

**Amit Singh, Ph.D**  
**Associate Professor**  
**Department of Microbiology and Cell Biology**  
**Indian Institute of Science (IISc), Bengaluru**  
**asingh@iisc.ac.in and 91-9481700318**

**Academic Qualification**

S.No	Degree	Year	Subject	University	% of Marks
1	B. Sc	1996	Microbiology	Delhi	62 %
2	M. Sc	1998	Biotechnology	IIT Roorkee	76.8%
3	Ph. D	2004	Biochemistry	Delhi	-

**Ph.D**

Thesis Title: Gene Regulation and Pathogenesis in *Mycobacterium tuberculosis*

Guide Name: Prof. Anil K. Tyagi, University: Delhi University; Year of award: 2004

**Work experience**

S.No	Position	Institution Place	From (Date)	To (date)
1	Associate Professor	Indian Institute of Science, Bangalore	July 2018	To-date
1	Assistant Professor	Indian Institute of Science, Bangalore	February, 2014	June-2018
2	Wellcome-DBT Intermediate Fellow	International Centre for Genetic Engineering and Biotechnology, New Delhi	May, 2010	January, 2014
3	Post-Doc Research Work	University of Alabama at Birmingham, USA	August, 2004	April, 2010

**Professional Recognition**

S.No	Name of the Award	Award Agency	Year
1	Wellcome Trust-DBT India Alliance Intermediate Award	Wellcome Trust UK-DBT India Alliance	2010
2	Concepts and Novel Ideas in HIV Research (CNIHR)	NIH, USA	2010
3	Innovative Young Biotechnologist Award (IYBA)	DBT	2011
4	Merck Millipore India Innovation Award	Merck Millipore	2012
5	Senior Innovative Biotechnologist Award	DBT	2014
6	NASI-Scopus Young Scientist Award	Scopus-Elsevier-NASI	2016
7	Wellcome-DBT India Alliance Senior Award	Wellcome Trust UK-DBT India	2016
8	Elected Member, Guha Research Council		2017
9	National Bioscience Award for Career Development	DBT	2018

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10	CDRI- Drug Research Award	CSIR	2019
11	Fellow, National Academy of Sciences, India	NASI	2021
12	Revati & Satya Nadham Atluri Chair Award	IISc	2021
13	Shanti Swarup Bhatnagar Award	CSIR	2021
14	Life member, Society of Biological Chemists (India), Bangalore, India		
15	Society for Free Radical Biology and Medicine, USA		

### Professional Memberships

- Member of scientific advisory board (SAB) to review Max-Planck Partner Group – a Joint Center between Max-Planck Germany and NCBS, Bengaluru, India.
- Member for Research Grants Council (RGC) of Hong Kong.
- Member of Department of Biotechnology (DBT) Northeastern twinning proposal task force.
- Member of Scientific Advisory Board (SAB) Omix Labs.
- DBT-Nominee for the Institutional Biosafety Committee (IBSC), Aurigene Discovery Technologies Limited.
- Member, Biology Divisional Flow Cytometry Committee, IISc.
- Member, Biosafety Level -3 (BSL3) Committee, IISc.
- Consultant, Institutional Biosafety Committee (IBSC), IISc.
- Executive member, Society of Biological Chemist (SBC), India.

### Reviewer

- Grants for DBT, DST, ICMR, British Society for Antimicrobial Chemotherapy (BSAC)-UK, MRC-UK.
- Manuscripts for PLoS One, PLoS Pathogens, Cell Research, Antioxidants and Redox Signaling, IUBMB Life, Scientific Reports, J of Genetics, Free Radical Biology in Medicine, ASM mSphere, and Molecular Systems biology.

### Guest Editor

- IUBMB-life thematic issue on “New Advances in Tuberculosis Drug Discovery/Therapeutics”

### Publications

1. **Singh A**, Shee S, TV R, et al. Biosensor-integrated transposon mutagenesis reveals rv0158 as a coordinator of metabolism-linked redox homeostasis in *Mycobacterium tuberculosis*. Research Square. *eLife* . 2023. In print.
2. Dey A, Anand K, **Singh A**, Prasad R, Barthwal R. *MOSR* and *NDHA* Genes Comprising G-Quadruplex as Promising Therapeutic Targets against *Mycobacterium tuberculosis*: Molecular

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Recognition by Mitoxantrone Suppresses Replication and Gene Regulation. *Genes*. 2023. 14: 978

3. Shee S, Singh S, Tripathi A, Thakur C, Kumar T A, Das M, Yadav V, Kohli S, Rajmani RS, Chandra N, Chakrapani H, Drlica K, **Singh A**. Moxifloxacin-Mediated Killing of *Mycobacterium tuberculosis* Involves Respiratory Downshift, Reductive Stress, and Accumulation of Reactive Oxygen Species. *Antimicrob Agents Chemother*. 2022. 20: e0059222.
4. **Singh A**, Zhao X and Drlica K. Fluoroquinolone heteroresistance, antimicrobial tolerance, and lethality enhancement. *Front Cell Infect Microbiol Sec Molecular Bacterial Pathogenesis*. 2022. In Press.
5. Bandyopadhyay P, Pramanick I, Biswas R, Sabarinath PS, Sreedharan S, Singh S, Rajmani R, Laxman S, Dutta S and **Singh A**. S-Adenosylmethionine-responsive cystathionine  $\beta$ -synthase modulates sulfur metabolism and redox balance in *Mycobacterium tuberculosis*. *Sci Adv*. 2022. 8: eabo0097.
6. Tripathi A, Anand K, Das M, O’Niel RA, Sabarinath PS, Thakur C, Reddy RRL, Rajmani R, Chandra N, Laxman S and **Singh A**. *Mycobacterium tuberculosis* requires SufT for Fe-S cluster maturation, metabolism, and survival in vivo. *PLoS Pathog*. 2022. 18(4): e1010475.
7. Prathiar S, Agrawal R, Pal VK, Singh A and Govindaraju T. Reliable fluorometric detection of SARS-CoV2 by targeting the G-Quadruplex through pH- triggered conformational polymorphism. *ACS Sens*. 2022. 7: 453 – 459.
8. Thakur C, Tripathi A, Ravichandran S, Shivananjaiah A, Chakraborty A, Vardappa S, Chikkanvenkatappa N, Nagaraja D, Lakshminarasimhaiah S, **Singh A**, Chandra N. A new blood-based RNA signature (R9), for monitoring effectiveness of tuberculosis treatment in a South Indian longitudinal cohort. *iScience*. 2022. 103745.
9. Shyam M, Verma H, Bhattacharje G, Mukherjee P, Singh S, Kamilya S, Jalani P, Das S, Dasgupta A, Mondal A, Das AK, **Singh A**, Brucoli F, Bagn  ris C, Dickman R, Basavanakatti VN, Naresh Babu P, Sankaran V, Dev A, Sinha BN, Bhakta S, Jayaprakash V. Mycobactin Analogues with Excellent Pharmacokinetic Profile Demonstrate Potent Antitubercular Specific Activity and Exceptional Efflux Pump Inhibition. *J Med Chem*. 2022. 65: 234-256.
10. Pal VK, Agrawal R, Rakshit S, Shekar P, Murthy DTM, Vyakarnam A and **Singh A**. Hydrogen sulfide blocks HIV rebound by maintaining mitochondrial bioenergetics and redox Homeostasis. *eLife*. 2021. e68487.
11. Shytaj IL, Procopio AF, Tarek M, Carlon-Andres I, Tang HY, Goldman AR, Munshi MH, Pal VK, Forcato M, Sreeram S, Leskov K, Ye F, Lucic B, Cruz N, Ndhlovu LS, Biciato S, Padilla-Parra S, Diaz RS, **Singh A**, Lusic M, Karn, Alvarez-Carbonell D and Savarino A.

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Glycolysis downregulation is a hallmark of HIV-1 latency and sensitizes infected cells to oxidative stress. *EMBO Mol Med*. 2021. e13901.

12. Biji A, Khatun O, Swaraj S, Narayan R, Rajmani R, Sardae R, Satish D, Mehta S, Bindhu H, Jeevan M, Saini D, **Singh A**, Gupta D and Tripathi S. Identification of COVID-19 prognostic markers and therapeutic targets through meta-analysis and validation of Omics data from nasopharyngeal samples. *EBioM*. 2021. 70: 103525.
13. Anand K, Tripathi A, Shukla K, Malhotra N, Jamithireddy AK, Jha RK, Chaudhury SN, Rajmani RS, Ramesh A, Nagaraja V, Gopal B, Nagaraju G, Seshasayee ASN, **Singh A**. *Mycobacterium tuberculosis* SufR Responds to Nitric oxide via its 4Fe-4S cluster and Regulates Fe-S cluster Biogenesis for Persistence in Mice. *Redox Biol*. 2021. 102062.
14. Ravichandran S, Banerjee U, Devi GDR, Kandukuru R, Thakur C, Chakravorty D, Balaji KN, **Singh A** and Chandra N. VB10, a new blood biomarker for differential diagnosis and recovery monitoring of acute viral and bacterial infections. *EBioM*. 2021. 67: 103352.
15. Das M, Dewan A, Shee S and **Singh A**. The Multifaceted Bacterial Cysteine Desulfurases: From Metabolism to Pathogenesis. *Antioxidants*. 2021. 10: 997
16. Banerjee U, Baloni P, **Singh A** and Chandra N. Immune Subtyping in Latent Tuberculosis. *Front Immunol*. 2021. 12: 595746.
17. Nukathoti S, Nikitha H, Singh S, **Singh A**, Mamannamana V and Surolia A. Mevo lectin specificity towards high-mannose structures with terminal  $\alpha$ Man(1,2) $\alpha$ Man residues and its implication to inhibition of the entry of *Mycobacterium tuberculosis* into macrophages. *Glycobiology*. 2021. cwab022.
18. Singh S, Ghosh S, Pal VK, Munshi MH, Shekhar P, Murthy DTN, Mugesh G and **Singh A**. Antioxidant nanozyme counteracts HIV-1 by modulating intracellular redox potential. *EMBO Mol Med*. 2021. e13314.
19. Mishra R, Yadav V, Guha M and **Singh A**. Heterogeneous Host–Pathogen Encounters Coordinate Antibiotic Resilience in *Mycobacterium tuberculosis*. *Trends Microbiol*. 2020. S0946-842.
20. Banerjee U, Sankar S, **Singh A** and Chandra N. A Multi-pronged computational pipeline for prioritizing drug target strategies for latent tuberculosis. *Front Chem*. 2020. 8: 593497.
21. Bhaskar A, Kumar S, Khan MZ, **Singh A**, Dwivedi VP and Nandicoori VK. Host sirtuin 2 as an immunotherapeutic target against tuberculosis. *eLife*. 2020. 9: e55415.
22. Sachdeva K, Goel M, Sudhakar M, Mehta M, Raju R, Raman K, **Singh A** and Sundaramurthy V. *Mycobacterium tuberculosis* (*Mtb*) lipid-mediated lysosomal rewiring in

- infected macrophages modulates intracellular *Mtb* trafficking and survival. *J Bio Chem*. 2020. RA120: 012809.
23. Tyagi P, Pal VK, Agrawal R, Srinivasan S, Singh, S and **Singh A**. *Mycobacterium tuberculosis* reactivates HIV-1 via exosomes-mediated resetting of cellular redox potential and bioenergetics. *mBio*. 2020. 11: e03293.
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28. Mahadik K, Prakhar P, Rajmani RS, **Singh A** and Balaji KN. c-Abl-TWIST1 Epigenetically Dysregulate Inflammatory Responses during Mycobacterial Infection by Co-Regulating Bone Morphogenesis Protein and miR27a. *Front Immunol*. 2018. 1(9): 85.
29. **Singh A** and Surolia A. Tuberculosis: Today's researches-tomorrow's therapies. *IUBMB Life*. 2018. 70(9): 814-817.
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33. Pal VK, Bandyopadhyay P and **Singh A**. Hydrogen sulfide in physiology and pathogenesis of bacteria and viruses. *IUBMB Life*. 2018. 70 (5): 393-410.
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38. Padiadpu J, Baloni P, Anand K, Munshi M, Thakur C, Mohan A, **Singh A** and Chandra N. Identifying and Tackling Emergent Vulnerability in Drug-Resistant Mycobacteria. *ACS Infect Dis*. 2016. 2(9): 592-607.
39. Holla S, Prakhar P, Singh V, Karnam A, Mukherjee T, Mahadik K, Parikh P, **Singh A**, Rajmani RS, Ramachandra SG and Balaji KN. MUSASHI-Mediated Expression of JMJD3, a H3K27me<sub>3</sub> Demethylase, Is Involved in Foamy Macrophage Generation during Mycobacterial Infection. *PLoS Pathog*. 2016. 12(8): e1005814.
40. Palmer CS, Henstridge DC, Yu D, **Singh A**, Balderson B, Duette G, Cherry CL, Anzinger JJ, Ostrowski M and Crowe SM. Emerging Role and Characterization of Immunometabolism: Relevance to HIV Pathogenesis, Serious Non-AIDS Events, and a Cure. *J Immunol*. 2016.196(11): 4437-44.
41. Palmer CS, Cherry CL, Sada-Ovalle I, **Singh A** and Crowe SM. Glucose Metabolism in T Cells and Monocytes: New Perspectives in HIV Pathogenesis. *EBioMedicine*. 2016. 6: 31-41.
42. Mehta M, Rajmani RS and **Singh A**. *Mycobacterium tuberculosis* WhiB3 Responds to Vacuolar pH-induced Changes in Mycothiol Redox Potential to Modulate Phagosomal Maturation and Virulence. *J Biol Chem*. 2016. 291(6): 2888-903.

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43. Palde PB, Bhaskar A, Pedró Rosa LE, Madoux F, Chase P, Gupta V, Spicer T, Scampavia L, **Singh A** and Carroll KS. First-in-Class Inhibitors of Sulfur Metabolism with Bactericidal Activity against Non-Replicating *M. tuberculosis*. *ACS Chem Biol*. 2016. 11(1): 172-84.
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45. Chandra P, Ghanwat S, Matta SK, Yadav SS, Mehta M, Siddiqui Z, **Singh A** and Kumar D. *Mycobacterium tuberculosis* Inhibits RAB7 Recruitment to Selectively Modulate Autophagy Flux in Macrophages. *Sci Rep*. 2015. 5: 16320.
46. Sharma S, Rajmani RS, Kumar A, Bhaskar A, **Singh A**, Manivel V, Tyagi AK and Rao KV. Differential proteomics approach to identify putative protective antigens of *Mycobacterium tuberculosis* presented during early stages of macrophage infection and their evaluation as DNA vaccines. *Indian J Exp Biol*. 2015. 53(7): 429-39.
47. Tyagi P, Dharmaraja AT, Bhaskar A, Chakrapani H and **Singh A**. *Mycobacterium tuberculosis* has diminished capacity to counteract redox stress induced by elevated levels of endogenous superoxide. *Free Radic Biol Med*. 2015. 84: 344-354.
48. Kumar S, Vendruscolo M, **Singh A**, Kumar D and Samal A. Analysis of the hierarchical structure of the *B. subtilis* transcriptional regulatory network. *Mol Biosyst*. 2015. 11(3): 930-41.
49. Bhaskar A, Munshi M, Khan SZ, Fatima S, Arya R, Jameel S and **Singh A**. Measuring glutathione redox potential of HIV-1-infected macrophages. *J Biol Chem*. 2015. 290(2): 1020-38.
50. Bhaskar A, Chawla M, Mehta M, Parikh P, Chandra P, Bhav D, Kumar D, Carroll KS and **Singh A**. Reengineering redox sensitive GFP to measure mycothiol redox potential of *Mycobacterium tuberculosis* during infection. *PLoS Pathog*. 2014. 10(1): e1003902.
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58. **Singh A**, Gupta R, Vishwakarma RA, Narayanan PR, Paramasivan CN, Ramanathan VD and Tyagi AK. Requirement of the mymA operon for appropriate cell wall ultrastructure and persistence of *Mycobacterium tuberculosis* in the spleens of guinea pigs. *J Bacteriol*. 2005. 187(12): 4173-86.
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60. Singh R, Rao V, Shakila H, Gupta R, Khera A, Dhar N, **Singh A**, Koul A, Singh Y, Naseema M, Narayanan PR, Paramasivan CN, Ramanathan VD and Tyagi AK. Disruption of mptpB impairs the ability of *Mycobacterium tuberculosis* to survive in guinea pigs. *Mol Microbiol*. 2003. 50(3): 751-62.
61. **Singh A**, Jain S, Gupta S, Das T and Tyagi AK. mymA operon of *Mycobacterium tuberculosis*: its regulation and importance in the cell envelope. *FEMS Microbiol Lett*. 2003. 227(1): 53-63.

## **Patents**

1. Mycobacterial disease detection, treatment, and drug discovery, US201440163078A1
2. Biosensor for detection of mycothiol redox potential, PCT/IN2014/0000316, Document number 14798377
3. Shortening tuberculosis therapy and reducing relapse by co-administering chloroquine in TB and HIV-TB co-infected individuals (Applied), 201941045667



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## **Research**

### **Ongoing Research Projects**

- 1 Shortening tuberculosis therapy duration using chloroquine, DBT, 2021 - 2022
- 2 Gas-mediated antibiotic resistance in *Mycobacterium tuberculosis*, DBT, 2019 - 2022
- 3 Fe-S cluster biogenesis and regulation in *Mtb*, Wellcome Trust India Alliance, 2017 – 2023
- 4 Mechanisms of stress tolerance in *Mycobacterium tuberculosis* and its physiological relevance, DBT, 2017 – 2023
- 5 Investigating Mycobacterial Responses to Endogenous Peroxynitrite (Co-PI), DBT, 2018 – 2022

### **Completed Research projects**

- 1 Role of oxidoreductive stress in HIV-TB co-infection, ICMR, 2013
- 2 Measuring glutathione redox potential of HIV-1 infected macrophages, NIH, USA, 2013
- 3 Measuring intracellular redox potential of *Mycobacterium tuberculosis* using redox sensitive GFP, DBT, 2014
- 4 Understanding the mechanisms of drug resistance mechanisms in *Mycobacterium tuberculosis*, DBT 2015
- 5 Control of *Mycobacterium tuberculosis* dormancy and reactivation program by the oxygen sensor WhiB4, Wellcome Trust India Alliance, 2015
- 6 Role of WhiB3 and WhiB7 in resistance to acidic pH, DBT, 2018

## **Collaborators**

1. **Biom Pharmaceutical Corporation, Sarasota, Florida:** Preclinical Efficacy of PS121, An Antiviral Formulation, Against SARS-CoV2.
2. **OmiX Research and Diagnostics Laboratories, Bengaluru, India:** Development of LAMP colorimetric kits for diagnosis of Tuberculosis, COVID and Influenza.
3. **OmiX Research and Diagnostics Laboratories, Bengaluru, India:** To detect drug-resistant *Mycobacterium tuberculosis* in specimens (Sputum) from TB patients using redox bioprobe, Mrx1-roGFP2 which was developed by my group, (completed).
4. **Foundation for Neglected Disease Research (FNDR), Bengaluru, India:** Small molecules/drugs identified by my group are taken up by FNDR to perform pre-clinical trials and pharmacological/toxicological studies. Since many drugs are already in use for other clinical indications, thus anticipating very good potential of these compounds in targeting drug-resistant MTB, (completed).