a. Complete bio-data of the applicant (not to exceed 3000 words)

Curriculum Vitae: Sangita Mukhopadhyay, PhD, FNA, FASc, FNASc, FTASc
TATA Innovation Fellow
J C Bose National Fellow

1. Name: SANGITA MUKHOPADHYAY **Sex (M/F):** FEMALE,

2. Present Position: Staff Scientist VII
Group Leader, Laboratory of Molecular Cell Biology,

3. Address (Official)
Centre for DNA Fingerprinting and Diagnostics,
Inner Ring Road, Uppal
Hyderabad - 500039. India.
Tel: 91-40-27216134 (O); Mobile: 9490751094
E-mail: sangita@cdfd.org.in

4. Nationality: INDIAN

5. Marital Status: MARRIED

6. Whether belongs to SC/ST/PH/OBC: General

7. Date of birth: 1st January, 1966

8. Academic B.Sc (Botany Hons) Burdwan University, West Bengal, 1988 (1st Class)
M.Sc (Botany), Burdwan University, West Bengal, 1991 (1st class 1st)
PhD (Life Science), RMRC, Utkal University, Odisha (1996 [submitted], 1998 [year of award])

Thesis title: Experimental Filariasis in *Mastomys coucha* - An Immuno biological study
Name of the Supervisor: Dr. B. Ravindran, Director, (Retd.), Professor Emeritus (Honorary), Institute of Life Sciences (ILS), Bhubaneshwar, Odisha 751023, India

9. Research Experience: 31 years (including PhD)

10. Position and Employment

S. No	Institution	Position	From (Date)	To (Date)
1	CDFD, Hyderabad	Staff scientist VII Director – Additional Charge	01/07/2019 01/07/2023	Till date 18/02/2024
2.	CDFD, Hyderabad	Staff Scientist VI	21/04/2014	30/06/2019
3.	CDFD, Hyderabad	Staff Scientist V	21/04/2010	20/04/2014
4.	CDFD, Hyderabad	Staff Scientist IV	28/08/2005	20/04/2010
5.	CDFD, Hyderabad	Staff Scientist III	28/08/2000	27/08/2005
6.	CDRI, Lucknow	Scientist C	6/10/1999	27/08/2000

11. Professional training undergone

1. Project Associate at National Institute of Immunology (NII), New Delhi, India, from 24th April, 1997 to 06.10.1999
2. Biotechnology Overseas Associateship of DBT at University of Texas, Houston, USA, 31st October, 2005 to 30th September, 2006
3.Workshop on Grantmanship for AIDS Researchers, sponsored by OAR, NIH, USA during 6-7 May, 2004.

12. Professional recognition/Awards/Honors Received

A. International

1. Third World Women Scientist Grant Award by TWAS, Italy, 2003
2. Elected member of American Association of Immunologists, USA, 2010
3. **Elected Member of American Society of Hematology** (ASH), USA, 2007

B. National

1. **Best poster award** by `Indian Immunology Society & Symposium on Immunoparasitology', India, 2002
2. **Young Scientist Award** by Department of Science and Technology, 2003
3. **Young Women Bioscientists of Promise Award**, 2004 by Indian Science Congress Association.
4. **DBT Overseas Associateship Award** by DBT, India; 2005
5. **National Young Woman Bioscientist Award** by DBT, 2007
6. **National Bioscience Award for Career Development**, 2008; by DBT
7. **Kshanika Oration Award**, 2009 by Indian Council of Medical Research (ICMR)
8. **Basanti Devi Amir Chand Prize**, 2011 by ICMR
9. **Fellow of the National Academy of Sciences of India**, 2010
10. **Fellow of the Indian Academy of Sciences, Bangalore**, 2013
11. **ICMR Chaturvedi Ghanshyam Das Jaigopal Memorial Award**, 2015
12. **Fellow of the Indian National Science Academy, New Delhi**, 2016
13. **Member of the Guha Research Conference** (GRC), 2016
14. **Fellow of the Telangana Academy of Sciences, Telangana**, 2016
15. **TATA Innovation Fellowship** 2017-2018, DBT
16. **J C Bose National Fellowship**, 2022.
17. **Felicitation** by the Hon'ble Governor of Telangana & Hon'ble Lt. Governor of Puducherry Dr. (Smt.) Tamilisai Soundararajan, Oct 10, 2022 in **"Women Scientists Conclave: Self Reliance'** Organized by National Academy of Sciences, India (Hyderabad Chapter) jointly with the Academy for Science, Technology & Communication (ASTC)
18. **IIS Senior Scientist Oration Award**, 2023 by Indian Immunology Society.

13. Current Research interests

Dr Mukhopadhyay is carrying out research in the area of Immunology and Infection Biology to understand the molecular mechanism of pathogenesis of Tuberculosis (TB) and inflammatory disorders like sepsis and tissue injury. She is studying the molecular basis of host-pathogen interactions with special emphasis to pathogen-mediated modulation of innate and adaptive immune responses during Tuberculosis. Her research laid an excellent foundation for translating the outcomes in designing better and efficacious drugs/therapeutic interventions to control tuberculosis. Her group has identified TWO repurposed drugs to treat tuberculosis. She has designed effective immunomodulator to boost immune responses and host-directed immunotherapy to control TB. Also her

group is interested to understand the etiological factors responsible for various pathophysiological disorders like diabetes and liver pathology/cancer associated with Tuberculosis and designing of suitable therapeutics. Additionally, she is developing therapeutic interventions to other hyperinflammatory diseases like sepsis and tissue injury. She has designed novel non-steroidal anti-inflammatory biologic to allow scar-less wound healing, cancer and tissue inflammation which has significant impact in reducing morbidity and mortality of humankind. Her present ambition is oriented towards Technology development, transfer and commercialization of products which may fetch financial remuneration to the University of Hyderabad.

In addition to active research, she is also involved in teaching of PhD students and various outreach program to teach young minds in Colleges and Universities. She has an ambition to motivate young minds to take up research as a carrier which will ultimately enrich our human resources and is the need of hour as India is moving rapidly from an agrarian economy towards a futuristic, innovative and technology driven economy.

Societal Relevance

Despite considerable advancements in healthcare and medical research, tuberculosis has far-reaching impacts on individuals, communities, and healthcare systems worldwide. One of the most pressing societal implications of TB lies in its devastating effect on public health, especially in low-income and marginalized communities. TB also exacerbates existing social inequalities, hindering economic development and perpetuating a cycle of poverty and ill-health. This necessitates an urgent need for developing effective therapeutic drug to control the menace. Understanding the molecular etiology of bacterial virulence and its interaction with the host is therefore necessary to identify suitable drug target. Targeting bacterial virulence factors and/or cell-to-cell signalling pathways by developing host-directed therapeutics is more rational than traditional antibiotic-based therapies.

In this context, Dr Mukhopadhyay has made seminal contributions to understand the mechanism of pathogenesis of Tuberculosis disease as well as inflammatory disorders. She have identified several novel virulent factors belonging to the PE/PPE family and elucidated their molecular mechanism of action by which the *M. tuberculosis* pathogen hijacks the host protective immune responses. This basic research laid an excellent foundation for carrying out further translational research to design better and efficacious drugs and therapeutic interventions to control tuberculosis. In addition, she is striving to design novel drugs to treat scar-less wound healing and tissue inflammation which has immense commercial impact in the World drug market.

(**Media Highlight**s 1. https://www.thehindu.com/sci-tech/health/novel-mechanism-may-lead-to-better-tb-control/article6764393.ece and 2. http://vigyanprasar.gov.in/isw/A-new-boost-to-anti-tb-crusade.html)

14. Members of Scientific/Societies/other Professional bodies:

1) **Member of Sectional Committee – IX, INSA,** New Delhi
2) **Member of the CSIR Medical Sciences Research Committee**
3) **Committee member** of 2020 and 2021 Inspiring Science Awards
4) **Expert Member** of Assessment Committee of CCMB, Hyderabad
5) **Member of Scientific Advisory Committee** of NIBMG, Kalyani, W. Bengal
6) **Expert Member** of Faculty Recruitment Assessment Committee of University of Hyderabad
7) **Committee member of INSA JRD-TATA** Fellowship Programme
8) **Committee member of INSA Medal** for Young Scientists
9) **Committee member of INSPIRE Faculty Fellowship Scheme**, Life Sciences Biomedical
10) **Selection Committee member** of Scientist performance of NIAB, Hyderabad
11) **Reviewer of CSIR FIRST Scheme**
12) **Member of DST-WOS-A**, Govt of India, 2016 – 2019
13) **Elected member of Guha Research Conference**
14) **RAP-SAC Member of NCCS, Pune**, 2015, 2016
15) **Reviewer of Dr. D. S. Kothari Postdoctoral Fellowship Scheme** of UGC
16) **Member of Research Progress Committee**, Nirma University, Ahmedabad, 2014-2016.
17) **Member of DBT Task Force** (Infectious Disease), 2014-2018
18) **Member of** Twinning R&D program for NER (Medical Biotechnology),
19) **Committee Member of TNQ**
20) **Elected member of American Society of Hematology**, USA
21) **Elected member of American Association of Immunologists**, USA
22) **Indian Science Congress Association, India** (Life member)
23) **Indian Immunology Society, India** (Life member)
24) **Molecular Immunology Forum, India** (Life Member)
25) **Fellow of the National Academy of Sciences of India**, 2010,
26) **Fellow of the Indian Academy of Sciences, Bangalore**, 2013
27) **Fellow of the Indian National Science Academy, New Delhi**, 2016
28) **Fellow of the Telangana Academy of Sciences, Telangana**, 2016
29) **Board member of LVPEI, Hyderabad, till April, 2024**
30) **Reviewer of CSIR SKM Fellowship program**
31) **Member of DST-SERB PAC Committee**
32) **Advisory Committee Member of DBT-PGT programme** at the Department of Biotechnology and Bioinformatics, University of Hyderabad
33) **Member of Board of Studies of Centre for Integrated Studies,** University of Hyderabad,
34) **ICMR Task Force** Committee member

Institutional (CDFD, Hyderabad) Responsibility

1) In-charge Director of CDFD, 01-07-2023 to 18-02-2024
2) Selection Committee member for recruitment of Scientist at CDFD
3) Authorized to sanction CDFD purchase within Rs 1,00,000 /-
4) Chairperson, IBSC till 2023
5) Chairperson, Flow cytometry
6) Member of Institutional Management Committee.
7) Chairperson of CDFD Sexual Harassment Complaints committee till 2022
8) Chairperson of CDFD Patent cell

9) Chairperson of Woman Cell of CDFD
10) Chairperson, ABSL3 facility of CDFD

15. A brief statement of major scientific achievements.

The main aim of Dr Mukhopadhyay's research is to focus Host-directed immunotherapy in tuberculosis and designing of therapeutics to control health disorders associated with inflammation. She has made active collaboration with Hospitals and Medical Institutes for understanding mycobacterial pathogenesis. She has also designed a novel molecule to reduce inflammation/tissue injury and to heal wound with minimum scar (***filed Indian and USA patent***). She has made seminal contributions to understand how the innate and adaptive (Th1/Th2) pathways of host are hijacked by some of the mycobacterial proteins like Chorismate mutase (***iScience, 2024***) ESAT-6, PknG and PE/PPE family proteins (PPE2, PPE18) to downregulate host-defense mechanisms and are proved to be important drug targets. She identified that *M. tuberculosis* ESAT-6 protein interacts with beta-2 microglobulin (β2M) and inhibits class-I and lipid antigen presentation as well as interfere with iron regulation to support bacterial survival (***PLoS Pathog[2014] 10:e1004446; J. Immunol[2019]203:1918***). Also she showed PknG inhibits phagosome-lysosome fusion by targeting the Rab7l1 signaling (***J. Immunol [2018]201:1421; Immunology [2022] 165:328***). The other protein, PPE18 activates IL-10 cytokine production and Th2 T-cell proliferation and inhibits class II antigen presentation targeting the TLR2-LRR 11~15 domain (***J. Immunol[2009]183:6269; J. Immunol[2011]186:5413; J. Biol. Chem[2012]287:16930***; ***J. Immunol[2016]197:1776; Eur. J. Immunol[2020]51:603***) that supports survival and replication of *M. tuberculosis* in host (***PLoS ONE[2012]7:e52601***). Further she identified TWO FDA approved drugs targeting PPE18-TLR2 and ESAT-6-β2M that can be repurposed to treat Tuberculosis (***supported by TATA Innovation Fellowship; Two Indian Patent filed [2024]***). As well as another suitable drug target is identified by her based on PE11 esterase domain that palys a critical role in m. tuberculosis cell wall architecture and virulence. Her group is interested to understand the etiological factors responsible for various pathophysiological disorders like diabetes and liver pathology/cancer associated with Tuberculosis and designing of suitable therapeutics. Importantly, she identified Anti-oxidant as an important immune booster to improve host defense against tuberculosis and other infectious disease (***Blood[2006]107:1513; J. Immunol[2010]184:2918***) Another important finding of her reveals that PPE2 protein harboring a nuclear localization signal and DNA-binding motif is able to translocate to nucleus where it interacts with GATA-binding site overlapping with the TATA-box of iNOS promoter and inhibits nitric oxide production (***Sci. Rep[2017]7:39706***). The protein is also shown to inhibit NADPH activity and ROS production by directly interacting with one of the NADPH components, $p67^{phox}$ (***J. Immunol[2019]203:1218***) and inhibit myeloid hematopoiesis (***Immunobiology[2021]226:152051***). Thus the protein shows moonlighting effects in inhibiting host's innate immune defense (***J. Immunol[2021] 207:2393***). **An USA patent has been granted in 2013** focusing PPE2 as new drug target of tuberculosis. Importantly, discovery of the anti-inflammatory signaling of PPE18 was further translated into development of novel therapeutics to treat septicemia (***Indian patent granted, 2023; J. Immunol[2018]200:3587***). Further, she indicated PPE17 as a novel diagnostic marker in tuberculosis that can be used to detect latent TB cases (***PLoS ONE[2018]13:e0207787; PLoS ONE[2017]12:e0179965***). She has initiated a new research program where mycobacterial immunomodulatory virulent proteins are repurposed for treating various health disorder like

Sepsis and Inflammation. While PPE18 protein was shown to be useful in controlling sepsis, PPE2 serves a novel biological molecule that inhibits mast cells and thus can be successfully used to mast cell centric disorders associated with inflammation like tissue injury/wound healing, inflammatory bowel disease and cancer (***Indian Patent filed in 2020 [PPE2]; Indian patent granted 2023 [PPE18]; Manuscript published in Journal of Immunology [2018] and EMBO Molecular Medicine [2022]***). She has published a total of 73 research papers and about 20 papers are having more than 50 citations as corresponding author. Her research has tremendous potential in designing therapeutic immunomodulators to improve immune status during *M. tuberculosis* infection and inflammation. Based on her translational approach in anti-Tuberculosis drug designing, she has been awarded the prestigious **TATA Innovation Fellowship of DBT, Govt of India and JC Bose National Fellowship, 2022, from DST-SERB**.

16. Total Number of Publications: 73
(http://www.cdfd.org.in/labpages/sangita_publications.html)

Total Citations: 3011, h-index: 24; i10-index- 28 (as per Google Scholar)

73. Dahiyaa P, Banerjee A, Saha A, Nandicoori VK, Ghosh S and **Mukhopadhyay S***. Structure-function relationship of PE11 esterase of *Mycobacterium tuberculosis* with respect to its role in virulence (2024). bioRxiv (https://doi.org/10.1101/2024.06.18.599654).

72. Pal R and **Mukhopadhyay S*** The SH3 binding domain of chorismate mutase (Rv1885c) of *Mycobacterium tuberculosis* is important for the modulation of host immune-effector functions and virulence (2024). ***iScience*** (Accepted in principle)

71. Bisht MK, Pal R, Dahiya P, Naz S, Sanyal P, Nandicoori VK, Ghosh S and **Mukhopadhyay S***. The PPE2 protein of *Mycobacterium tuberculosis,* present in the circulation of infected mice, can enter into the macrophages to inhibit iNOS/NO production and facilitate survival of the bacilli (2023). ***Tuberculosis (Edinb)*** 143:102421.

70. Bisht MK, Dahiya P, Ghosh S and **Mukhopadhyay S***. The cause–effect relation of tuberculosis on incidence of diabetes mellitus (2023). ***Frontiers in Cellular and Infection Microbiology*** 13:1134036 (Impact Factor **5.7;** Citation - 19)

69. Srivastava S, Dey S and **Mukhopadhyay S*** (2023). Vaccines Against Tuberculosis Disease: Where Are We Now? (2023). ***Vaccines*** 11:1013 (Impact Factor **4.5;** Citation - 11)

68. Shrivastava R, Pavuluri S, Ghosh S and **Mukhopadhyay S***. Rab7l1 plays a role in regulating surface expression of Toll like receptors and downstream signaling in activated macrophages (2023). ***Biochemical and Biophysical Research Communications*** 640:125-133 (Impact Factor **3.322**)

67. Shrivastava R, Pradhan G, Ghosh S and **Mukhopadhyay S***. Rabaptin5 acts as a key regulator for Rab7l1-mediated phagosome maturation process (2022). ***Immunology*** 165:328-340. (Impact factor **7.397,** Citation 8)

66. Pal R, Battu MB and **Mukhopadhyay S***. Therapeutic application of PPE2 protein of *Mycobacterium tuberculosis* in inhibiting tissue inflammation (2022). ***EMBO Molecular Medicine*** 14(9):e14891 (Impact Factor **14**)

65. Pal R, Bisht MK and **Mukhopadhyay S***. Secretory proteins of *Mycobacterium*

tuberculosis and their roles in modulation of host immune responses: Focus on therapeutic targets (2022). ***The FEBS Journal*** 289:4146-4171 (Impact factor **5.62**; Citations 31)

64. Pal R, Ghosh S and **Mukhopadhyay S***. Moonlighting by PPE2 protein: Focus on Mycobacterial virulence (2021). ***Journal of Immunology*** 207:2393-2397. (Invited Review) (Impact factor **5.22,** Citations 7)

63. Sontyana B, Shrivastava R, Battu S, Ghosh S and **Mukhopadhyay S***. Phagosome maturation and modulation of macrophage effector functions by intracellular pathogens: targets for therapeutics (2021). ***Future Microbiology*** 17:59-76 (**Invited Review**) (Impact factor **3.19,** Citation 5**)**

62. Srivastava S, Abraham PR and **Mukhopadhyay S*.** Aptamers: An Emerging Tool for Diagnosis and Therapeutics in Tuberculosis (2021). ***Frontiers in Cellular and Infection Microbiology*** 11:656421 (Impact factor **5.7**; Citations 18)

61. Srivastava S and **Mukhopadhyay S*.** *Mycobacterium tuberculosis* protein PPE2 binds to DNA region containing promoter activity (2021). ***Biochemical and Biophysical Research Communications*** 567:166-170 (Impact factor **3.322**)

60. Pal R and **Mukhopadhyay S***. PPE2 protein of *Mycobacterium tuberculosis* affects myeloid hematopoiesis in mice (2021). ***Immunobiology*** 226:152051 (Impact factor **3.152,** Citation 8)

59. Jha V, Pal R, Kumar D and **Mukhopadhyay S***. ESAT-6 protein of *Mycobacterium tuberculosis* increases holotransferrin-mediated iron uptake in macrophages by downregulating surface hemochromatosis protein HFE (2020). ***Journal of Immunology*** 205:3095-3106. (Impact factor- **5.22,** Citation 11)

58. Dolasia K, Nazar F amd **Mukhopadhyay S***. *Mycobacterium tuberculosis* PPE18 protein inhibits MHC class II antigen presentation and B cell response in mice (2020). ***European Journal of Immunology*** 51:603-619. (Impact factor **6.688;** Citations 14)

57. Jha V, Rao RN, Janardhan S, Raman R, Sastry GN, Sharma V, Rao JS, Kumar D and **Mukhopadhyay S***. Uncovering structural and molecular dynamics of ESAT-6:β2M interaction: Asp53 of human β2-microglobulin is critical for the ESAT-6:β2M complexation (2019). ***Journal of Immunology*** 203:1918-1929 (Impact factor **5.422**; Citations 11)

56. Srivastava S, Battu MB, Khan MZ, Nandicoori VK, **Mukhopadhyay S***. *Mycobacterium tuberculosis* PPE2 protein interacts with $p67^{phox}$ and inhibits reactive oxygen species production (2019). ***Journal of Immunology*** 203:1218-1229 (Impact factor **5.422**; Citations 33)

55. Pal R, Nazar F and **Mukhopadhyay S***. The PE and PPE family proteins of *Mycobacterium tuberculosis*: What they are upto? (2019). A chapter in the book titled "*Mycobacterium tuberculosis*: Molecular & Functional Epidemiology, Virulence, and Pathogenesis" **published by Springer**. (**Invited Review**) (Citation 8)

54. Udgata A, Dolasia K, Ghosh S and **Mukhopadhyay S***. Dribbling through the host defence: targeting the TLRs by pathogens (2019). ***Critical Reviews of Microbiology*** 45:354-368. (Impact factor **7.391,** Citation 7)

53. Pradhan G, Raj Abraham P, Shrivastava R, **Mukhopadhyay S***. Calcium signaling commands phagosome maturation process (2019). ***International Reviews of Immunology*** 38: 57-69. (Impact factor **3.481,** Citation 16)

52. Qureshi R, Rameshwaram NR, Battu MB and **Mukhopadhyay S***. PPE65 of *M.*

tuberculosis regulate pro-inflammatory signalling through LRR domains of Toll like receptor-2 (2019). ***Biochemical and Biophysical Research Communications***. 508:152-158. (Impact factor **3.575,** Citation 12)

51. Abraham PR, Devalraju KP, Jha V, Valluri VL and **Mukhopadhyay S***. PPE17 (Rv1168c) protein of *Mycobacterium tuberculosis* detects individuals with latent TB infection (2018). ***PLoS ONE*** 13:e0207787. (Impact factor **3.24,** Citation 25)

50. Pradhan G, Shrivastva R and **Mukhopadhyay S***. Mycobacterial PknG targets the Rab7l1 signaling pathway to inhibit phagosome-lysosome fusion (2018). ***Journal of Immunology*** 201:1421-1433. (Impact factor **5.422**, Citations- 62)

49. Ahmed A, Dolasia K and **Mukhopadhyay S***. *Mycobacterium tuberculosis* PPE18 protein reduces inflammation and increases survival in animal model of sepsis (2018). ***Journal of Immunology*** 200:3587-3598. (Impact factor **5.422**, Citations- 17)

48. Rameshwaram NR, Singh P, Ghosh S* and **Mukhopadhyay S***. Lipid metabolism and intracellular bacterial virulence: key to next-generation therapeutics (2018). ***Future Microbiology*** 13:1301-1328. (Impact factor **3.19**, Citations- 35)

47. Dolasia K, Bisht MK, Pradhan G, Udgata A and Mukhopadhyay S*. TLRs/NLRs: Shaping the landscape of host immunity (2018). ***International Reviews of Immunology*** 37:3-19. (Impact factor **3.481**, Citation 135)

46. Singh P, Rameshwaram NR, Ghosh S and **Mukhopadhyay S***. Cell envelope lipids in the pathophysiology of *Mycobacterium tuberculosis* (2018). ***Future Microbiology*** 13:689-710. (Impact factor 3.19, Citation 33)

45. Bhat KH, Srivastava S, Kotturu SK, Ghosh S and **Mukhopadhyay S***. The PPE2 protein of *Mycobacterium tuberculosis* translocates to host nucleus and inhibits nitric oxide production (2017). ***Scientific Reports*** 7: 39706. (Impact factor **4.996**, Citation 44)

44. Abraham PR, Pathak N, Pradhan G, Sumanlatha G and **Mukhopadhyay S***. The N-terminal domain of *Mycobacterium tuberculosis* PPE17 (Rv1168c) protein plays a dominant role in inducing antibody responses in active TB patients (2017). ***PLoS ONE*** 12:e0179965. Impact factor **3.24,** Citation 9)

43. **Mukhopadhyay S*** and Ghosh S*. *Mycobacterium tuberculosis*: what is the role of PPE2 during infection? (2017). ***Future Microbiology*** 12:457-460. (**Invited Review**) (Impact factor **3.19,** Citation 4)

42. Rao RN, Shrivastava R, Pradhan G, Singh P and **Mukhopadhyay S***. Phagosome lysosome fusion hijack - An art of intracellular pathogens (2017). ***Proceedings of the Indian Academy of Science*** 83:533-548 doi: 10.16943/ptinsa/2017/48971. (Citation 2)

41. Udgata A, Qureshi R and **Mukhopadhyay S***. Transduction of functionally contrasting signals by two mycobacterial PPE proteins downstream of TLR2 receptors (2016). ***Journal of Immunology*** 197: 1776-1787. (Impact factor **5.422**, Citations 28)

40. Singh P, Rao RN, Reddy JR, Prasad RB, Kotturu SK, Ghosh S and **Mukhopadhyay S***. PE11, a PE/PPE family protein of *Mycobacterium tuberculosis* is involved in cell wall remodeling and virulence (2016). ***Scientific Reports*** 6:21624. (Impact factor **4.996**, Citation 117)

39. Abraham PR, Udgata A, Latha GS and **Mukhopadhyay S***. The *Mycobacterium*

tuberculosis PPE protein Rv1168c induces stronger B cell response than Rv0256c in active TB patients (2016). ***Infection, Genetics and Evolution*** 40:339-345. (Impact factor **3.342,** Citation 9)

38. Ahmed A, Das A and **Mukhopadhyay S***. Immunoregulatory functions and expression patterns of PE/PPE family members: Roles in pathogenicity and impact on anti-tuberculosis vaccine and drug design (2015). ***IUBMB Life***. 67:414-427. (Impact factor **3.885**, Citation 45)

37. Hussain Bhat K and **Mukhopadhyay S***. Macrophage takeover and the host-bacilli interplay during tuberculosis (2015). ***Future Microbiology*** 10:853-872. (Impact factor 3.19, Citation 59)

36. Sreejit G, Ahmed A, Parveen N, Jha V, Valluri VL, Ghosh S and **Mukhopadhyay S***. The ESAT-6 protein of *Mycobacterium tuberculosis* interacts with beta-2-microglobulin (β2M) affecting antigen presentation function of macrophage (2014). ***PLoS Pathogens*** 10:e1004446. (Impact factor **7.464**, Citation 172)

35. Abraham PR, Latha GS, Valluri VL and **Mukhopadhyay S***. *Mycobacterium tuberculosis* PPE protein Rv0256c induces strong B cell response in tuberculosis patients (2014). ***Infection Genetics and Evolution*** 22:244-249. (Impact factor 3.342, Citation 17)

34. Parveen N, Varman R, Nair S, Das G, Ghosh S and **Mukhopadhyay S***. Endocytosis of *Mycobacterium tuberculosis* heat shock protein 60 is required to induce interleukin-10 production in macrophages (2013). ***Journal of Biological Chemistry*** 288:24956-24971. (Impact factor **5.485**, Citation 63)

33. Bhat KH, Das A, Srikantam A and **Mukhopadhyay S***. PPE2 protein of *Mycobacterium tuberculosis* may inhibit nitric oxide in activated macrophages (2013). ***Annals of the New York Academy of Sciences*** 1283:97-101. (Impact factor **6.499**, Citation 39)

32. Bhat KH, Ahmed A, Kumar S, Sharma P and **Mukhopadhyay** S*. Role of PPE18 protein in intracellular survival and pathogenicity of *Mycobacterium tuberculosis* in mice (2012). ***PLoS ONE*** 7:e52601. (Impact factor **3.04**, Citation 61)

31. Bhat KH, Chaytanya CK, Parveen N, Varman R, Ghosh S and **Mukhopadhyay S***. Proline-proline-glutamic acid (PPE) protein Rv1168c of *Mycobacterium tuberculosis* augments transcription from HIV-1 long terminal repeat promoter (2012). ***Journal of Biological Chemistry*** 287:16930-16946. (Impact factor **5.485**, Citation 39)

30. Akhter Y, Ehebauer MT, **Mukhopadhyay S** and Hasnain SE (2012). The PE/PPE multigene family codes for virulence factors and is a possible source of mycobacterial antigenic variation: perhaps more (2012). ***Biochimie*** 94: 110-116. (Impact factor **4.079**, Citation 176)

29. **Mukhopadhyay S***, Nair S and Ghosh S. Pathogenesis in tuberculosis: transcriptomic approaches to unraveling virulence mechanisms and finding new drug targets (2012). ***FEMS Microbiology Reviews*** 36:463-485. (Impact factor **15.177**, Citation 96)

28. Nair S, Pandey AD and **Mukhopadhyay S***. The PPE18 protein of *Mycobacterium tuberculosis* inhibits NF-κB/rel-mediated proinflammatory cytokine production by upregulating and phosphorylating suppressor of cytokine signaling 3 protein (2011). ***Journal of Immunology*** 186:5413-5424. (Impact factor **5.422**, Citation 103)

27. Das A. and **Mukhopadhyay S***. The evil axis of obesity, inflammation and type-2 diabetes (2011). ***Endocrine, Metabolic & Immune Disorders - Drug Targets*** 11:23-31. (Impact factor 2.68, Citation 66)

26. **Mukhopadhyay S*** and Balaji KN. The PE and PPE proteins of *Mycobacterium tuberculosis* (2011). ***Tuberculosis*** 91:441-447. (Impact factor **3.131,** Citation 134)

25. Alam K, Ghousunnissa S, Nair S, Valluri VL, and **Mukhopadhyay S***. Glutathione-redox balance regulates c-rel-driven IL-12 production in macrophages: possible implications in antituberculosis immunotherapy (2010). ***Journal of Immunology*** 184:2918-2929. (Impact factor **5.422**, Citation 70)

24. Bashir N, Kounsar F, **Mukhopadhyay S**, and Hasnain SE. *Mycobacterium tuberculosis* conserved hypothetical protein rRv2626c modulates macrophage effector functions (2010). ***Immunology*** 130:34-45. (Impact factor **6.4**, Citation 41)

23. Nair S, Ramaswamy PA, Ghosh S, Joshi DC, Ghosh S, Pathak N, Siddiqui I, Sharma P, Hasnain SE, Mande SC and **Mukhopadhyay S***. The PPE18 of *Mycobacterium tuberculosis* interacts with TLR2 and activates IL-10 induction in macrophage (2009). ***Journal of Immunology*** 183:6269-6281. (Impact factor **5.422**, Citation 226)

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4. **Mukhopadhyay S**, Sahoo PK, George A, Bal V, Rath S and Ravindran B. Delayed clearance of filarial infection and enhanced Th1 immunity due to modulation of macrophage APC functions in xid mice (1999). ***Journal of Immunology*** 163: 875-883 (Impact factor **5.422**, Citation 46)

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2. **Mukhopadhyay S** and Ravindran B. Antibodies to diethylcarbamazine potentiate the anti-filarial activity of the drug (1997). ***Parasite Immunology*** 19:191-195. (Impact factor **2.220**, Citation 48)

1. **Mukhopadhyay S**, Dash AP and Ravindran B. *Setaria digitata* in *Mastomys coucha*: An animal model for chemotherapeutic and immunobiological studies (1996). ***Parasitology*** 113:323-330. (Impact factor **3.981**, Citation 16)

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(Manuscripts with either higher impact factor or higher citation are highlighted in BLUE)

Manuscript under revision/invitation

1. Shrivastava R, Battu M and **Mukhopadhyay S*** (2024). PknG protein of *Mycobacterium tuberculosis* targets RGDI-1 in the regulation of Rab7l1 GTPase activity (*Under Revision in Journal of Immunology*)
2. Shrivastava R, Akshay GM, Brahmaji S and **Mukhopadhyay S*** (2024) PPE18 protein of Mycobacterium tuberculosis functions as a virulence factor and is a novel therapeutic target (*Under Revision in Journal of Immunology*)
3. Akshay GM, Bisht MK and **Mukhopadhyay S*** (2024) Countering the effector functions of ESAT-6 protein of *Mycobacterium tuberculosis*: Strategies on developing anti-mycobacterial therapeutics *(Under Revision in FEBS J)*
4. Pavuluri S, Kotcherlakota R and Mukhopadhyay S (2024) Repurposing of microbial proteins as new generation therapeutic agents towards biomedical applications (*Review Invitation from Trends in Molecular Medicine*)

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17. List of patents filed/granted – 06 (Filed 04 and Granted 02)

A. Total No of Patents filed – 04

i) Mukhopadhyay S, Brahmaji S and Ghosh, S. Designing novel host directed therapeutics to improve protective immune response and efficacy of anti-TB drugs. Indian Patent Filed on August 01, 2024. Patent Application No. 202441058271.

ii) Mukhopadhyay S and Akshay GM. Pharmaceutical composition of mirabegron and anti-tuberculosis drugs. Indian Patent Filed on July 03, 2024. Patent Application no. 202441050958.

iii) Mukhopadhyay S, Bisht MK and Ghosh, S. Recombinant proline-proline-glutamate protein based vaccine and method of development thereof. Indian Patent Filed on October 04, 2023. Patent Application No 202341066556.

iv) Mukhopadhyay S, Pal R and Battu MB. Therapeutic composition for Inflammation/Tissue Injury. Indian Patent Filed on January 7, 2020 (Priority date – January 8, 2019). Patent Application No 201941000876.

B. Total No of Patents granted - 02

v) Mukhopadhyay S. and Ahmed A. A novel therapeutic for treatment of sepsis. Indian patent granted. Patent Number: 474397. Date of Grant of Application: 29 November 2023.

vi) S. Mukhopadhyay, K. H. Bhat and N. Khan. A novel protein as potential candidate for development of anti-tuberculosis therapeutics (USA Patent awarded). US Patent Application Number: 12/551,115; Invention ID: IN-000044-02-US-REG Patent No: US-8603739B2 Date of grant: December 10, 2013

18. Media Highlights

1.https://www.thehindu.com/sci-tech/health/novel-mechanism-may-lead-to-better-tb-control/article6764393.ece
2. http://vigyanprasar.gov.in/isw/A-new-boost-to-anti-tb-crusade.html

19. List of important national/international projects under taken

a. Completed project as Principal Investigator - 18

b. Completed project as Co-Investigator - 1

b. Ongoing project as Principal Investigator - 3

a. Completed projects as Principal Investigator (last 5 years)

a.1) Project Title: Studying the efficacy of PPE2 protein in the treatment of inflammation and tissue injury (BT/PR35722/BRB/10/1837/2019)
Funding agency: Department of Biotechnology (DBT), Govt of India
Duration: 05.08.2021 - 04.08.2024; **Grant size:** Rs 57.64 lakhs

a.2) Project Title: Approaching *Mycobacterium tuberculosis* PPE protein Rv1168c (PPE17) as a potential marker for diagnosis of Tuberculosis (TB) patients in India (BT/PR20669/MED/29/1072/2016)
Funding agency: Department of Biotechnology (DBT), Govt of India
Duration: 02/01/2018 – 01/07/2022; **Grant size:** Rs 45.22 lakhs

a.3) Project Title: Inhibition of TLR2-PPE18 interaction as novel therapeutic to improve the Th1-based anti- TB protective response of the host (BT/HRD/35/01/03/2018)
Funding agency: Tata Innovation Fellowship, Department of Biotechnology (DBT)
Duration: 01/04/2018 – 31/03/2022; Grant size: Rs 36.00 lakhs

a.4) Project Title: Signaling pathways involved in downregulation of proinflammatory responses by PPE18 protein of *Mycobacterium tuberculosis*: implication of PPE18 as therapeutics (SR/SO/HS/0120/2010)
Funding agency: Department of Science and Technology, Govt of India
Duration: 2012 – 2015; **Grant size:** Rs 41.90 lakhs

a.5) Project Title: Modulation of host immune responses by a PPE protein of *Mycobacterium tuberculosis*: Understanding its role in host-pathogen cross-talk (BT/PR5496/MED/29/512/2012)
Funding agency: Department of Biotechnology (DBT), Govt of India
Duration: 2013-2016; **Grant size:** Rs 70.00 lakhs

a.6) Project Title: Investigating potential of *Mycobacterium tuberculosis* protein PPE18 encapsulated nanoparticle as therapy for microbial sepsis (No BT/PR11605/NNT/28/758/2014)
Funding agency: Department of Biotechnology (DBT), Govt of India
Duration: 2016 - 2018; **Grant size:** Rs 49.14 lakhs

a.7) Project Title: Molecular and biophysical characterization of the ESAT-6:β2M complex and its effect on intracellular iron concentration and macrophage anti-mycobacterial effector responses (No EMR/2016/000644)
Funding agency: Department of Science and Technology, Govt of India
Duration: 2016 – 2019; Grant size: Rs 38.57 lakhs

a.8) Project Title: Virtual Centre of Excellence on multidisciplinary approaches aimed at interventions against *Mycobacterium tuberculosis*
(BT/PR12817/COE/34/23/2015),
Funding agency: Department of Biotechnology (DBT), Govt of India
Duration: 2015 – 2020; **Grant size:** Rs 49.91 lakhs

a.9) Project Title: Deciphering the mechanism of *Mycobacterium tuberculosis* secretory protein PknG in Rab7l1 GTPase activity and understanding the immunomodulatory role in phagosome maturation (CRG/2019/000239)
Funding agency: DST-SERB, Govt of India.
Duration: 19.02.2020 – 18.08.2023; **Grant size:** Rs 55.19 lakhs

b. Ongoing projects as Principal Investigator

b.1) Project Title: Understanding the role of Chorismate mutase in mycobacterial virulence (27(0364)/20/EMR-II)
Funding agency: Council of Scientific and Industrial Research (CSIR), Govt of India.
Duration: 01.10.2020 - 30.09.2023; **Grant size:** Rs 32.84 lakhs

b.2) Project Title: Studying the efficacy of a genetically engineered BCG as a vaccine candidate against tuberculosis (2021-10087/GTGE/ADHOC-BMS)
Funding agency: Indian Council of Medical Research (ICMR), Govt of India.
Duration: 22.01.2023 - 21.01.2026; **Grant size:** Rs 56 lakhs

b.3) Project Title: Role of PPE2 protein of *Mycobacterium tuberculosis* in the modulation of adipose tissue function and development of insulin resistance"
(BT/PR51149/MED/29/1660/2023)
Funding agency: Department of Biotechnology (DBT), Govt of India.
Duration: 27.06.2024 - 25.06.2027; **Grant size:** Rs 64.95 lakhs

b.4). Project Title: Therapeutic application of a synthetic peptide derived from Mycobacterial PPE2 protein in treating inflammatory bowel disease (37WS(0020)/2023-24/EMR-II/ASPIRE)
Funding agency: Council of Scientific and Industrial Research (CSIR), Govt of India
Duration: 20.06.2024 - 19.06.2026; **Grant size:** Rs 25.90 lakhs

20. Mentorship provided to Students:

i) Research Scientist/Project Associate/Project SRF/JRF: 20

ii) Summer Research Fellows and Project assistants: 28

iii) PhD Students (Degree Awarded / Ongoing): 25

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