OMB No. 0925-0001 and 0925-0002 (Rev. 10/2021 Approved Through 09/30/2024)

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
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NAME: **Avneesh K. Singh**

eRA COMMONS USER NAME (credential, e.g., agency login): **AK-Singh**

POSITION TITLE: **Associate Professor**

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

| INSTITUTION AND LOCATION | DEGREE(if applicable) | Completion DateMM/YYYY | FIELD OF STUDY |
| --- | --- | --- | --- |
| AMU, Aligarh, (UP), India | B.Sc. | 06/1990 | Zoology, Botany, Chemistry |
| AMU, Aligarh, (UP), India | M.Sc. | 06/1992 | Zoology, |
| Lucknow University, Lucknow (UP), India | Ph.D. | 12/1999 | Zoology (Immunology) |
| Vanderbilt University, Nashville, TN, USA | Post-doctoral Fellow | 02/2005 | Immunology |

**A. Personal Statement**

**An accomplished scientist with more than ten years of expertise in Microbiology, Immunology, and stem cell research with peer-reviewed publication records. My scientific training includes but is not limited to performing experiments in Immunology (especially in Autoimmune disease, Infectious disease, and transplantation) on small and large animals, reviewing scientific data, writing manuscripts for publication, and making presentations for scientific meetings with peer reviewers and project management experience has enabled me to develop strong analytical, communication, and problem-solving skills. I aim to apply my knowledge and expertise to protect and improve public health.**

**I have been working on testing genetically engineered (GE) pig hearts for Xenotransplantation (XTx) in a pre-clinical pig-to-baboon xenotransplantation model. I am also working to optimize the immunosuppression regimen for GE pig heart (xenograft) for their long-term survival in the baboon.**

**We demonstrated the successful transplantation of the first genetically engineered pig heart into an end-stage heart failure patient** **after US FDA approval, "A significant milestone or a medical breakthrough." Our goal is to make clinical cardiac Xenotransplantation the preferred treatment choice for end-stage heart failure patients.**

**I am investigating regulatory T cells' immunotherapeutic potential in XTx to prevent xenograft rejection and induce immune tolerance. Previously, I have purified and successfully expanded baboon naturally occurring CD4+CD25+ Treg cells using irradiated pig PBMC and IL-2 and have demonstrated suppression of autologous effector CD4+CD25neg T-cell and B cells proliferation (Singh et al.; Xenotransplantation).**

**B.** **Positions and Honors**

**Past Positions and Honors**

**2000-2002 Research Associate;** HHMI, Dept. of Micro & Immunology, Vanderbilt University, Nashville, TN; Research Projects: Regulation of Autoimmune disease by natural Killer T cells

**2002–2005 Post-doctoral Research Fellow;** Dept. of Microbiology & Immunology, Vanderbilt University Medical Center, Nashville, TN; Research Projects: To investigate the role of NKT cells in Experimental Autoimmune Encephalomyelitis (EAE) and Systemic lupus erythematosus (SLE)

**2005-2006 Research Scientist [C]** Transplantation Biology Branch, NIDDK/National Institute of Health Bethesda, MD. @Kelly Services at NIH; Research Projects: Hematopoietic stem cell-based therapy for inducing alloimmune tolerance

**2006 – 2017 Research Scientist,** Cardiothoracic Surgery Research Program, NIH Heart Center at Suburban hospital, sponsored by NHLBI/NIH, Bethesda. Research Project: CARDIAC XENOTRANSPLANTATION IN PIG TO BABOON MODEL

**2016- 2017 Assistant Professor** (PT) Department of Surgery, Johns Hopkins Medicine, Baltimore, MD

Project: CARDIAC XENOTRANSPLANTATION IN PIG TO BABOON MODEL

**2017- 2022 Assistant Professor** Department of Surgery, School of Medicine, University of Maryland, Baltimore, MD

**2022- Present Associate Professor** Department of Surgery, School of Medicine, University of Maryland, Baltimore, MD

Project: CARDIAC XENOTRANSPLANTATION IN PIG TO BABOON MODEL

* Testing genetically modified xenografts (pig organs) for a pre-clinical model of cardiac Xenotransplantation.
* Optimization of immunosuppression regime for cardiac Xenotransplantation
* Testing the immunotherapeutic potential of regulatory T (Treg) cells in pig-to-baboon cardiac Xenotransplantation

**SUMMARY OF EXPERIENCE**

* Teaching experience in an academic institution (Vanderbilt Medical Center and NIH), which includes supervision and mentoring of post-doctoral, post-baccalaureate fellows and summer students
* Project management and communication skills as an individual and in collaboration with colleagues and distinct scientists or managers and performed some of the many activities on a day-to-day basis
* Monitor the progress of the project, generate, analyze and review scientific data with respect to the accuracy, precision, and reliability of scientific publications
* Verify the completeness, correctness, consistency, compliance, or authenticity of the project
* Recommend methods for performing data analysis or testing of scientific & technical products/designs, which includes scientific devices and equipment
* Prepare reports on performance, acceptability, and scientific deficiencies of the project
* Notify individuals or offices orally of decisions, problems, or further actions needed
* Participate in advisory meetings, working groups, or task groups and conversations to discuss ongoing scientific and technical issues, problems, and solutions

 **C. Contributions to Science**

* Recently, demonstrated successful transplantation of first genetically engineered pig heart into an end-stage heart failure patient after US FDA approval "A significant milestone or a medical breakthrough."
* Successfully demonstrated the survival (up to 9 months) of pre-clinical non-human primates (Baboon) on a genetically engineered pig heart
* Successfully achieved the longest cardiac xenograft survival (i.e., 945 days) in a pre-clinical model of Xenotransplantation from genetically engineered pigs along with modified immunosuppression
* Demonstrated immuno-regulatory role of CD4+CD25+ Treg cells in cardiac Xenotransplantation and natural killer T (NKT) cells in autoimmune diseases
* Published more than forty peer-reviewed scientific articles

**AWARDS/ACHIEVEMENTS**

* National Merit Scholarship in High School (1985)
* Dr. K. S. Krishnan Research (DAE) Fellowship for pursuing Ph.D. in life sciences (1993)
* The Sidney P. Colowick Award for outstanding post-doctoral research achievements from Vanderbilt University, Nashville, Tennessee (2002)
* Young Investigator Travel Grant for attending International Xenotransplantation Meeting in Osaka, Japan (2013)

**LIST OF PUBLICATIONS (Most Recent)**

1. **Singh AK**, Griffith BP, Goerlich CE, Mohiuddin MM; The Road to the First FDA-Approved Genetically Engineered Pig Heart Transplantation into Human; Xenotransplantation; 2022 Sep;29(5):e12776.; [https://DOI.org10.1111/xen.12776. Epub 2022 Sep 20](https://DOI.org10.1111/xen.12776.%20Epub%202022%20Sep%2020)
2. Goerlich CE, **Singh AK**, Mohiuddin MM. The Immunobiology and Clinical Translation of Genetically Engineered Porcine Hearts for Human Transplantation. Nature Cardiovascular Research; Volume 1, pages715–726 (2022); <https://doi.org/10.1038/s44161-022-00112-x>
3. Mohiuddin MM, **Singh AK** Goerlich CE, . Pre-clinical rationale and current pathways to support the first human clinical trials in cardiac Xenotransplantation. Hum Immunol. 2022 Jul 15; S0198-8859(22)00136-7. <https://DOI.org/10.1016/j.humimm.2022.07.001>
4. Griffith BP, Goerlich CE, **Singh AK**, Shah A, Grazioli A, Ayares D, Mohiuddin MM. Pig-to-Human Cardiac Xenotransplantation Using a Genetically Modified Pig Donor. New England Journal of Medicine. (Under Review). The N England J Medicine; 2022; 387:35-44; <https://DOI.org/10.1056/NEJMoa2201422>
5. **Singh AK**, Goerlich CE, Shah et al.; Transplant International. 2022 Mar 23;35:10171. <https://DOI.org/10.3389/ti.2022.10171>

**OTHER PEER-REVIEWED PUBLICATIONS**

1. Mohiuddin MM, Goerlich CE\*, **Singh AK\***, et al.; Xenotransplantation. 2022 Mar 31:e12744. <https://doi.org/10.1111/xen.12744> **\*** Contributed equally
2. Goerlich CE, Singh A, Treffalls JA, et al.; Xenotransplantation. 2022 Jan 10:e12724. <https://DOI.org/10.1111/xen.12724> ; PMID: 35001436
3. Goerlich CE, Griffith B, Hanna P, Hong SN, Ayares D Singh AK, Mohiuddin MM; J Thorac Cardiovasc Surg; 2021 Sep 4; S0022-5223(21)01261-7. <https://DOI.org/10.1016/j.jtcvs.2021.07.051> .; PMID: 34579956
4. Goerlich CE, Griffith B, Singh AK, et al.; Front. Immunol. 12:667093. <https://DOI.org/10.3389/fimmu.2021.667093>
5. Goerlich CE, DiChiacchio L, Zhang T, Singh AK, et al.; . Scientific Reports. 2020 Jul 1;10(1):10709. <https://DOI.org/10.1038/s41598-020-66430-x> .PMID: 32612124
6. DiChiacchio L, Singh AK, Lewis B, et al.; Ann Thorac Surg 2020 May;109(5):1357-1361. <https://DOI.org/10.1016/j.athoracsur.2019.08.090> .
7. DiChiacchio L, **Singh AK**, Chan JL, et al.; Front Cardiovasc Med. 2019 Jul 25; 6:95. <https://DOI.org/10.3389/fcvm.2019.00095> . eCollection 2019
8. Mohiuddin MM, DiChiacchio L, **Singh AK**, et al; Transplantation 2019 Mar;103(3):453-454. <https://DOI.org/10.1097/TP.0000000000002608>
9. **Singh AK**, Chan, JL, DiChiacchio L, et al. Xenotransplantation.2018 Oct 5:e12465. <https://DOI.org/10.1111/xen.12465>
10. Agbor-Enoh S\*, Chan JL\*, **Singh A\***,J Heart Lung Transplant. 2018 Aug;37(8):967-975. <https://DOI.org/10.1016/j.healun.2018.04.009> *.* **\***First Coauthor
11. **Chan JL, Miller JG, Singh AK, et al; Clin Transplant. 2018 Aug;32(8):e13330.** <https://DOI.org/10.1111/ctr.13330> **. Epub 2018 Jun 29**
12. **Singh AK, Corcoran PC, Lewis BG, et al.; Xenotransplantation. 2018 Mar;25(2): e12379.** <https://DOI.org/10.1111/xen.12379> **. Epub 2017 Dec 17**
13. **Chan, JL\*, Singh AK\*, Corcoran PC, et al; Xenotransplantation 2017 Nov;24(6).** <https://DOI.org/10.1111/xen.12330> **. \*First Coauthor**
14. Cooper, DKC, Wijkstrom, M, Hariharan, S, Chan JL, **Singh A** et al. (2017). Transplantation **101**(7): 1551-1558.
15. Mohiuddin, MM, **Singh, AK**, Corcoran, PC, et al. (2016).  Nat Commun **7**: 11138.
16. Azimzadeh, AM, Kelishadi, SS, Ezzelarab, MB, **Singh AK**, et al. (2015). Xenotransplantation **22**(4): 310-316.
17. Zhou, Y, **Singh, AK**, Hoyt, RF, Jr., et al. (2014). J Thorac Cardiovasc Surg **148**(3): 1131-1137; discussiom 1117.
18. Wang, S, Zhou, Y, Andreyev, O, Hoyt RF, **Singh AK**, et al. (2014). Exp Cell Res **323**(1): 56-65.
19. Mohiuddin, MM, **Singh, AK**, Corcoran, PC, et al. (2014). Am J Transplant **14**(2): 488-489.
20. Mohiuddin, MM, **Singh, AK**, Corcoran, PC, et al. (2014). Xenotransplantation **21**(1): 35-45.
21. Mohiuddin, MM, **Singh, AK**, Corcoran, PC, et al. (2014). J Thorac Cardiovasc Surg **148**(3): 1106-1113; discussion 1113-1104.
22. **Singh, AK**, Seavey, CN, Horvath, KA, et al. (2012). Xenotransplantation **19**(2): 102-111.
23. Mohiuddin, MM, Corcoran, PC, **Singh, AK**, et al. (2012). Am J Transplant **12**(3): 763-771.
24. Wang, S, Zhou, Y, Seavey, CN, **Singh AK**, et al. (2010). Stem Cell Res **4**(2): 117-128.
25. Horvath, KA, Corcoran, PC, **Singh, AK**, et al. (2010). Transplant Proc **42**(6): 2152-2155.
26. Corcoran, PC, Horvath, KA, **Singh, AK**, et al. (2010). Transplant Proc **42**(6): 2149-2151.
27. **Singh, AK**, Horvath, KA and Mohiuddin, MM (2009). Transplant Proc **41**(1): 418-421.
28. Porter, CM, Horvath-Arcidiacono, JA, **Singh, AK**, et al. (2007). Xenotransplantation **14**(4): 298-308.
29. **Singh, AK**, Yang, JQ, Parekh, VV, et al. (2005). Eur J Immunol **35**(4): 1143-1154.
30. Parekh, VV, Wilson, MT, Olivares-Villagomez, D, **Singh AK,** et al. (2005). J Clin Invest **115**(9): 2572-2583.
31. Parekh, VV\*, **Singh, AK\***, Wilson, MT, et al. (2004). J Immunol **173**(6): 3693-3706. \*First Co Author
32. Yang, JQ\*, **Singh, AK\***, Wilson, MT, et al. (2003). J Immunol **171**(4): 2142-2153. \*First Co Author
33. Wilson, MT, Johansson, C, Olivares-Villagomez, D,**Singh AK**, et al. (2003). Proc Natl Acad Sci USA **100** (19): 10913-10918.
34. Wilson, MT, **Singh, AK** and Van Kaer, L (2002). Trends Mol Med **8**(5): 225-231.
35. **Singh, AK**, Wilson, MT, Hong, S, et al. (2001). J Exp Med **194**(12): 1801-1811.
36. **Singh, AK**, Sharma, RK, Agrawal, S, et al. (1998). Transplant Proc **30**(7): 3659.
37. Sharma, RK, **Singh, AK**, Agrawal, S, et al. (1998). Transplant Proc **30**(7): 2966.
38. Avula, S, Sharma, RK, **Singh, AK**, et al. (1998). Transplant Proc **30**(7): 3674.
39. Agrawal, S, **Singh, AK**, Sharma, RK, et al. (1998). Transplant Proc **30**(7): 2974.

**PUBLISHED ABSTRACTS**

1. **Chan, JL, Singh, AK, Thomas, ML, et al. (2016). Journal of Heart and Lung Transplantation 35(4): S47-S48.**
2. **Chan, JL, Singh, AK, Thomas, ML, et al. (2016). Circulation 134.**
3. **Mohiuddin, MM, Singh, AK, Corcoran, PC, et al. (2014). American Journal of Transplantation 14(2): 488-489.**
4. **Singh, AK, Seavey, CN, Horvath, KA, et al. (2012). Xenotransplantation 19(2): 102-111.**
5. **Singh, AK, Seavey, CN, Corcoran, PC, et al. (2012). Transplantation 94(10): 68-68.**
6. **Mohiuddin, MM, Singh, AK, Corcoran, PC, et al. (2012). American Journal of Transplantation 12: 530-531.**
7. **Mohiuddin, MM, Singh, AK, Corcoran, PC, et al. (2012). Transplantation 94(10): 70-70.**
8. **Singh, AK, Seavey, CN, Horvath, KA, et al. (2010). American Journal of Transplantation 10: 21-21.**
9. **Singh, AK, Seavey, CN, Horvath, KA, et al. (2010). American Journal of Transplantation 10: 298-298.**
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11. **Horvath, KA, Corcoran, PC, Singh, AK, et al. (2010). American Journal of Transplantation 10: 299-299.**
12. **Corcoran, PC, Horvath, KA, Singh, AK, et al. (2010). American Journal of Transplantation 10: 300-300.**
13. **Mohiuddin, MM, Singh, AK, Seavey, C, et al. (2009). Xenotransplantation 16(5): 362-363.**
14. **Mohiuddin, MM, Singh, AK, Corcoran, PC, et al. (2009). Xenotransplantation 16(5): 357-357.**
15. **Horvath, KA, Corcoran, PC, Singh, AK, et al. (2009).Xenotransplantation 16(5): 380-380.**
16. **Corcoran, PC, Horvath, KA, Singh, AK, et al. (2009).Xenotransplantation 16(5): 429-429.**
17. **Azimzadeh, AM, Kelishadi, SS, Ezzelarab, M, Singh AK, et al. (2009). Xenotransplantation 16(5): 356-356.**
18. **Singh, AK, Horvath, KA and Mohiuddin, MM (2008). American Journal of Transplantation 8: 562-562.**
19. **Wilson, MT, Johansson, C, Olivares-Villagomez, D, Singh AK, et al. (2003). Faseb Journal 17(7): C82-C83.**
20. **Singh, RR, Singh, AK, Wang, CR, et al. (2003). Journal of the American Society of Nephrology 14: 383a-383a.**
21. **Singh, AK, Yang, JQ, Wilson, MT, et al. (2003). Faseb Journal 17(7): C279-C279.**
22. **Yang, JQ, Singh, AK, Hong, S, et al. (2002). Faseb Journal 16(4): A326-A326.**
23. **Singh, AK, Wilson, MT, Hong, S, et al. (2002). Faseb Journal 16(5): A1043-A1043.**
24. **Singh, AK, Hong, S, Du, CG, et al. (2001). Faseb Journal 15(5): A1212-A1212.**