Stanford



Michael R. Howitt

Associate Professor of Pathology and of Microbiology and Immunology

Bio

ACADEMIC APPOINTMENTS

- Associate Professor, Pathology
- Associate Professor, Microbiology and Immunology
- Member, Bio-X
- Member, Maternal & Child Health Research Institute (MCHRI)
- Faculty Fellow, Sarafan ChEM-H

HONORS AND AWARDS

- Investigator in the Pathogenesis of Infectious Disease Award, Burroughs Wellcome Fund (2025)
- NIH K01 Career Development Award, NIDDK (2017-2022)
- Harvard Digestive Diseases Center P/F Award, Harvard (2017)
- Barry R. and Irene Tilenius Bloom Fellowship, HSPH (2016)

PROFESSIONAL EDUCATION

- Post Doctoral Fellowship, Harvard School of Public Health , Immunology and Infectious Diseases (2017)
- Ph.D., Stanford University , Microbiology and Immunology (2011)
- B.A., UC Berkeley , Molecular and Cell Biology (2002)

LINKS

- Howitt Lab website: https://www.howittlab.com

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

Our lab studies how microbes interact with epithelial and immune cells to shape inflammation, tissue repair, and intestinal function. We focus on tuft cells, specialized chemosensory epithelial cells that detect microbial and environmental signals through pathways shared with taste cells. These cells initiate type 2 immune responses. We investigate how protists and bacteria activate tuft cells and how these responses influence immune cell function, epithelial differentiation, and intestinal physiology.

We study these pathways in intestinal health and inflammatory bowel disease. An emerging interest is the role of tuft cells in bile duct inflammation, including primary sclerosing cholangitis (PSC). We combine microbial culture and colonization studies with genetically engineered mouse models,

human intestinal tissue, and patient-derived intestinal organoids. Approaches include tissue imaging, immune cell analysis, and RNA sequencing, including single-cell analysis. Projects can involve experimental work, computational analysis, or both.

We welcome inquiries from graduate students, medical students, and postdoctoral researchers interested in these questions. Our mentoring approach emphasizes close guidance, ownership of research questions, and the development of scientific independence.

Teaching

COURSES

2026-27

- Cellular and Molecular Immunology: An Introductory Course: BIO 230, IMMUNOL 200, MI 200 (Aut)

2025-26

- Cellular and Molecular Immunology: An Introductory Course: BIO 230, IMMUNOL 200, MI 200 (Aut)

2024-25

- Cellular and Molecular Immunology: An Introductory Course: BIO 230, IMMUNOL 200, MI 200 (Aut)

2023-24

- Cellular and Molecular Immunology: An Introductory Course: BIO 230, IMMUNOL 200, MI 200 (Aut)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Filipe Araujo Hoffmann, Jasmine Arunachalam, Alyssa Cutter, Hyungjin Kim, Xariana Vales Torres, Pat Yan

Postdoctoral Faculty Sponsor

Flora Tierney, Yang Zang

Doctoral Dissertation Advisor (AC)

Radeesha Jayewickreme, Yeongseo Son, Miles Tyner

GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS

- Immunology (PhD Program)
- Microbiology and Immunology (PhD Program)

Publications

PUBLICATIONS

- **Follicle-associated epithelial tuft cells amplify type 2 mucosal immunity and IgA production.** *Science immunology*
  Barrón, G. M., Jayewickreme, R. D., Tran, H. H., Thompson, T. W., Narasimhan, R., Zhu, Y., DeSchepper, L. B., Habashi, D., Nico, K. F., Tyner, M. D., Tierney, F. M., Billipp, T. E., Rosen, et al
  2026; 11 (124): eaee1358

- **Metabolic diversity in commensal protists regulates intestinal immunity and trans-kingdom competition.** *Cell*
  Gerrick, E. R., Zlitni, S., West, P. T., Carter, M. M., Mechler, C. M., Olm, M. R., Caffrey, E. B., Li, J. A., Higginbottom, S. K., Severyn, C. J., Kracke, F., Spormann, A. M., Sonnenburg, et al
  2023

- **Tuft cells mediate commensal remodeling of the small intestinal antimicrobial landscape.** *Proceedings of the National Academy of Sciences of the United States of America*
  Fung, C., Fraser, L. M., Barrón, G. M., Gologorsky, M. B., Atkinson, S. N., Gerrick, E. R., Hayward, M., Ziegelbauer, J., Li, J. A., Nico, K. F., Tyner, M. D., DeSchepper, L. B., Pan, et al

2023; 120 (23): e2216908120

- **Tuft cells, taste-chemosensory cells, orchestrate parasite type 2 immunity in the gut** *SCIENCE*
  Howitt, M. R., Lavoie, S., Michaud, M., Blum, A. M., Tran, S. V., Weinstock, J. V., Gallini, C. A., Redding, K., Margolskee, R. F., Osborne, L. C., Artis, D., Garrett, W. S.
  2016; 351 (6279): 1329-1333
- **MCT6 is an intestinal Lac-Phe exporter required for metformin-associated weight loss.** *Cell*
  Xiao, S., Tung, A. S., Spaas, J., Fu, S., Chen, X., Trinh, T. K., Moya-Garzon, M. D., Li, V. L., Cessna, H. T., Ito, K., Reghupaty, S. C., Lin, C., Lyu, et al
  2026
- **Protective or pathogenic? Tuft cells shape divergent immune outcomes in helminth and viral infections.** *Current opinion in immunology*
  Tyner, M. D., Howitt, M. R.
  2025; 97: 102657
- **The Lost Kingdom: commensal protists in the gut microbiota.** *Trends in microbiology*
  Gerrick, E. R., Howitt, M. R.
  2025
- **Distinct epigenomic landscapes underlie tissue-specific memory T cell differentiation.** *Immunity*
  Buquicchio, F. A., Fonseca, R., Yan, P. K., Wang, F., Evrard, M., Obers, A., Gutierrez, J. C., Raposo, C. J., Belk, J. A., Daniel, B., Zareie, P., Yost, K. E., Qi, et al
  2024
- **Tuft cell-derived acetylcholine promotes epithelial chloride secretion and intestinal helminth clearance.** *Immunity*
  Billipp, T. E., Fung, C., Webeck, L. M., Sargent, D. B., Gologorsky, M. B., Chen, Z., McDaniel, M. M., Kasal, D. N., McGinty, J. W., Barrow, K. A., Rich, L. M., Barilli, A., Sabat, et al
  2024
- **Intestinal tuft cell immune privilege enables norovirus persistence.** *Science immunology*
  Strine, M. S., Fagerberg, E., Darcy, P. W., Barron, G. M., Filler, R. B., Alfajaro, M. M., D'Angelo-Gavrish, N., Wang, F., Graziano, V. R., Menasche, B. L., Damo, M., Wang, Y., Howitt, et al
  2024; 9 (93): eadi7038
- **Commensal protists in reptiles display flexible host range and adaptation to ectothermic hosts.** *mBio*
  Gerrick, E. R., DeSchepper, L. B., Mechler, C. M., Joubert, L. -., Dunker, F., Colston, T. J., Howitt, M. R.
  2023: e0227323
- **The abundance and morphology of human large intestinal goblet and tuft cells during chronic schistosomiasis.** *Parasite immunology*
  Gologorsky, M. B., Mechler, C. M., Forgó, E., Charville, G. W., Howitt, M. R.
  2023: e12981
- **Succinate and tuft cells: how does this sensory process interface with food allergy?** *The Journal of allergy and clinical immunology*
  Nico, K. F., Tyner, M. D., Howitt, M. R.
  2022
- **The Taste Receptor TAS1R3 Regulates Small Intestinal Tuft Cell Homeostasis.** *ImmunoHorizons*
  Howitt, M. R., Cao, Y. G., Gologorsky, M. B., Li, J. A., Haber, A. L., Biton, M., Lang, J., Michaud, M., Regev, A., Garrett, W. S.
  2020; 4 (1): 23–32
- **A Tuft Act to Follow: Leukotrienes Take the Stage in Anti-worm Immunity.** *Immunity*
  Fung, C. n., Howitt, M. R.
  2020; 52 (3): 426–28
- **Tropism for tuft cells determines immune promotion of norovirus pathogenesis.** *Science (New York, N.Y.)*
  Wilen, C. B., Lee, S., Hsieh, L. L., Orchard, R. C., Desai, C., Hykes, B. L., McAllaster, M. R., Balce, D. R., Feehley, T., Brestoff, J. R., Hickey, C. A., Yokoyama, C. C., Wang, et al
  2018; 360 (6385): 204-208
- **A single-cell survey of the small intestinal epithelium.** *Nature*

Haber, A. L., Biton, M., Rogel, N., Herbst, R. H., Shekhar, K., Smillie, C., Burgin, G., Delorey, T. M., Howitt, M. R., Katz, Y., Tirosh, I., Beyaz, S., Dionne, et al
2017; 551 (7680): 333-339

- **Helicobacter pylori CheZHP and ChePep form a novel chemotaxis-regulatory complex distinct from the core chemotaxis signaling proteins and the flagellar motor.** *Molecular microbiology*
  Lertsethtakarn, P., Howitt, M. R., Castellon, J., Amieva, M. R., Ottemann, K. M.
  2015; 97 (6): 1063-1078
- **The Microbial Metabolites, Short-Chain Fatty Acids, Regulate Colonic T-reg Cell Homeostasis** *SCIENCE*
  Smith, P. M., Howitt, M. R., Panikov, N., Michaud, M., Gallini, C. A., Bohlooly-Y, M., Glickman, J. N., Garrett, W. S.
  2013; 341 (6145): 569-573
- **Exploring host-microbiota interactions in animal models and humans** *GENES & DEVELOPMENT*
  Kostic, A. D., Howitt, M. R., Garrett, W. S.
  2013; 27 (7): 701-718
- **A complex microworld in the gut Gut microbiota and cardiovascular disease connectivity** *NATURE MEDICINE*
  Howitt, M. R., Garrett, W. S.
  2012; 18 (8): 1188-1189
- **ChePep Controls Helicobacter pylori Infection of the Gastric Glands and Chemotaxis in the Epsilonproteobacteria** *MBIO*
  Howitt, M. R., Lee, J. Y., Lertsethtakarn, P., Vogelmann, R., Joubert, L., Ottemann, K. M., Amieva, M. R.
  2011; 2 (4)