**Dr. Samer Singh**

*Assistant Professor*
Centre of Experimental Medicine and Surgery (CEMS)
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## EDUCATION

Ph.D. - Biotechnology (Jawaharlal Nehru University, New Delhi)
M.Sc. – Microbiology (Dr. R.M.L. Avadh University, Faizabad)

## AREAS OF INTEREST

Cancer Biology, Drug Discovery, Medical Microbiology, Microbial Biotechnology

## RESEARCH EXPERIENCE

Developmental Signaling Pathways in Disease (Cancer, Genetic Disease/Syndrome, Drug Discovery & Repurposing), Microbial Disease Prevention & Control (Vaccine Development, Antimicrobial Resistance, Prospecting of Medicinal Plants for Antimicrobial Compounds)

## POSITIONS/ EXPERIENCE

- **2019 – cont.: Assistant Professor,** Banaras Hindu University, Varanasi, India
- **2014 – cont.: Assistant Professor**, Panjab University, Chandigarh, India (on Leave)
- **2012 – 2014: Ramalingaswami Fellow** (Scientist D *eq.*), Jawaharlal Nehru University, New Delhi, India
- **2009 – 2012: Assistant Scientist** at Miller School of Medicine, University of Miami, Florida, USA
- **2007 – 2009: Research Associate C**, Dartmouth Medical School, Dartmouth College, Hanover, New Hampshire, USA
- **2004 – 2007: Research Associate B**, Dartmouth Medical School, Dartmouth College, Hanover, New Hampshire, USA

## AWARDS & HONORS

- **2012**: **Ramalingaswami fellowship** (DBT, Govt. of India)
- **2010**: **Research paper** "Activation of Hedgehog Signaling by the Environmental Toxicant Arsenic May Contribute to the Etiology of Arsenic-Induced Tumors. *Cancer Res.* 2010;70(5):1981-1988" **Highlighted by *Nature* (http://www.nature.com/nature/journal/v464/n7286/pdf/464144f.pdf)**
- **2006**: **Research paper** "A highly conserved amino-terminal region of sonic hedgehog is required for the formation of its freely diffusible multimeric form. *J Biol Chem*. 2006;281(7): 4087-93" **Cover Image of *J Biol Chem.* (http://www.jbc.org/content/281/7.cover-expansion)**
- **2003**: Awarded **UNESCO-ASM Travel Award**

**SELECTED RECENT PUBLICATIONS**

1. Singh AK, Das S, **Singh S**, Gajamer VR, Pradhan N, Lepcha YD, Tiwari HK. Prevalence of antibiotic resistance in commensal *Escherichia coli* among the children in rural hill communities of Northeast India. PLoS One. 2018 Jun 18;13(6):e0199179. doi: 10.1371/journal.pone.0199179.
2. Sharma A, **Singh S**, Tewari R, Bhatt VP, Sharma J, Maurya IK. Phytochemical analysis and mode of action against *Candida glabrata* of *Paeonia emodi* extracts. *J Mycol Med.* 2018 May 23. pii: S1156-5233(18)30021-0. doi: 10.1016/j.mycmed.2018.04.008.
3. Maurya IK, **Singh S**, Tewari R, Tripathi M, Upadhyay S, Joshi Y. Antimicrobial activity of *Bulbothrix setschwanensis* (Zahlbr.) Hale lichen by cell wall disruption of *Staphylococcus aureus* and *Cryptococcus neoformans*. *Microb Pathog*. 2018 Feb; 115:12-18. doi: 10.1016/j.micpath.2017.12.015.
4. Kaur R, Tiwari A, Manish M, Maurya IK, Bhatnagar R, **Singh S**. Common Garlic (*Allium sativum*) has Potent Anti-*Bacillus anthracis* Activity among Various Commonly Used Spices and Herbs. *bioRxiv* 162214. 2017 July 11; doi: https://doi.org/10.1101/162214 **(Corresponding author)**
5. Long J, Tokhunts R, Old WM, Houel S, Rodgriguez-Blanco J, **Singh S**, Schilling N, Capobianco AJ, Ahn NG, Robbins DJ. Identification of a family of Fatty-Acid-speciated sonic hedgehog proteins, whose members display differential biological properties. *Cell Rep*. 2015 Mar 3;10(8):1280-7.
6. Kaur M, Garg R, **Singh S***, Bhatnagar R*****. Rabies vaccines: where do we stand, where are we heading? *Expert Rev Vaccines*. 2015 Mar;14(3):369-81. **(*Corresponding author)**
7. Ali MA, Solanki PR, Srivastava S, **Singh S**, Agrawal VV, John R, Malhotra BD. Protein Functionalized Carbon Nanotubes-based Smart Lab-on-a-Chip. *ACS Appl Mater Interfaces*. 2015 Mar 18;7(10):5837-46. doi: 10.1021/am509002h.
8. Patel A, Burton DG, Halvorsen K, Balkan W, Reiner T, Perez-Stable C, Cohen A, Munoz A, Giribaldi MG, **Singh S**, Robbins DJ, Nguyen DM, Rai P. MutT Homolog 1(MTH1) maintains multiple KRAS-driven pro-malignant pathways. *Oncogene*. 2014 Jul 14. doi: 10.1038/onc.2014.195
9. Manish M, Rahi A, Kaur M, Bhatnagar R, **Singh S***. A single-dose PLGA encapsulated Protective Antigen domain 4 nanoformulation protects mice against *Bacillus anthracis* spore challenge. *PLoS One*. 2013 Apr 29;8(4):e61885. **(*Corresponding author)**
10. **Singh S**, Wang Z, Fei DL, Black KE, Goetz JA, et al. Hedgehog-producing cancer cells respond to and require autocrine Hedgehog activity. ***Cancer Res.*** 2011;71(13):4454-4463.

**PATENTS**

1. *Transformation of an edible crop with pagA gene of Bacillus anthracis*. Indian patent (**2078/DEL/2005; Publication date: 2009-07-31**)
2. *Novel vaccine formulation against anthrax*. Indian patent (**Appl. 3469/DEL/2012**)

**RESEARCH PROJECTS (LAST 5 YEARS)**

1. Title: "*A combination therapy for non-small cell lung carcinoma (NSCLC): targeting cancer stem cells and bulk tumor cell population together*"; Ramalingaswami Fellowship, **Department of Biotechnology** (India); **Amount: INR 85.9 lakh** (2012-2017; extended upto 2018); **PI**

2. Title: "*Cloning, Expression and Characterization of Thermostable Enzymes having Potential Use in Molecular Biology from Thermophiles"*; **University Grants Commission**; **Amount: INR 6 lakh** (2016-2018); **PI**
3. Title: "*Design and Evaluation of Inhibitors Abrogating Surface Bound Mycobacterium tuberculosis a-Enolase Interaction with Extracellular Matrix Proteins for Tuberculosis Control*"; **Indian Council of Medical Research** (ICMR), India; **Amount: INR 59 lakh** (2015-2018); **Co-PI**
4. Title: "*Development of recombinant Omp25 based vaccine against brucellosis for humans*"; **DBT network project**; **Amount: INR 1.14 Crore** (2012-2015)**; Co-PI**

**PUBLICATIONS (TOTAL 39)**

***Developmental Signaling and Disease* (14)**

1. Long J, Tokhunts R, Old WM, Houel S, Rodgriguez-Blanco J, **Singh S**, Schilling N, Capobianco AJ, Ahn NG, Robbins DJ. Identification of a family of Fatty-Acid-speciated sonic hedgehog proteins, whose members display differential biological properties. *Cell Rep*. 2015 Mar 3;10(8):1280-7.
2. Patel A, Burton DG, Halvorsen K, Balkan W, Reiner T, Perez-Stable C, Cohen A, Munoz A, Giribaldi MG, **Singh S**, Robbins DJ, Nguyen DM, Rai P. MutT Homolog 1(MTH1) maintains multiple KRAS-driven pro-malignant pathways. *Oncogene*. 2015 May 14;34(20):2586-96
3. You M, Varona-Santos J, **Singh S**, Robbins DJ, Savaraj N, Nguyen DM. Targeting of the Hedgehog signal transduction pathway suppresses survival of malignant pleural mesothelioma cells *in vitro*. *J Thorac Cardiovasc Surg*. 2014 Jan;147(1):508-16.
4. Fei DL, Sanchez-Mejias A, Wang Z, Flaveny C, Long J, **Singh S**, Rodriguez-Blanco J, Tokhunts R, Giambelli C, Briegel K, Schulz WA, Gandolfi AJ, Karagas MR, Zimmers TA, Jorda M, Bejarano P, Capobianco AJ, Robbins DJ. Hedgehog signaling regulates bladder cancer growth and tumorigenicity. *Cancer Research*; 2012 Sep 1;72(17):4449-58
5. Rodriguez-Blanco J, Schilling NS, Tokhunts R, Giambelli C, Long J, Fei DL, **Singh S**, Black KE, Wang Z, Galimberti F, Bejarano PA, Elliot S, Glassberg MK, Nguyen DM, Lockwood WW, Lam WL, Dmitrovsky E, Capobianco AJ and Robbins DJ. The Hedgehog processing pathway is required for NSCLC growth and survival. *Oncogene*. 2013 May 2;32(18):2335-45
6. **Singh S**, Wang Z, Fei DL, Black KE, Goetz JA, Tokhunts R, Giambelli C, Rodriguez-Blanco J, Long J, Lee E, Briegel KJ, Bejarano PA, Dmitrovsky E, Capobianco AJ, Robbins DJ. Hedgehog-producing cancer cells respond to and require autocrine Hedgehog activity. *Cancer Res.* 2011 Jul 1;71(13):4454-4463
7. Fei DL, Li H, Kozul CD, Black KE, **Singh S**, Gosse JA, Direnzo J, Martin KA, Wang B, Hamilton JW, Karagas MR, Robbins DJ. Activation of Hedgehog Signaling by the Environmental Toxicant Arsenic May Contribute to the Etiology of Arsenic-Induced Tumors. *Cancer Res*. 2010 Mar 1;70(5):1981-1988
8. Tokhunts R*, **Singh S***, Chu T, D'Angelo G, Baubet V, Goetz JA, Huang Z, Yuan Z, Ascano M, Zavros Y, Therond PP, Kunes S, Dahmane N, Robbins DJ. The full-length unprocessed hedgehog protein is an active signaling molecule. *J Biol Chem.* 2010 Jan 22;285(4):2562-8. (***Equal contribution**)
9. **Singh S**, Tokhunts R, Baubet V, Goetz JA, Huang ZJ, Schilling NS, Black KE, Mackenzie TA, Dahmane N, Robbins DJ. Sonic hedgehog mutations identified in

holoprosencephaly patients can act in a dominant negative manner. *Hum Genet*. 2009 Feb;125(1):95-103

10. Li N, **Singh S**, Cherukuri P, Li H, Yuan Z, Ellisen LW, Wang B, Robbins D, Direnzo J. Reciprocal intra-epithelial interactions between TP63 and Hedgehog signaling regulate quiescence and activation of progenitor elaboration by mammary stem cells. *Stem Cells*. 2008 May;26(5):1253-64
11. Farzan SF, **Singh S**, Schilling NS, Robbins DJ. The adventures of sonic hedgehog in development and repair. III. Hedgehog Processing and Biological Activity. *Am J Physiol Gastrointest Liver Physiol.* 2008 Apr;294(4):G844-9
12. Yuan Z, Goetz JA, **Singh S**, Ogden SK, Petty WJ, Black CC, Memoli VA, Dmitrovsky E, Robbins DJ. Frequent requirement of hedgehog signaling in non-small cell lung carcinoma. *Oncogene.* 2007 Feb 15;26(7):1046-55
13. **Singh S**, Goetz JA, Robbins DJ. Sonic hedgehog. *UCSD-Nature Molecule Pages*. 2006 March 17. doi:10.1038/mp.a002208.01
14. Goetz JA*, **Singh S***, Suber LM, Kull FJ, Robbins DJ. A highly conserved amino-terminal region of sonic hedgehog is required for the formation of its freely diffusible multimeric form. *J Biol Chem.* 2006 Feb 17;281(7):4087-93. (***Equal contribution**)

***Microbial Disease - Prevention and Control (17)***

15. Singh AK, Das S, **Singh S**, Gajamer VR, Pradhan N, Lepcha YD, Tiwari HK. Prevalence of antibiotic resistance in commensal *Escherichia coli* among the children in rural hill communities of Northeast India. PLoS One. 2018 Jun 18;13(6):e0199179. doi: 10.1371/journal.pone.0199179.
16. Sharma A, **Singh S**, Tewari R, Bhatt VP, Sharma J, Maurya IK. Phytochemical analysis and mode of action against *Candida glabrata* of *Paeonia emodi* extracts. *J Mycol Med.* 2018 May 23. pii: S1156-5233(18)30021-0. doi: 10.1016/j.mycmed.2018.04.008.
17. Maurya IK, **Singh S**, Tewari R, Tripathi M, Upadhyay S, Joshi Y. Antimicrobial activity of *Bulbothrix setschwanensis* (Zahlbr.) Hale lichen by cell wall disruption of *Staphylococcus aureus* and *Cryptococcus neoformans*. *Microb Pathog*. 2018 Feb; 115:12-18. doi: 10.1016/j.micpath.2017.12.015.
18. Kaur R, Tiwari A, Manish M, Maurya IK, Bhatnagar R, **Singh S**. Common Garlic (*Allium sativum*) has Potent Anti-*Bacillus anthracis* Activity among Various Commonly Used Spices and Herbs. *bioRxiv* 162214. 2017 July 11; doi: https://doi.org/10.1101/162214 **(Corresponding author)**
19. Manish M, Bhatnagar R, **Singh S**. Preparation and Characterization of PLGA Encapsulated Protective Antigen Domain 4 Nanoformulation. *Methods Mol Biol.* 2016; 1404:669-81. doi: 10.1007/978-1-4939-3389-1 **(Corresponding author)**
20. Kaur M, Garg R, **Singh S***, Bhatnagar R*. Rabies vaccines: where do we stand, where are we heading? *Expert Rev Vaccines*. 2015 Mar;14(3):369-81. **(*Corresponding author)**
21. Kaur M*, **Singh S***, Bhatnagar R. Anthrax Vaccines: Present Status and Future Prospects. *Expert Rev. Vaccines,* 2013 August; 12(8): 955–970 (***Equal contribution**)
22. Manish M, Rahi A, Kaur M, Bhatnagar R, **Singh S**. A single-dose PLGA encapsulated Protective Antigen domain 4 nanoformulation protects mice against *Bacillus anthracis* spore challenge. *PLoS One*. 2013 Apr 29;8(4):e61885. **(Corresponding author)**
23. Aziz MA, Sikriwal D, **Singh S**, Jarugula S, Kumar PA, Bhatnagar R. Transformation of an edible crop with the *pagA* gene of *Bacillus anthracis*. *FASEB J.* 2005 Sep;19(11):1501-3

24. **Singh S**, Singh A, Aziz MA, Waheed SM, Bhat R, Bhatnagar R. Thermal inactivation of protective antigen of *Bacillus anthracis* and its prevention by polyol osmolytes. *Biochem Biophys Res Commun.* 2004 Sep 24; 322(3):1029-37
25. **Singh S,** Aziz MA**,** Khandelwal P, Bhat R and Bhatnagar R. The osmoprotectants glycine and its methyl derivatives prevent the thermal inactivation of protective antigen of *Bacillus anthracis*. *Biochem Biophys Res Commun.* 2004 Apr 2; 316(2): 559-564
26. Aziz MA**, Singh S,** Anand Kumar P, Bhatnagar R. Expression of protective antigen in transgenic plants: a step towards edible vaccine against anthrax. *Biochem Biophys Res Commun*. 2002 Dec 6;299(3): 345-51
27. **Singh S,** Ahuja N, Chauhan V, Rajasekaran E, Mohsin Waheed S, Bhat R and Bhatnagar R**.** Gln277 and Phe554 residues are involved in thermal inactivation of protective antigen of *Bacillus anthracis*. *Biochem Biophys Res Commun.* 2002 Sep 6;296(5):1058-62
28. Singh A, **Singh S**, Waheed SM, Khandelwal P and Bhatnagar R. Expression of anthrax lethal factor gene by osmolyte induction. *FEMS Microbiol Lett.* 2002 Apr 9;209(2):301-5
29. Gupta P, **Singh S**, Tiwari A, Bhat R and Bhatnagar R. Effect of pH on stability of Anthrax lethal factor: Correlation between denaturation and activity. *Biochem Biophys Res Commun.* 2001 June 15;284(3): 568-73
30. Chauhan V, Singh A, Waheed S M, **Singh S** and Bhatnagar R. Constitutive expression of protective antigen gene of *Bacillus anthracis* in *Escherichia coli*. *Biochem Biophys Res Commun*. 2001 May 4; 283(2):308-315
31. Chaudhary P, Singh S, Bhatnagar R, Sarin NB, Bashir SF. Expression of Edema Factor gene (*cya*) from *Bacillus anthracis* in model plant Tobacco. *Plant Archives*. 2013 October; 13 (2): 1143-1148 (ISSN:0972-5210)

***Others (8)***

32. **Singh S**, Tewari BS. Biosynthesis of high-value amino acids by synthetic biology. *In*: Singh SP, Pandey A, Du G, Yadav SK, *eds*. '*Synthetic Biology, Cell Engineering & Bioprocessing Technologies*' part of 'CDBB: *Current Developments in Biotechnology and Bioengineering*' (Series). Pandey A (series ed.) Publisher: *Elsevier.* 2018 November 28; p257- 294 (https://doi.org/10.1016/B978-0-444-64085-7.00011-3; ebook ISBN: 978-0-444-64086-4; paper back ISBN: 978-0-444-64085-7) **(Corresponding author)**
33. Pandey SS, **Singh S**, Pathak C, Tiwari BS. "Programmed Cell Death: A Process of Death for Survival" - How Far Terminology Pertinent for Cell Death in Unicellular Organisms. *J Cell Death.* 2018 Aug 2; 11:1179066018790259. doi:10.1177/1179066018790259. eCollection 2018.
34. **Singh S.** Impact of Information Technology on Biomedical Sciences Research and Management. In: Singh K, Kaushal S, Verma A, *eds.* 'Information Technology and Its Impact on Society'. Chandigarh, India: SAPATRISHI PUBLICATIONS; 2018. p. 313-322 (ISBN:9789386632876)
35. Ali MA, Solanki PR, Srivastava S, **Singh S**, Agrawal VV, John R, Malhotra BD. Protein Functionalized Carbon Nanotubes-based Smart Lab-on-a-Chip. *ACS Appl Mater Interfaces*. 2015 Mar 18;7(10):5837-46.
36. Gupta V, **Singh S**, Rawat K, Bohidar HB, and Solanki PR. Cytotoxicity and Antimicrobial Activity of Transition Metal Oxide Nanoparticles. *Adv Sci Lett.* 2014 July, 20(7-9), 1650-1653

37. **Singh S**, Ambastha V, Levine A, Sopory SK, Yadava PK, Tripathy BC, Tiwari BS. Anhydrobiosis and programmed cell death in plants: commonalities and differences. *Current Plant Biology*. 2015 May; 2: 12–20 (ISSN: 2214-6628)
38. Sahu A, **Singh S**, Solanki PR, Mitra S. Curcuminoid loaded Poly Methyl Methacrylate Nanoparticles: *In vitro* effect on squamous cell carcinoma. In: Bhupinder Singh, Anupama Kaushik, Mehta SK, Surya Kant Tripathi. *eds.* Nanotechnology: Novel Perspectives and Prospects. New Delhi, India: *McGraw Hill*; 2015. p. 881-886. (ISSN13: 978-9339221096)
39. **Singh S**, Gaur R, Agarwal SK, Darmwal NS. Partitioning and properties of alkaline protease from *Bacillus* in aqueous biphasic system. *Ind J Microbiol*. 2002 December; 42(4):343-345

***TECHNICAL EXPERTISE/EXPERIENCE***

- **Molecular biology techniques** including Molecular cloning, PCR, Real-time quantitative PCR (Q-PCR), Site-directed mutagenesis, Southern hybridization, ***In situ*** **RNA hybridization (ISH), Immunohistochemistry (IHC)**, **Laser capture microdissection (LCM)**

- **Animal** (mammalian and insect) **cell culture and assays** (Cell proliferation, Cytotoxicity, Apoptosis, Receptor binding *etc.*), **Establish stable cell lines,** Clonogenicity/ Cell transformation assays

- **RNA interference technology** (siRNA and shRNA) to modulate expression of target genes to understand their role in a given signaling pathway both *in vitro* and *in vivo*

- **Xenograft tumor mice models** to understand tumorigenesis, Handling of tumor and clinical specimen for immunohistochemistry and immunoblotting analysis

- **Confocal laser scanning microscopy** to study localization and interaction of biomolecules

- **Flow cytometry and cell sorting** to differentiate and isolate different cell populations

- **Overexpression of recombinant proteins using fed-batch culture** (*E. coli*, *P. pastoris*), **Protein purification** using various chromatography techniques (Gel permeation, Ion exchange, Affinity *etc.*) and **Protein refolding**, Fast Protein Liquid chromatography (**AKTA-FPLC**)

- **Others: Sub-cellular fractionation;** Immunoprecipitation; Quantitative and Qualitative analysis of biomolecules (Antigen-Antibody interaction); ELISA; Isolation, identification and culturing of bacterial strains