

## BIOGRAPHICAL SKETCH

NAME: Shruti Naik

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

POSITION TITLE: Associate Professor

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	COMPLETION	FIELD
University of Maryland, College Park, MD	B.S.	12/2005	Cell and Molecular Biology
University of Pennsylvania, Philadelphia, PA	Ph.D.	12/2012	Immunology
The Rockefeller University, New York, NY	Postdoc	05/2018	Epithelial Stem Cell Biology

**A. Personal Statement**

I am an internationally recognized and immunologist with over 15 years' experience working in microbe-tissuecrosstalk, barrier immunity and immune-stem cell interactions. I am Associate Professor in the Department of Immunology and Immunotherapy and Department of Dermatology, Director of the Tissue Repair Program, and a member of Precision Immunology Institute (PrIISM). My research program is centered on understanding how adult tissue stem cells, such as those generating intestinal epithelia, are regulated by environmental signals like microbes. By coupling cutting-edge genomic and imaging technologies such as spatial transcriptomics with clinical observations and translational studies, my group aims to identify and develop novel therapeutic interventions for immune-mediated conditions. My scientific contributions include the first identification of commensal function in skin immunity and the first discovery of inflammatory memory in stem cells. I have published seminal studies on immune-commensal crosstalk (*Science, Nature*) and inflammatory stem memory (*Nature, Cell*) that have been cited 100's of times, including recent senior author papers in tissue repair and inflammatory disease *Science* (Konieczny *et al Science* 2022) and *Science immunology* (Castillo *et al Science Immunology* 2023), *Immunity* (Subudhi *et al Immunity* 2024), underscoring my extensive track record of productivity (55 peer reviewed publications, with a large fraction in top tier journals). I have been invited to give over 120 talks and seminars at national and international venues. The impact of my discoveries is underscored by my receipt several early career fellowships (Pew, Packard, NIH DP2) and international Awards (Leo Foundation Award, Takeda Innovator in Regeneration)

**B. Positions, Scientific Appointments, and Honors**

Positions and Scientific Appointments

2024-	Associate Professor, Department of Immunology and Immunotherapy and Department of Dermatology, Icahn School of Medicine at Mt Sinai, NY, NY
2024-	Director, Tissue Repair Program, Icahn School of Medicine at Mt Sinai, NY, NY
2023-2024	Associate Director, Colton Center for Autoimmunity, NYUGSoM, NY, NY
2018-2024	Associate Professor, Departments of Pathology, Medicine, and Dermatology. Member, Perlmutter Cancer Center, NYU Grossman School of Medicine, New York, NY
2018-2024	Assistant Professor, Departments of Pathology, Medicine, and Dermatology. Member, Perlmutter Cancer Center, NYU Grossman School of Medicine, New York, NY
2013-18	Damon Runyon Postdoctoral Fellow, The Rockefeller University, New York, NY
2012-13	Post-doctoral Intramural Research Training Award Fellow. NIH, Bethesda, MD
2009-12	Pre-doctoral Intramural Research Training Award Fellow. NIH, Bethesda, MD
2007-12	Graduate student. University of Pennsylvania, Philadelphia, PA
2005-07	Research Assistant. Naval Medical Research Center, Silver Spring, MD
2003-05	JIFSAN Intern. Food and Drug Administration, College Park, MD

Academic and Professional Honors

2024 Leo Foundation Award Region Americas Winner

2023 Burroughs Welcome Trust PATH Forward Award  
2023 Cold Spring Harbor Laboratory WiSE McClintock Award  
2023 Irma Hirschl-Weill-Caulier Career Scientist Award  
2022 NYULH Outstanding Postdoctoral Mentor Award  
2021 NYSCF Robertson Investigator Award (1 of 3 international awardees)  
2021 International Cytokine Society Early Career Award (1 of 6 international awardees)  
2021 NYUrWIS Mentor of the Year (1 of 2 Institutional Awardees)  
2020 David and Lucille Packard Science and Engineering Fellow (1 of 18 National awardees)  
2020 NIH Director's New Innovator Award DP2  
2020 Pew-Stewart Fellow, Pew Foundation (1 of 37 National awardees)  
2019 New York University Whitehead Fellowship (1 of 2 Awardees)  
2019 HHMI Gilliam Fellowship Mentor  
2019 Dr. Marcia Robbins-Wilf Research Award, Skin Cancer Foundation (1 of 3 Awardees)  
2019 Takeda Innovator in Science Award. New York Academies of Science and Takeda Pharmaceutical Company (International Early Career Grant Prize Winner)  
2018 Blavatnik Regional Award for Young Scientists. New York Academies of Science and the Blavatnik Foundation (Life Science Grant Prize Winner)  
2018 Career Transition Award (K22), National Institutes of Allergy and Infectious Disease  
2018 Dale A. Frey Award for Breakthrough Scientists, Damon Runyon Foundation (1 of 6 Awardees)  
2018 Sartorius & Science Prize for Regenerative Medicine & Cell Therapy, Sartorius group and American Academy for the Advancement of Science (1 of 4 International Finalists)  
2018 Tri-Institutional Breakout Prize for Junior Investigators, Rockefeller University, Memorial Sloan Kettering Cancer Center and Cornell University (1 of 6 Awardees)  
2018 Nature Inspiring Scientist (1 of 10 Longlist World-wide)  
2017 Best Selected Talk, Epithelial Differentiation and Keratinization Gordon Research Conference  
2016 L'Oréal For Women in Science Fellowship, L'Oréal USA (1 of 5 National Awardees)  
2015 Regeneron Postdoctoral Prize for Creative Innovation, Regeneron Pharmaceuticals (National Grand Prize Winner)  
2014 Future of Science Fund Scholarship, Keystone Symposia Tissue-Resident Memory T cells  
2014 Damon Runyon Postdoctoral Fellowship, Damon Runyon Foundation  
2013 Best Paper Award 2012, Cytokine Interest Group, National Institutes of Health  
2012 President's Travel Award, University of Pennsylvania  
2012 Graduate and Professional Student Assembly Travel Award, University of Pennsylvania  
2012 Fellows Award for Research Excellence, National Institutes of Health  
2012 Women Scientists Advisor Scholar Award, National Institutes of Health (1 of 3 Awardees)  
2011 Fellows Award for Research Excellence, National Institutes of Health  
2010 Travel Bursary Award for Young Researchers, International Immunology Congress, Japan

#### Leadership and Synergistic Activities

- Editorial and Referee Service: *Ad Hoc* Journal Referee >25 journals including *Science*, *Nature*, *Cell*, *Science Translational Medicine*, *Cell Metabolism*, *Immunity*, *elife*, *Molecular Immunology*, *Cell Host and Microbe*, *Trends in Immunology*, *Journal of Immunology*, *Nature Communications*, *Nature Immunology*, *Journal of Investigative Dermatology*, *Molecular Oncology*, *PNAS*. Advisory Editor for StemJournal and StemBook (international, multidisciplinary, open access forum for communicating outstanding research in stem cell biology) 2019-2021
- Consulting: Scientific Advisor for Seed Inc (Microbiome-based biotech company) 2018- and Biomx 2020-
- Conference Organization: Co-organizer HHMI Janelia Farms 2021 R3- repair, replace, regenerate workshop (>900 participants), Keystone Symposium Scientific Advisory Board Member, 2025 Innate Immune Memory Keystone Symposium, Lead Organizer.

#### **C. Contributions to Science**

##### 1. Host-commensal interactions

My studies laid the foundational groundwork for a new field on the interactions between skin commensals and resident immune cells and underscored the importance of this dialogue in cutaneous immunity. We found that indigenous microbes co-opt tissue-specific modes of interacting with the host to discretely modulate immune cell function in the local microenvironment. Continuing this line of inquiry, we uncovered that key commensal species are able to elicit distinct populations of immune effectors, suggesting that sustaining complex communities of

commensals is necessary to maintain a diverse repertoire of immune function. Importantly, this dialogue takes place in the absence of overt inflammation. Thus, our work revealed a new type of “homeostatic” immune response that is continuously calibrating barrier immunity to commensal signals.

- a) **Naik S**, Bouladoux N, Wilhelm C, Molloy MJ, Salcedo R, Kastenmuller W, Deming C, Quinones M, Koo L, Conlan S, Spencer S, Hall JA, Dzutsev A, Kong H, Campbell DJ, Trinchieri G, Segre JA, Belkaid Y. Compartmentalized control of skin immunity by resident commensals. *Science*. 337:1115-9 (2012). *Highlighted in Nature Research Highlights, Nature News, Nature Reviews Immunology, Nature Immunology, Science Daily, Scientific American, LA Times and various other news and media outlets. Faculty 1000 Top 10 Articles of 2012. Cited >1000 times.*
- b) Belkaid Y and **Naik S**. Compartmentalized and systemic control of tissue immunity by commensals. *Nature Immunology*. 14:646-53 (2013) Cited >300 times.
- c) **Naik S\***, Bouladoux N\*, Linehan J, Han SJ, Harrison OJ, Wilhelm C, Conlan S, Himmelfarb S, Byrd A, Deming C, Quinones M, Brenchley JM, Kong H, Tussiwand R, Murphy KM, Merad M, Segre JA and Belkaid Y. Commensal-dendritic cell interactions specifies a unique protective skin immune signature. *Nature*. 520:104-108 (2015). \*Equal contribution. *Featured in Society for Mucosal Immunology. Previewed in Cell Host and Microbe. Highlighted in New England Journal of Medicine, Science Signaling, Science Daily, Medical News Today, NIH Research Matters. Cited >650 times.*
- d) Kobayashi T, **Naik S**✉, and Nagao K✉. Choreographing immunity in the skin epithelium. *Immunity* 50, 2019. ✉Corresponding author. Cited >55 times.

## 2. Inflammatory memory in stem cells and tissue adaptation

Epithelial tissues interface with the terrestrial environment and routinely experience inflammation. Although a vast majority of these inflammatory reactions resolve, they imprint the tissue with a memory. Cells of the immune system are traditionally thought to be the bearers of this memory, allowing them to react faster to subsequent inflammatory pressures. Yet, barrier tissues are composites of epithelial, mesenchymal, nervous, vascular, and immunological networks working in unison to sustain optimal function in health and disease. Whether tissue resident cells, distinct from the immune system, are entrained in response to a perturbation, remained to be addressed. We examined the consequences of inflammation on long-lived epithelial stem cells and uncovered their remarkable capacity to remember inflammation for the sake of tissue fitness and function. Memory in epithelial stem cells is maintained at the level of chromatin and enhances their regenerative potential. Thus, our work provided a sea change in how the field views inflammatory memory, demonstrating that memory of inflammation is not exclusive to the immune system but also a feature of long-lived tissue stem cells. Such an understanding of memory has important clinical implications for future therapeutic avenues in hyperproliferative epithelial disorders such as psoriasis

- a) **Naik S**✉, Larsen SB\*, Gomez N, Alaverdyan K, Sendoel A, Polak L, Kulukian A, Chai S, and Fuchs E✉. Inflammatory memory sensitizes skin epithelial stem cells to tissue damage. *Nature*. 550:475-480 (2017). \*Equal contribution. ✉Corresponding authors. *Highlighted in Nature, Nature Immunology, Cell Stem Cell, Immunity, and Science Signaling Papers of Note, Science Daily, The Scientist Magazine, and Faculty of 1000. Cited >390 times.*
- b) **Naik, S.** The healing power of painful memories. *Science* 359:1113 (2018).
- c) Xing Y and **Naik S**. Under pressure: Stem cell-niche interactions coordinate tissue adaptation to inflammation. *Curr Opin Cell Biol*. 2020 Sep 8;67:64-70.
- d) **Naik S**✉ and Fuchs E✉. Inflammatory memory and tissue adaptation in sickness and in health. *Nature*, July 13 2022 ✉Corresponding authors

## 3. Immune-epithelial crosstalk in tissue repair and inflammatory disease

The skin is routinely subject to injurious, inflammatory, infectious and other damage causing stimuli. Repair in the skin epithelium is mediated by a process called re-epithelialization, that involves proliferation and migration of the wound edge epithelium. This process was thought to be driven via cell autonomous sensing of tissue hypoxia and activation of hypoxia inducible factor 1 a (HIF1a). We uncovered that in vivo hypoxia is not sufficient to activate HIF1a whose activation requires a secondary signal, IL-17A. Induction of HIF1a by IL-17A is mediated by ERK-AKT-mTOR signaling, which induces transcription and translation of HIF1a. This discovery upended the long-standing view that hypoxia is sufficient to induce HIF1a and spotlighted a novel effector of IL-17A.

- a) **Naik, S**✉ Larsen SB, Cowley C and Fuchs E✉. Two to tango: dialogue between immunity and stem cells in health and disease. *Cell* 175, 2018 ✉Corresponding authors. Cited >130 times

- b) Konieczny P\*, Yue Xing \*<sup>‡</sup>, Sidhu I, Subudhi I, Mansfield KP, Hsieh B, Biancur DE, Larsen SB, Cammer M, Li D, Landén NX, Loomis CA, Heguy A, Tikhonova AN, Tsirigos A, and Naik S<sup>‡</sup>. Interleukin-17 governs hypoxic adaptation of injured epithelium. *Science*. June 16 2022 <sup>‡</sup>Corresponding authors *Highlighted in Nature Immunology, Nature Reviews Immunology, Trends in Immunology*
- c) Castillo RL\*, Sidhu I \*, Dolgalev I, Subudhi I, Yan D, Konieczny P, Hsieh B, Chu T, Haberman RH, Selvaraj S, Shiomi T, Medina R, Girija PV, Heguy A, Loomis CA, Chiriboga L, Ritchlin C, Garcia-Hernandez MDL, Carucci J, Meehan SA, Neumann AL, and Scher JU<sup>‡</sup>, Naik S<sup>‡</sup>. Spatial transcriptomics stratifies health and psoriatic disease severity by emergent cellular ecosystem. *Science Immunology* June 2 2023. <sup>‡</sup>Corresponding authors
- d) Subudhi I\*, Konieczny P\*<sup>‡</sup>, Prystupa A, Castillo RL, Sze-Tu E, Xing Y, Rosenblum D, Reznikov I, Sidhu I, Loomis C, Lu CP<sup>5</sup>, Anandasabapathy N, Suárez-Fariñas M, Gudjonsson JE, Tsirigos A, Scher JU, and Naik S<sup>‡</sup>. Epithelial-Immune Metabolic Codependency Fuels Inflammatory Disease. *Immunity*, May 20 *epub*<sup>‡</sup>Corresponding author

Complete list of published work (55 publications) in MyBibliography:

<https://www.ncbi.nlm.nih.gov/myncbi/1Fo7i9VKzrJAQ/bibliography/public/>