Stanford



Tushar Desai

Professor of Medicine (Pulmonary, Allergy and Critical Care Medicine)

Medicine - Pulmonary, Allergy & Critical Care Medicine

CLINICAL OFFICE (PRIMARY)

- **Chest Clinic**

  300 Pasteur Dr Rm A157

  MC 5351

  Stanford, CA 94305

  Tel (650) 725-7061 **Fax** (650) 498-6288

Bio

BIO

Dr. Tushar Desai specializes clinically in the treatment of general pulmonary and Interstitial Lung Diseases like Idiopathic Pulmonary Fibrosis (IPF). He has practiced pulmonary medicine since 2002.

Dr. Desai conducts basic and translational research on lung stem cells that repair and regenerate the lung after injury, and their role in diseases like IPF, Chronic Obstructive Pulmonary Disease (COPD), and lung adenocarcinoma. His lab also studies the molecular signals that regulate lung stem cell activity, and how the signals can be manipulated to restore their activity. He participates in research involving gene correction of CFTR in lung stem cells from patients with Cystic fibrosis followed by autologous stem cell transplantation to provide lifelong restoration of physiological activity.

CLINICAL FOCUS

- Pulmonary Disease
- Interstitial Lung Diseases

ACADEMIC APPOINTMENTS

- Professor, Medicine - Pulmonary, Allergy & Critical Care Medicine
- Member, Bio-X
- Member, Cardiovascular Institute
- Member, Institute for Stem Cell Biology and Regenerative Medicine
- Member, Maternal & Child Health Research Institute (MCHRI)
- Member, Stanford Cancer Institute

ADMINISTRATIVE APPOINTMENTS

- Director of Graduate Studies, Stem Cell Biology PhD program, (2021-2025)
- Director of Translational Lung Biology, Department of Medicine, (2020- present)

HONORS AND AWARDS

- Elected Member, American Society for Clinical Investigation (2019)
- Lung Force Gala Honoree, American Lung Association (2018)
- Woods Family Endowed Faculty Scholar in Pediatric Translational Medicine, Stanford Child Health Research Institute (2016-2021)
- Stanford Medical Student Teaching Recognition, Stanford University School of Medicine (2011-2014)
- Robert Dawson Evans Fellow Excellence in Teaching Award, Boston University School of Medicine, Department of Internal Medicine (2000)
- House Officer Research Award, University of Michigan Hospitals, Department of Internal Medicine (1998)
- Worth F. Bloom M25 Prize, Tufts University School of Medicine (1995)

BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Member, American Society for Clinical Investigation (2019 - present)
- Member, Scientific Advisory Board, UK Regenerative Medicine Platform, Engineered Cell Environment Hub (2018 - 2024)
- Member, Scientific Advisory Committee, American Thoracic Society (ATS) (2015 - 2019)

PROFESSIONAL EDUCATION

- Board Certification: Pulmonary Disease, American Board of Internal Medicine (2022)
- Fellowship: Boston University Pulmonary and Critical Care Fellowship (2002) MA
- Residency: University of Michigan Health System Internal Medicine Residency (1998) MI
- MD, MPH, Tufts University School of Medicine (1995)
- BA, Amherst College , Psychology (1991)

PATENTS

- Dawn T. Bravo, Sriram Vaidyanathan, Matthew H. Porteus, Calvin J. Kuo, Jayakar Nayak, Ameen Salahudeen and Tushar J. Desai. "United States Patent 17/353,049 Compositions and methods for airway tissue regeneration", Leland Stanford Junior University, Jun 21, 2021
- Tushar Desai, Pehr Harbury, Daniel Riordan. "United States Patent 62/475,090 Molecular profiling using proximity ligation- in situ hybridization", Leland Stanford Junior University, Mar 22, 2017

LINKS

- Desai lab homepage: https://desailab.stanford.edu/

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

My lab is focused on understanding the causes of and working towards specific molecular and cell-based treatments for lung diseases like cancer, pulmonary fibrosis, COPD. We focus our attention on lung stem cells and the molecular signals that regulate their activity to repair and regenerate lung tissue after injury. These same stem cells can become dysfunctional, generating cancer if they become overactive, and resulting in respiratory failure if they lose their potency. We are focused on Wnt signaling because this appears to be a key signal that confers stem cell potency in both mouse and human lung, and is overactive in diseases like lung adenocarcinoma and Idiopathic Pulmonary Fibrosis (IPF). My lab also studies the role of TERT in lung stem cell biology and repair of acute lung injury, which is a culprit gene mutation in IPF. Our experimental approaches involve mouse genetics, single cell genomics, organoid culture, lung slice culture, and we perform histological analysis of lung tissue using advanced fluorescence microscopy technologies. A portion of my lab is also involved in the invention of new technologies to facilitate highly multiplexed staining of protein (immunostaining) and RNA (in situ hybridization) of human tissues.

Lung stem cells can also be exploited to treat monogenic diseases, by using CRISPR to correct the genetic mutation then transplanting them back into the patient. This strategy of ex vivo gene correction in stem cells followed by autologous stem cell transplantation is already being trialed in blood disorders like Sickle cell anemia. We are part of a Stanford group that is using CRISPR to correct CFTR mutations in airway stem cells and working towards developing a protocol for safe and effective autologous transplantation into the sinuses of Cystic fibrosis patients. We hope to advance this cell-based therapeutic approach of transplanting stem cells into the airways and gas exchange region of the lungs to treat diseases resulting from loss of stem cell potency.

Teaching

COURSES

2025-26

- Stem Cells Immersion: Applications in Medicine, Business and Law: STEMREM 203 (Aut, Sum)

2024-25

- Regenerative Medicine Seminar Series: STEMREM 250 (Spr)
- Stem Cell Biology and Regenerative Medicine Journal Club: STEMREM 280 (Spr)
- Stem Cell Intensive: STEMREM 200 (Aut)
- Stem Cells Immersion: Applications in Medicine, Business and Law: STEMREM 203 (Aut, Win, Spr, Sum)

2023-24

- Stem Cell Intensive: STEMREM 200 (Aut)
- Stem Cells Immersion: Applications in Medicine, Business and Law: STEMREM 203 (Aut, Win)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Khristian Bauer-Rowe, Austin Huang, Stewart Kim, Jeeyoon Na, Joshua Rico

Postdoctoral Faculty Sponsor

Dan Su, Ziyue Yang

Doctoral Dissertation Co-Advisor (AC)

Isabela Fuentes

Postdoctoral Research Mentor

Dan Su

GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS

- Cancer Biology (PhD Program)
- Medicine (Masters Program)
- Pulmonary & Critical Care Medicine (Fellowship Program)
- Stem Cell Biology and Regenerative Medicine (PhD Program)

Publications

PUBLICATIONS

- **Enhanced cfDNA methylation profiling by detection and correction of jagged ends.** *Nature methods*
  Wang, R., Hamilton, E. G., Almanza, D., Bonilla, R., Sugio, T., Hui, A., Tian, F., Phillips, N. A., Liu, C. L., Yoo, C. H., Alig, S., Rossi, C., Juul, et al

2026

- **Neuroendocrine cells orchestrate regeneration through Desert hedgehog signaling.** *Cell*
  Kong, W., Lu, W. J., Dubey, M., Suryawanshi, R. K., Vijayakumar, S., Jeong, Y., Gombar, S., Diehn, M., Shin, K., Ott, M., Chien, Y. H., Sarin, K. Y., Desai, et al
  2025

- **Histological signatures map anti-fibrotic factors in mouse and human lungs.** *Nature*
  Guo, J. L., Griffin, M., Yoon, J. K., Lopez, D. M., Zhu, Y., Lu, J. M., Mikos, G., Parker, J. B., Mascharak, S., Brenac, C., Guardino, N. J., Abbas, D. B., Li, et al
  2025

- **Evidence for lung barrier regeneration by differentiation prior to binucleated and stem cell division.** *The Journal of cell biology*
  Guild, J., Juul, N. H., Andalon, A., Taenaka, H., Coffey, R. J., Matthay, M. A., Desai, T. J.
  2023; 222 (12)

- **KRAS(G12D) drives lepidic adenocarcinoma through stem-cell reprogramming.** *Nature*
  Juul, N. H., Yoon, J. K., Martinez, M. C., Rishi, N., Kazadaeva, Y. I., Morri, M., Neff, N. F., Trope, W. L., Shrager, J. B., Sinha, R., Desai, T. J.
  2023

- **An integrated cell atlas of the lung in health and disease.** *Nature medicine*
  Sikkema, L., Ramírez-Suástegui, C., Strobl, D. C., Gillett, T. E., Zappia, L., Madissoon, E., Markov, N. S., Zaragosi, L. E., Ji, Y., Ansari, M., Arguel, M. J., Apperloo, L., Banchero, et al
  2023

- **Alveolar cell fate selection and lifelong maintenance of AT2 cells by FGF signaling.** *Nature communications*
  Brownfield, D. G., de Arce, A. D., Ghelfi, E., Gillich, A., Desai, T. J., Krasnow, M. A.
  2022; 13 (1): 7137

- **Developmental Insights into Lung Cancer** *ANNUAL REVIEW OF CANCER BIOLOGY, VOL 5, 2021*
  Desai, T. J.
  edited by Jacks, T., Sawyers, C. L.
  2021; 5: 351–69

- **Lung stem cells and therapy for cystic fibrosis** *Lung Stem Cells in Development, Health and Disease (ERS Monograph)*
  Vaidyanathan, S., McCarra, M., Desai, T. J.
  edited by Nikolic, M. Z., Hogan, B. L.
  2021: 306-321

- **Progenitor identification and SARS-CoV-2 infection in human distal lung organoids.** *Nature*
  Salahudeen, A. A., Choi, S. S., Rustagi, A., Zhu, J., van Unen, V., de la O, S. M., Flynn, R. A., Margalef-Catala, M., Santos, A. J., Ju, J., Batish, A., Usui, T., Zheng, et al
  2020

- **Niche Cells and Signals that Regulate Lung Alveolar Stem Cells In Vivo.** *Cold Spring Harbor perspectives in biology*
  Juul, N. H., Stockman, C. A., Desai, T. J.
  2020

- **An atlas of the aging lung mapped by single cell transcriptomics and deep tissue proteomics.** *Nature communications*
  Angelidis, I., Simon, L. M., Fernandez, I. E., Strunz, M., Mayr, C. H., Greiffo, F. R., Tsitsiridis, G., Ansari, M., Graf, E., Strom, T., Nagendran, M., Desai, T., Eickelberg, et al
  2019; 10 (1): 963

- **High-Efficiency, Selection-free Gene Repair in Airway Stem Cells from Cystic Fibrosis Patients Rescues CFTR Function in Differentiated Epithelia.** *Cell stem cell*
  Vaidyanathan, S. n., Salahudeen, A. A., Sellers, Z. M., Bravo, D. T., Choi, S. S., Batish, A. n., Le, W. n., Baik, R. n., de la O, S. n., Kaushik, M. P., Galper, N. n., Lee, C. M., Teran, et al
  2019

- **Automated cell-type classification in intact tissues by single-cell molecular profiling** *ELIFE*
  Nagendran, M., Riordan, D. P., Harbury, P. B., Desai, T. J.

2018; 7

- **Single-cell Wnt signaling niches maintain stemness of alveolar type 2 cells.** *Science (New York, N.Y.)*
  Nabhan, A. n., Brownfield, D. G., Harbury, P. B., Krasnow, M. A., Desai, T. J.
  2018

- **Trinucleotide repeat containing 6c (TNRC6c) is essential for microvascular maturation during distal airspace sacculation in the developing lung.** *Developmental biology*
  Guo, H., Kazadaeva, Y., Ortega, F. E., Manjunath, N., Desai, T. J.
  2017; 430 (1): 214-223

- **Keeping it together: Pulmonary alveoli are maintained by a hierarchy of cellular programs.** *BioEssays*
  Logan, C. Y., Desai, T. J.
  2015; 37 (9): 1028-1037

- **Cellular mechanisms of alveolar pathology in childhood interstitial lung diseases: current insights from mouse genetics** *CURRENT OPINION IN PEDIATRICS*
  Kuo, C. S., Desai, T. J.
  2015; 27 (3): 341-347

- **Reconstructing lineage hierarchies of the distal lung epithelium using single-cell RNA-seq.** *Nature*
  Treutlein, B., Brownfield, D. G., Wu, A. R., Neff, N. F., Mantalas, G. L., Espinoza, F. H., Desai, T. J., Krasnow, M. A., Quake, S. R.
  2014; 509 (7500): 371-375

- **Alveolar progenitor and stem cells in lung development, renewal and cancer.** *Nature*
  Desai, T. J., Brownfield, D. G., Krasnow, M. A.
  2014; 507 (7491): 190-194

- **Stem cells: Differentiated cells in a back-up role.** *Nature*
  Desai, T. J., Krasnow, M. A.
  2013; 503 (7475): 204-205

- **Distinct roles for retinoic acid receptors alpha and beta in early lung morphogenesis** *DEVELOPMENTAL BIOLOGY*
  Desai, T. J., Chen, F., Lu, J. M., Qian, J., Niederreither, K., Dolle, P., Chambon, P., Cardoso, W. V.
  2006; 291 (1): 12-24

- **Retinoic acid selectively regulates Fgf10 expression and maintains cell identity in the prospective lung field of the developing foregut** *DEVELOPMENTAL BIOLOGY*
  Desai, T. J., Malpel, S., Flentke, G. R., Smith, S. M., Cardoso, W. V.
  2004; 273 (2): 402-415

- **COPD: Clinical Manifestations, Diagnosis, and Treatment** *Baum's Textbook of Pulmonary Diseases (Eds: James D. Crapo, Jeffrey Glassroth, Joel Karlinsky, and Talmadge E. King Jr.)*
  Desai TJ, Karlinsky, JB
  2004; 7th ed