pandey, M.D; Ph.D. Founder and Director, Institute of Bioinformatics Professor, Johns Hopkins University School of Medicine Baltimore, MD, USA | |
| Institute/University | Institute of Bioinformatics Bangalore, India (Registered as a Ph.D. student at KIIT University, Bhubaneswar) | |
| Dissertation Title | "Mass spectrometry-based investigation of protein phosphorylation and virulence determinants in <i>Mycobacterium tuberculosis</i> " | |
| Degree | Master of Science (Biotechnology) | Sep 2008 - Jul 2010 |
| Institute/University | University of Mysore, India | |
| Dissertation title | "Detection of Expression Level, Amplification and Mutation of EGFR Gene in Non small Cell lung Cancer (NSCLC)" | |
| | Bachelor of Science (Biotechnology) | Jun 2004 - May 2007 |
| Degree | | |
| Institute/University | Bangalore University, India | |
| Dissertation title | "Study the patterns of inheritance in Non-Mendelian traits using various statistical methods" | |

RESEARCH PROJECTS DURING PHD

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| (A) Project title | Whole genome sequencing analysis of 200 <i>Mycobacterium tuberculosis</i> clinical isolates from north India | 2014 - 2018 |
| Participants | National Reference laboratory (NRL), National JALMA Institute for Leprosy and other Mycobacterial diseases, Indian Council of Medical Research (ICMR), Agra and Institute of Bioinformatics Bangalore, India | |
| Investigators | Dr. Srikanth Prasad Tripathy, Dr. T. S. Keshava Prasad, Dr. Akhilesh Pandey, Dr. D.S. Chauhan, Dr. Harsha Gowda | |
| Funding | Indian Council of medical research, Govt. of India and Infosys Foundation | |
| Description | Worked at the National Reference laboratory BSL-III facility for a year. Investigated the whole genomes of 200 <i>Mycobacterium tuberculosis</i> clinical isolates resistant to first and second line anti-tubercular drugs on Illumina HiSeq 2500 sequencer. Optimized culture conditions for <i>M. tuberculosis</i> clinical isolates, performed drug susceptibility testing and isolated high-quality DNA for Next generation sequencing. Analyzed and interpreted sequencing data | |
| (B) Project title | Whole genome sequencing analysis of <i>Mycobacterium tuberculosis</i> isolated from various extrapulmonary sites | 2015 - 2017 |
| Participants | Department of Microbiology, Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh and Institute of Bioinformatics Bangalore, India | |
| Investigators | Dr. Kusum Sharma, Dr. Harsha Gowda and Dr. T. S. Keshava Prasad | |
| Funding | Infosys Foundation | |
| Description | Performed DNA isolation and QC for Next generation sequencing experiments. Analyzed sequencing data | |
| (C) Project title | Quantitative proteomic and phosphoproteomic analysis of H37Ra and H37Rv strains of <i>Mycobacterium tuberculosis</i> using high resolution mass-spectrometry | 2014 - 2016 |
| Participants | CSIR-Institute of Genomics and Integrative Biology (IGIB), New Delhi and Proteomics laboratory, Institute of Bioinformatics, Bangalore | |
| Investigators | Dr. Sheetal Gandotra and Dr. T.S. Keshava Prasad | |
| Funding | Department of Biotechnology (DBT), Government of India and Infosys Foundation | |
| Description | Employed 8-plex tandem mass tag (TMT) peptide labeling and TiO ₂ -based phosphopeptide enrichment strategies to study the virulence determinants in <i>M. tuberculosis</i> using high resolution mass spectrometry | |

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| (D) Project title | Development of epitope based diagnostic gadget for detection of <i>Mycobacterium tuberculosis</i> in the Indian population | 2012 - 2013 |
| Participants | Microtest Innovations Pvt Ltd., Bangalore and Institute of Bioinformatics , Bangalore, India | |
| Investigators | Dr. T. S. Keshava Prasad and Dr. N. Jayasuryan | |
| Funding | Department of Science and Technology, Govt. of India. | |
| Description | Using B-cell epitope prediction tools, identified 12 potential antigenic epitopes corresponding to 10 immunogenic MTB antigens. Cloned and expressed the antigens to assess their seroreactivity in TB patients and healthy controls through ELISA | |
| (E) Project title | Integrated multi-omic analysis of avirulent strain H37Ra of <i>Mycobacterium tuberculosis</i> | 2016 - 2018 |
| Participants | CSIR-Institute of Genomics and Integrative Biology (IGIB), New Delhi and Proteomics laboratory, Institute of Bioinformatics, Bangalore | |
| Investigators | Dr. Sheetal Gandotra and Dr. T.S. Keshava Prasad | |
| Funding | Karnataka Biotechnology and Information Technology Services (KBITS) and Yenepoya University, Mangalore | |
| Description | Performed proteogenomic analysis of H37Ra strain of <i>Mycobacterium tuberculosis</i> to investigate the virulence attributes | |
| (F) Project title | A multi-omics approach to non-tuberculous mycobacterium – the case of <i>Mycobacterium abscessus</i> UC22. | 2016 - 2018 |
| Participants | National Reference laboratory (NRL), National Jalma Institute for Leprosy and other Mycobacterial diseases, Indian Council of Medical Research (ICMR), Agra and Institute of Bioinformatics Bangalore, India | |
| Investigators | Dr. Srikanth Prasad Tripathy and Dr. T. S. Keshava Prasad | |
| Funding | Karnataka Biotechnology and Information Technology Services (KBITS) and Yenepoya University, Mangalore | |
| Description | Performed integrated genomic and proteogenomic analysis of UC22 strain of <i>Mycobacterium abscessus</i> clinical isolate | |

AWARDS AND SCHOLARSHIPS

- Awarded five year scholarship from Council of Scientific and Industrial Research (CSIR) under University Grants Commission (UGC) scheme, Govt. of India for qualifying national entrance examination for Ph.D. support. All India rank: 65 **2011**
- Qualified National Eligibility test (NET) for Lectureship in the field of Life Science conducted by CSIR, Govt. of India **2011**

- Qualified All-India Graduate Aptitude Test in Engineering -GATE, Biotechnology, for Ph.D. (98.3 percentile). All India rank: 225 **2011**
- Awarded 6 months fellowship and contingency funds from BCIL (Biotech Consortium India Limited) , Department of Biotechnology (DBT), Govt. of India **2010**
- Awarded two years M.Sc. scholarship from Department of Biotechnology (DBT) Govt. of India for qualifying national entrance examination. All India rank: 206 **2008**
- Contingency support from Department of Biotechnology, Govt. of India for MSc. dissertation project done at Triesta Sciences (R&D), HCG Hospitals Bangalore **2010**

PEER-REVIEWED PUBLICATIONS

1. **Verma, R.**, Pinto, S., Patil, A. H., Advani, J., Subba, P., Kumar, M., Sharma, J., Dey, G., Ravikumar, R., Buggi, S., Satishchandra, P., Sharma, K., Suar, M. T., Srikanth, C., Singh, D., Gowda, H., Pandey, A., Gandotra, S. and Prasad, T. S. K. (2017). Quantitative proteomic and phosphoproteomic analysis of H37Ra and H37Rv strains of *Mycobacterium tuberculosis*. *Journal of Proteome Research*. 16(4):1632-1645.
2. **Verma, R.**, Balakrishnan, L., Sharma. K., Khan A. A., Advani, J., Gowda, H., Tripathy, S.P., Suar, M., Pandey, A., Gandotra, S., Prasad, T. S. K. and Subramanian, S. (2015). A network map of Interleukin-10 signaling pathway. *Journal of Cell Communication and Signaling*. 51, 1-7.
3. Sharma, S.*, **Verma, R.***, Advani J., Solanki, H., Chatterjee, O., Chatterjee, A., Suar, M., Pandey A., Prasad, T. S. K. and Gowda, H. (2017).Whole genome sequencing analysis of *Mycobacterium tuberculosis* isolates from extra-pulmonary tuberculosis patients. *OMICS: A Journal of Integrative Biology*.21:413-425.
* **Shared first author**
4. Prasad, K., **Verma, R.**, Kumar, S., Nirujogi, R. S., Sathe, G. J., Madugundu, A. K., Sharma, J., Puttamalles, V. N., Ganjiwale, A., Myneedu, V. P., Chatterjee, A., Pandey, A., Harsha, H. C. and Narayana, J. (2013). Proteomic analysis of purified protein derivative of *Mycobacterium tuberculosis*. *Clinical Proteomics*. 10, 8.
5. Pinto, S.*, **Verma, R. ***, Advani J, Chatterjee, O, Kapoor, S., Gowda, H, Pandey, A., Gandotra, S., Keshava, T.S.K Integrated multi-omic analysis of *M. tuberculosis* H37Ra redefines virulence attributes (2018). *Frontiers in Microbiology*
* **Shared first author**
6. Advani, J., **Verma, R.**, Chatterjee, O., Rex, D. A. B., Najar, M. A., Ravishankara, N., Suresh, S., Pachori, P. K., Gupta, U. D., Pinto, S. M., Chauhan, D. S., Tripathy, S. P., Gowda, H. and Prasad, T. S. K. (2018). Rise of clinical microbial proteogenomics: A multi-omics approach to non-tuberculous mycobacterium – the case of *Mycobacterium abscessus* UC22. *OMICS: A Journal of Integrative Biology*. In press
7. Prasad, T. S. K., Mohanty, A. K., Kumar, M., Sreenivasamurthy, S. K., Dey, G., Nirujogi, R. S., Pinto, S. M., Madugundu, A. K., Patil, A. H., Advani, J., Manda, S. S., Gupta, M. K., Dwivedi, S. B., Kelkar, D. S., Hall, B., Jiang, X., Peery, A., Rajagopalan, P., Yelamanchi, S. D., Solanki, H. S.,

Raja, R., Sathe, G. J., Chavan, S. N., **Verma, R.**, Patel, K. M., Jain, A. P., Syed, N., Datta, K. K., Khan, A. A., Dammalli, M., Jayaram, S., Radhakrishnan, A., Mitchell, C. J., Na, C. H., Kumar, N., Sinnis, P., Sharakhov, I. V., Wang, C., Gowda, H., Tu, Z., Kumar, A., and Pandey, A. (2017). Integrating transcriptomic and proteomic data for accurate assembly and annotation of genomes. *Genome Research*. 27, 133-144.

8. Sandhya, V. K., Raju, R., **Verma, R.**, Advani, J., Sharma, R., Radhakrishnan, A., Nanjappa, V., Narayana, J., Somani, B. L., Mukherjee, K. K., Pandey, A., Christopher, R. and Prasad, T. S. K. (2013). A network map of BDNF/TRKB and BDNF/p75NTR signaling system. *Journal of Cell Communication and Signaling*. 4, 301-307.
9. Bhattacharjee, M., Sharma, R., Goel, R., Balakrishnan, L., Renuse, S., Advani, J., Shantal, T. G., **Verma, R.**, Pinto, S. M., Nirujogi, R. S., Nair, B., Prasad, T. S. K., Harsha, H. C., Jois, R., Shankar, S. and Pandey, A. (2013). A Multilectin affinity approach for comparative glycoprotein profiling of rheumatoid arthritis and spondyloarthritis. *Clinical Proteomics*. 10, 11.

MANUSCRIPTS IN PREPARATION

1. Advani J.*, **Verma, R.***, Chatterjee, O., Pachouri, P., Upadhyay, P., Yadav, J., Singh, R., Naaz, F., Ravikumar, R., Buggi, S., Suar, M., Satishchandra, P., Gupta, U., Pandey, A., Tripathy, S. P., Chauhan, D. S., Gowda, H. and Prasad, T. S. K.. Whole genome sequencing of 200 *Mycobacterium tuberculosis* clinical isolates from India reveals genetic heterogeneity and region specific variations that might affect drug susceptibility.
* **Shared first author**
2. Advani J., Sharma K., **Verma R.**, Chatterjee O., Solanki H., Sharma A., Varma S., Modi M., Ray P., Pandey A, Gowda H. and Prasad T.S.K. Whole genome sequencing data of *Mycobacterium tuberculosis* extra pulmonary isolates from Punjab, India

POSTER PRESENTATION AND WORKSHOPS

1. **Verma, R.**, Proteomic analysis of Purified protein derivative of *Mycobacterium tuberculosis* reveals novel antigenic epitopes. 5th Annual Proteomics Society of India) I Meeting: November 28-30, 2013, Bangalore, India
2. **Verma, R.**, Quantitative proteomic and phosphoproteomic analysis of H37Ra and H37Rv strains of *Mycobacterium tuberculosis*. 6th Proteomics Society (India) Annual Meeting in 2014. IIT, Bombay
3. **Verma, R.**, Genomic landscape of extra-pulmonary tuberculosis clinical isolates from India. NextGen Genomics, Biology, Bioinformatics and Technologies (NGBT) Conference 2016 at Kochi, Kerala
4. Indo-US Workshop on “Epigenetic Regulation and Genome Control (Emphasis on RNAi and microRNA)”, conducted by Centre for Cellular and Molecular Biology (CCMB), Hyderabad, December 2009

5. Workshop on “Microarray data analysis and Systems Biology” conducted by Institute of Computational Biology, Bangalore Educational and training division from 1st September 2010 to 7th September 2010 in Bangalore
6. Workshop on immunological techniques conducted by Bangalore Genei India Pvt. Ltd. Held on 29th to 31st October 2009 at Teresian College Mysore

INTERNSHIP AND TRAININGS

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| Position held | MSc. Intern | Apr 2010 - Jun 2010 |
| Project title | Detection of Expression Level, Amplification and Mutation of EGFR Gene in Non small Cell lung Cancer (NSCLC) | |
| Supervisor | Dr. Rashmita Sahoo, HOD Triesta R&D Laboratory | |
| Institute | Triesta R&D Laboratory, HCG Enterprises | |
| Funding | Department of Biotechnology, Govt. of India | |

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| Position held | Research trainee and BCIL Fellow | Sep 2010 - Jun 2011 |
| Project title | Characterizing the potential biomarkers for cell types and various conditions of mouse and human testis, at the level of alternatively spliced form | |
| Supervisor | Dr. Kshitish Acharya, Director, Shodhaka life Sciences | |
| Institute | Shodhaka Life Sciences Pvt. Ltd., IBAB, Biotech Park, Bangalore, India | |
| Funding | Biotech Consortium India Limited (BCIL), Department of Biotechnology, Govt. of India | |

TECHNICAL AND ANALYTICAL SKILLS

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| Infection biology | Clinical samples processing for isolation and culture of <i>M. tuberculosis</i> , drug susceptibility testing for first and second line anti-tubercular drugs, <i>M. tuberculosis</i> culture on LJ, Middlebrook 7H9 and 7H10 for susceptibility testing, DNA and RNA isolation from <i>M. tuberculosis</i> , biochemical tests for NTM identification |
| Molecular biology | PCR, reverse transcriptase PCR, cloning into plasmid vectors, isolation of chromosomal and plasmid DNA, competent cells preparation, isolation of RNA from bacterial and mammalian cells and purification of proteins using Ni-NTA affinity chromatography |
| Biochemistry | Western blot analysis, ELISA, protein concentration assays, polyacrylamide gel electrophoresis |
| Cell culture | Maintenance and expansion of bacterial cell culture, bacteria transformation, expression of proteins in bacterial cells |

Mammalian cell culture: Seeding, freezing and maintenance of cells, culture and stimulation of PBMCs with synthetic peptides for T-cell based assays and staining of cell surface markers and intracellular cytokines for flow cytometry analysis

Genomics

DNA isolation and quality testing of DNA for whole genome sequencing and NGS data analysis

Proteomics

Sample preparation: Proteomics-Protein extraction, estimation and proteolytic digestion, buffer exchange, SCX and RPLC fractionation, SCX-Stage tip and C18-Stage tip fractionation and clean-up of the sample. Quantitative proteomic approaches: Tandem mass tag (TMT) labeling, label-free quantitation and associated data analysis. TiO₂ beads-based phosphopeptide enrichment.

Analytical software skills

Genome data analysis tools: Visualization and interpretation of genomic data in Integrated Genome Browser (IGV), KvarQ for variant calling using fastq files, Kraken Metagenomic analysis tool and phylogenetic analysis

Signaling pathway analysis: DAVID 6.8 version for gene ontology and pathway enrichment analysis, STITCH 5.0 (search tool for interactions of chemicals), KEGG pathway enrichment tool, Netpath and Netslim for pathway mapping

Proteomics: Integrated genomics, transcriptomics, proteomics and phosphoproteomic data analysis. Proteomics data filtering and quality control, interpretation of spectra quality and assignment, networks and pathway analysis, functional domain analysis and protein-protein interactions

Primer designing and epitope mapping: Primer3 and OligoAnalyzer 3.1 for primer designing and validation, ABCPred and ElliPro for B-cell epitope mapping

HONORS

- Award for the best creative sketch in science, at 5th Annual Meeting of Proteomics Society of India, held at the Indian Institute of Science, Bangalore, India **2013**
- Secured third position in State level science quiz organized by Society of Biotechnologists held on 23rd March, 2009, University of Mysore, India **2009**
- Elected as the Joint Secretary of Science club during BSc. for the academic year 2004-2005 at the Garden city college, Bangalore University, India **2004**
- Recognized for active participation in the awareness program by SARD (Society for All Round Development), an initiative for HIV/AIDS preventive education, a joint initiative of Delhi govt. and UNESCO **2000**
- Indra Award by International Association of Educators for world peace (An Affiliate of UN – UNESCO, UNICEF, UNICED, UNDPI, ECOSOC) for active participation in social awareness programs conducted in underdeveloped regions of New Delhi **2000**

WEB LINKS TO PUBLISHED MANUSCRIPTS

<https://www.ncbi.nlm.nih.gov/pubmed/28692415>

<https://www.ncbi.nlm.nih.gov/pubmed/28241730>

<https://www.ncbi.nlm.nih.gov/pubmed/28003436>

<https://www.ncbi.nlm.nih.gov/pubmed/26253919>

<https://www.ncbi.nlm.nih.gov/pubmed/24010407>

<https://www.ncbi.nlm.nih.gov/pubmed/23870090>

<https://www.ncbi.nlm.nih.gov/pubmed/23606317>

<https://www.ncbi.nlm.nih.gov/pubmed/29971057>