**BIOGRAPHICAL SKETCH**

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NAME: Singh, Manisha

eRA COMMONS USER NAME (credential, e.g., agency login): msingh37

POSITION TITLE: Postdoctoral Fellow

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

| Institution and Location | Degree *(if applicable)* | Completion Date MM/YYYY | Field of Study |
|---|---|---|---|
| Dr. Bhim Rao Ambedkar University, India | B.S. | 07/2008 | Zoology, Botany , Chemistry |
| Guru Gobind Singh Indraprastha University, India | M.S. | 07/2010 | Forensic Science (specialization in DNA and genomic analysis) |
| All India Institute of Medical Sciences, India | Ph.D. | 05/2018 | Stem Cell Biology (minor in neuro-regeneration) |
| Johns Hopkins University School of Medicine, Maryland, USA(postdoc) | n/a | n/a | Role of neurotransmitters and mechanism of neuro-regeneration in Parkinson's disease |

**A. Personal Statement**

Total research experience of 7 years in the field of **Stem Cell Research and 1.5 years in Neurosciences**

I have a long-standing interest in exploring the neuro-regenerative potential of stem cells and understanding the molecular mechanisms that mediate that effect in synucleopathies like Parkinson's disease (PD) and Alzheimer's disease (AD). My eventual aim is to transition to an independent tenure track faculty position at a research institution. While in grad school at All India Institute of Medical Sciences, New Delhi, India, I joined Prof. Sujata Mohanty's lab in February 2012 and worked on the neuro-regenerative potential of primary human Mesenchymal stem cells obtained from bone marrow, adipose tissue and dental pulp Parkinson's Disease (PD). The main focus of my Ph.D. thesis was to answer a) Neurogenic effect of various growth factors (FGF2 and BDNF) and chemicals (Forskolin and 22-hydroxycholesterol) on hMSCs obtained from bone marrow, adipose tissue and dental pulp, b)

Differential response of hMSCs obtained from various tissue sources towards the above mentioned neurogenic agents, c) Detailed characterization (in terms of morphological, morphometric, ultra- structural, transcriptional, protein expression, functional characterization) of dopaminergic neuronal cells obtained after induction, d) Efficiency of generation of mature dopaminergic neuronal cells *in vitro* and e) Effect of bone marrow derived MSCs in naive and differentiated (with the best inducer) state, in improving the motor functional behavior of unilateral Parkinson's disease Wistar rat model. The detailed study revealed that 22-hydroxycholesterol (22-OHC) yielded the best dopaminergic neuronal cells and had better outcomes upon transplantation in Wistar PD rat model. This resulted in several first author publications in J. Scientific Reports, Cells and Cell Death Discovery, as well as other papers in Frontiers in Neuroscience, Journal of Endodontics, Journal of Biomedical Science and International Journal of Scientific Research.

For my post- doctoral training, I joined Prof. Solomon H. Snyder in April, 2019. I am trying to find out the physiological roles of D- aspartate and glutamate in brain other organs. My preliminary results show the higher expression of D- glutamate in some specific parts of brain, heart, lungs and kidneys. Hence, presently I am trying to establish some association of D-glutamate with material exchange in these organs. I am also trying to find out how D- Aspartate relates to Alzheimer's disease. Apart from the first- author projects, I am doing a few collaborative projects with other lab members (one related to cocaine receptors and other based on SARS-CoV2).

**Publications:**

a. Maged Harraz, Evan Semenza, Adarsha Malla, Maria Shishikura, **Manisha Singh**, Yum Hwang, In Guk Kang, Young Jun Song, Adele Snowman, Pedro Cortes, Senthilkumar Karuppagounder, Ted Dawson, Valina Dawson, Solomon Snyder. Cocaine receptor identified as BASP1. J. Nature, March 2021 (Under review).

b. **Manisha Singh,** Amit Kumar Dinda, Balram Airan, Sujata Mohanty*. 22 (R)-Hydroxycholesterol as a Novel and Efficient Inducer for Generating Functional Dopaminergic Neurons from Human Mesenchymal Stem Cells. *Cell Death Discov.* **7,** 13 (2021). https://doi.org/10.1038/s41420-020-00351-6

c. **Manisha Singh**, Pardeep Kumar Vaishnav, Amit Kumar Dinda, Sujata Mohanty*. Evaluation of Priming Efficiency of Forskolin in Tissue-Specific Human Mesenchymal Stem Cells into Dopaminergic Neurons: An In Vitro Comparative Study. Cells. 2020 Sep 9;9(9):2058. doi: 10.3390/cells9092058. PMID: 32917012; PMCID: PMC7565008.

d. **Singh, M.,** Pandey, P. K., Bhasin, A., Padma, M. V., & Mohanty, S. (2020). Application of Stem Cells in Stroke: A Multifactorial Approach. Frontiers in Neuroscience, 14, 473. https://doi.org/10.3389/fnins.2020.00473.

e. Neha Sultana; **Manisha Singh;** Ruchika R Nawal; Sarika Chaudhry; Seema Yadav; Sujata Mohanty; Sangeeta Talwar*. Evaluation of Biocompatibility and Osteogenic Potential of Tricalcium Silicate-based Cements Using Human Bone Marrow-derived Mesenchymal Stem Cells. J Endod. 2018 Mar; 44(3):446-451. doi: 10.1016/j.joen.2017.11.016. Epub 2018 Jan 3.

f. **Manisha Singh,** Anupama Kakkar, Rinkey Sharma, O.P. Kharbanda, Nitika Monga, Manish Kumar, Shantanu Chowdhary, Balram Airan, Sujata Mohanty*. Synergistic Effect of BDNF and FGF2 in Efficient Generation of Functional Dopaminergic Neurons from human Mesenchymal Stem Cells. Sci Rep. 2017 Sep 4;7(1):10378. doi: 10.1038/s41598-017-11028-z.

g. **Manisha Singh,** Suchi Gupta, Sonali Rawat, Swati Midha, Krishan Gopal Jain, Manu Dalela, Sujata Mohanty*. Mechanisms of Action of Human Mesenchymal Stem Cells in Tissue Repair Regeneration and their Implications. Annals of the National Academy of Medical Sciences (India) 2017; 53(02): 104-120. DOI: 10.1055/s-0040-1712752.

h. Krishan Gopal Jain, **Manisha Singh**, Anupama Kakkar, Rajesh Malhotra, Vineeta Batra, Alok Ray, Balram Airan, Sujata Mohanty*. Evaluating the osteogenic potential of CHT/HAP/PCL biocomposites in bone tissue engineering: An in vivo study. J. International Journal of Scientific Research, Volume-6, Issue-5, May – 2017, ISSN No 2277 – 8179.

i. Sujata Mohanty*, Anupama Kakkar, **Manisha Singh**. Biological Basis and Molecular Mechanism of Regeneration. Ann Natl Acad Med Sci (India), 51(3):105-124, 2015.

j. Sushmita Bose Nandy, Sujata Mohanty*, **Manisha Singh**, Madhuri Behari and Balram Airan. Fibroblast Growth Factor-2 alone as an efficient inducer for differentiation of human bone marrow mesenchymal stem cells into dopaminergic neurons. Journal of Biomedical Science 2014, 21:83 doi:10.1186/s12929-014-0083-1.

**Book Chapter:**

1. Chaudhuri R., **Singh M**., Mohanty S. (2020) Potential of Mesenchymal Stem Cells in Modulating Oxidative Stress in Management of Lung Diseases. In: Chakraborti S., ParinandiN., Ghosh R., Ganguly N., Chakraborti T. (eds) Oxidative Stress in Lung Diseases. Springer, Singapore. https://doi.org/10.1007/978-981-32-9366-3_3.

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**B. Positions and Employment**

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| 04/2019 - | Post doctoral Research Fellow, Snyder Lab, The Solomon H. Snyder Department of Neuroscience, Johns Hopkins University, Baltimore, MD |
| 10/2017-12/2018 | Research Officer, Mohanty Lab, Stem Cell Facility, All India Institute of Medical Science, New Delhi, India |

**Other Experience & Professional Memberships**

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|---|---|
| 2019 | Society for Neuroscience (SfN) |
| 2019- till date | Co-chair-Internationals Committee, Johns Hopkins Post-doctoral Association |
| 2018 | Literary Secretary, Society for Young Scientists, All India Institute of Medical Sciences, New Delhi, India |
| 2015 | Life Member of Indian Immunological Society |

**C. Honors**

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|---|---|
| 2016 | Senior Research Fellowship, University Grant Commission, India |
| 2014 | 3rd prize in poster presentation at 15th Indo-US flow cytometry workshop |
| 2013 | Junior Research Fellowship, University Grant Commission, India |
| 2005 | Best Student Award in B.S. |
| 2005 | 1st prize in science quiz in B.S. |
| 2005 | 3rd prize in science competition in B.S. |

**D. Contribution to Science:**

**1. Mesenchymal Stem Cells' *in vitro* differentiation**: During my Ph.D. course, I studied the various inducers that can be used to coax stem cells and yield optimum DAergic neuronal cells, which can further be used for translational purposes. I reported a comprehensive comparative data of in vitro differentiation of human primary MSCs obtained from bone marrow, adipose tissue and

dental pulp. I have characterized the coaxed MSCs at morphological, morphometric, transcriptome, protein and functional levels. I have compared FGF2, BDNF, forskolin and 22-OHC for theirdifferentiation potential. I have also validated my *in vitro* results in PD Wistar rat models. My study provides extensive comparative information on one-platform to select the inducer and MSC-type fortransplantation.

**a.** **Manisha Singh**, Amit Kumar Dinda, Balram Airan, Sujata Mohanty*. 22 (R)-Hydroxycholesterol as a Novel and Efficient Inducer for Generating Functional Dopaminergic Neurons from Human Mesenchymal Stem Cells. Accepted and in press in J. Cell Death Discovery, October, 2020. https://doi.org/10.1038/s41420-020-00351-6.

**b.** **Manisha Singh**, Pardeep Kumar Vaishnav, Amit Kumar Dinda, Sujata Mohanty*. Evaluation of Priming Efficiency of Forskolin in Tissue-Specific Human Mesenchymal Stem Cells into Dopaminergic Neurons: An In Vitro Comparative Study. Cells. 2020 Sep 9;9(9):2058. doi: 10.3390/cells9092058. PMID: 32917012; PMCID: PMC7565008.

**c.** **Manisha Singh**, Anupama Kakkar, Rinkey Sharma, O.P. Kharbanda, Nitika Monga, Manish Kumar, Shantanu Chowdhary, Balram Airan, Sujata Mohanty*. Synergistic Effect of BDNF and FGF2 in Efficient Generation of Functional Dopaminergic Neurons from human Mesenchymal StemCells. Sci Rep. 2017 Sep 4;7(1):10378. doi: 10.1038/s41598-017-11028-z.

**d.** Sushmita Bose Nandy, Sujata Mohanty*, **Manisha Singh**, Madhuri Behari and Balram Airan. Fibroblast Growth Factor-2 alone as an efficient inducer for differentiation of human bone marrow mesenchymal stem cells into dopaminergic neurons. Journal of Biomedical Science 2014, 21:83 doi:10.1186/s12929-014-0083-1.

**2. Mesenchymal Stem Cells and Bone tissue engineering:** I have contributed to several seminal studies related to the use of human bone marrow (hBM) derived MSCs in bone regeneration. In one of studies, we compared the various dental cements for bone regeneration using hBM-MSCs. This study has a great implication in dental reconstruction. In another study, we investigated the bone reforming capacity oh hBM-MSCs on scaffolds made from polycaprolactone, hydroxyapatite and chitosan. This study provides a substantial base to use BM-MSCs for bone tissue engineering.

**a.** Neha Sultana; **Manisha Singh**; Ruchika R Nawal; Sarika Chaudhry; Seema Yadav; Sujata Mohanty; Sangeeta Talwar*. Evaluation of Biocompatibility and Osteogenic Potential of Tricalcium Silicate-based Cements Using Human Bone Marrow-derived Mesenchymal Stem Cells. J Endod. 2018 Mar; 44(3):446-451. doi: 10.1016/j.joen.2017.11.016. Epub 2018 Jan 3.

**b.** Krishan Gopal Jain, **Manisha Singh**, Anupama Kakkar, Rajesh Malhotra, Vineeta Batra, Alok Ray, Balram Airan, Sujata Mohanty*. Evaluating the osteogenic potential of CHT/HAP/PCL biocomposites in bone tissue engineering: An in vivo study. J. International Journal of Scientific Research, Volume-6, Issue-5, May – 2017, ISSN No 2277 – 8179.