

Salil Bhate, MA (Cantab.), MMath., MS, PhD

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EMPLOYMENT *Broad Institute of MIT and Harvard, 10/2021 - present:*

Eric and Wendy Schmidt Center Postdoctoral Fellow

Mentors: Juan Caicedo and Caroline Uhler.

EDUCATION *MS and PhD in Bioengineering, Stanford University, 2015 - 2021:*

Advisor: Garry Nolan.

Thesis: *Towards semantic representations of tissue organization from high-parameter imaging data.*

MMath, Part III of Mathematical Tripos, University of Cambridge, 2014

Honours pass with distinction. Advisor: Vlad Markovic FRS.

Thesis: *Statistical properties of geometric flows and equidistribution.*

BA (hons) Mathematical Tripos, University of Cambridge, 2013:

First class, top 10%.

SELECTED PUBLICATIONS *bioRxiv, 2022: Deciphering causal genomic templates of complex molecular phenotypes.*

(* = first author) *S.S. Bhate**, A. Seigal and Juan Caicedo (corresponding author).

Cell Systems, Oct. 2021: Tissue schematics map the specialization of immune tissue motifs and their appropriation by tumors.

*S.S. Bhate**, G. L. Barlow* C. Schürch and G.P. Nolan.

Cell, Aug. 2020: Coordinated cellular neighborhoods orchestrate antitumoral immunity at the colorectal cancer invasive front.

C. Schürch*, *S.S. Bhate**, G. Barlow*, D. Phillips* et al.

European Journal of Immunology, Jan. 2021: Highly multiplexed tissue imaging using repeated oligonucleotide exchange reaction.

J. Kennedy-Darling*, *S.S. Bhate**, J. Hickey* et al.

OTHER PUBLICATIONS *ICML, Jul. 2023: Linear Causal Disentanglement via Interventions.* C. Squires, A. Seigal, *S.S. Bhate*, C. Uhler.

Science Advances, Jan. 2023: A tissue atlas of ulcerative colitis revealing sex-dependent differences in immune response and resistance to TNF inhibitor therapy.

A. T. Mayer, D. Holman, A. Sood, U. Tandon, *S. S. Bhate*, S. Bodapati, G. Barlow, J. Chang, S. Black, E. Crenshaw, A. Koron, S. Streett, S. Gambhir, W. J Sandborn, B. S Boland, T. Hastie, R. Tibshirani, J. Chang, G. P. Nolan, C. Schürch, S. Rogalla.

Leukemia, Nov. 2022: Splenic red pulp macrophages provide a niche for CML stem cells and induce therapy resistance. E. D. Bühner, M. A. Amrein, S. Forster, S. Istringhausen, C. M. Schürch, *S. S. Bhate*, T. Brodie, J. Zindel, D. Stroka, M. Al Sayed, C. Nombela-Arrieta, R. Radpour, C. Riether, A. F. Ochsenbein.

Science Advances, Jul. 2022: Immunotherapy of glioblastoma explants induces interferon- γ responses and spatial immune cell rearrangements in tumor center, but not periphery. T. Shekarian, C. P. Zinner, E. M. Bartoszek, W. Duchemin, A. T. Wachnowicz, S. Hogan, M. M. Etter, J. Flammer, C. Paganetti, T. A. Martins, P. Schmassmann, S. Zanganeh, F. Le Goff, M. G. Muraro, M.-F. Ritz, D. Phillips, *S. S. Bhate*, G. L. Barlow, G. P. Nolan, C. M. Schürch, G. Hutter.

BMC Bioinformatics, Jan. 2022: CellSeg: a robust, pre-trained nucleus segmentation and pixel quantification software for highly multiplexed fluorescence images. M. Y. Lee, J. S. Bedia, *S. S. Bhate*, G. L. Barlow, D. Phillips, W. J. Fantl, G. P. Nolan, C. M. Schürch.

Nature Communications, Nov. 2021: *Immune cell topography predicts response to PD-1 blockade in cutaneous T cell lymphoma.* D. Phillips, M. Matusiak, B. Rivero Gutierrez, S. S. Bhate, G. L. Barlow, S. Jiang, J. Demeter, K. S. Smythe, R. H. Pierce, S. P. Fling, N. Ramchurren, M. A. Cheever, Y. Goltsev, R. B. West, M. S. Khodadoust, Y. H. Kim, C. M. Schürch, G. P. Nolan.

Nature Communications, June 2021: *Subcellular localization of drug distribution by super-resolution ion beam imaging.* X. Rovira-Clavé, S. Jiang, Y. Bai, B. Zhu, G. Barlow, S. S. Bhate, A. F. Coskun, G. Han, C.-M. K. Ho, C. Hitzman, S.-Y. Chen, F.-A. Bava, G. P. Nolan.

Journal of Clinical Investigation, Jan. 2021: *Landscape of coordinated immune responses to H1N1 challenge in humans.* Z. Rahil, R. Leylek, C. M. Schürch, H. Chen, Z. Bjornson-Hooper, S. R. Christensen, P. F. Gherardini, S. S. Bhate, M. H. Spitzer, G. K. Fragiadakis, N. Mukherjee, N. Kim, S. Jiang, J. Yo, B. Gaudilliere, M. Affrime, B. Bock, S. E. Hensley, J. Idoyaga, N. Aghaeepour, K. Kim, G. P. Nolan, D. R. McIlwain.

Cell Stem Cell, Oct. 2018: *Systematic identification of factors driving cell-fate conversion using CRISPR activation screens.* Y. Liu, C. Yu, T. P. Daley, F. Wang, W. S. Cao, S.S. Bhate, X. Lin, C. Still, H. Liu, D. Zhao, H. Wang, X. S. Xie, S. Ding, W. H. Wong, M. Wernig, L. S. Qi.

Cell, Aug. 2018: *Deep profiling of mouse splenic architecture with CODEX multiplexed imaging.* Y. Goltsev, N. Samusik, J. Kennedy-Darling, S.S. Bhate, M. Hale, G. Vazquez, S. Black, G. P. Nolan.

BioBricks Foundation RFC 106, Mar 2015: *A Standard Type IIS Syntax for Plants.* V. Rutten, A. Munabi, F. Riche, G. Lewy, H. Wilson, M. Pipan, S. S. Bhate, T.-A. Nghiem, W. Kaufhold, J. Haseloff, A. Rubert, A. González, A. Quijano, I. Llopis, J. Gavaldá, L. Estellés, M. Vásquez, D. Orzáez, C. Deal, J. Gray, M. Spiegel, S. Monsey, A. Middlemiss, J. Day, N. Patron.

AWARDS

BroadIgnite, Spring 2023: (\$40,000 in research funding).

Cancer Immunotherapy AI Grand Challenge, Topcoder, 2023: Second place (\$3000 prize).

Bruce and Elizabeth Dunlevie Bio-X Stanford Interdisciplinary Graduate Fellowship, 2016: full tuition and stipend support at elevated rate, 3 years.

Clark Bioengineering Fellowship, 2015: full tuition and stipend support, 2 years.

Cambridge PMC Bursary, 2014: £2000 grant for interdisciplinary collaboration.

Senior Scholarship Prize, Gonville and Caius College (2011, 2012, 2013, 2014) for excellent performance in Parts IA, IB, II and III of the Math Tripos.

INVITED SEMINARS

BIOTRAC, Sep. 2023: Convergence of AI and Spatial Biology workshop

Takeda, Feb. 2023: Community-in-Practice working group

Broad Institute, Feb. 2023: Medical and Population Genetics Primer.

Takeda, Nov 2022. Thought leaders in AI symposium.

Genentech, Nov. 2022. Cellular and Tissue Genomics.

IISER Pune, Oct. 2022. Data Sciences department.

Broad Institute, Aug. 2022. Cell Circuits and Epigenomics.

Broad Institute, Mar. 2022. Models, Inference and Algorithms.

COMMITTEES

Models, Inference and Algorithms, Broad Institute

Steering Committee (since August '22) and co-chair (since Jan. '23).

MENTORING

Sandeep Kambhampati, PhD Student at Harvard, Jun. 2023-:

Neural PDEs for spatiotemporal transcriptomics

Marie Duc, PhD Student at Siemens Institute, Tübingen , Jan. 2023-:

Multimodal data integration for cancer genetics.

Nicholas Pielowski, PhD Student at Karolinska Institute, Summer 2022:
Registration methods for multiplexed imaging.

Michael Lee, Stanford University Undergraduate student, Summer 2019:
Cell segmentation for multiplexed imaging (Lee et al. BMC Bioinformatics).

TEACHING ***Ethics of Biotechnology, Stanford University, Spring 2018:*** Teaching assistant.
Hoefler award for mentorship of student writers.
Synthetic Biology lab, Stanford University, Fall 2017: Teaching assistant

CONFERENCES ***International Conference of Systems Biology, Oct. 2023.***
Short talk: Deriving genetic codes for phenotypic atlases from first principles
Machine Learning for Computational Biology, Dec. 2022.
Poster: Causal Phenotype Sequence Alignment
Neural Information Processing Systems, Dec. 2017
Workshop Poster: “Unsupervised representation learning to interrogate cellular behaviours in 46-parameter imaging data”
Workshop Poster: “A multi-modal neural network for learning cis and trans regulation of stress response in yeast”
Keystone Single Cell 'Omics, May 2017
Poster: “Single-cell reference maps of tissue architecture using multiparameter imaging and unsupervised representation learning with neural networks”
(SBSA Travel Award, \$1000)
AACR-CRI International Cancer Immunotherapy Conference, Sep. 2016
Spotlight talk: “Automatic identification of cellular niches using multiparameter imaging and deep learning”
(SBSA Travel Award, \$1000, BioX Oral Presentation travel award \$500)
Plants Workshop, iGEM Giant Jamboree, Nov. 2014: Conducted technical session on *M. polymorpha* in the plants for iGEM workshop.
Gold Medal, iGEM Nov. 2014: competed as member of University of Cambridge-JIC team

EXPERIENCE ***Intern, Atum Technologies, April - June 2015***
Protein engineering. Designed and performed high-throughput screen to optimize function of transposase variants in *S. cerevisiae*, finding several variants now in production.
Research assistant, Haseloff lab, Sep. 2014 - March 2015
Plant synthetic biology. Optimized constructs and protocols for electroporation of *M. polymorpha* spores.
Software engineering intern, FIS technologies, June - Sep. 2013
Implemented error logging tool for credit reporting software.

SKILLS AND INTERESTS ***Programming:*** Python, R, C++, C#, (modelling/machine-learning/software development). Pytorch/Tensorflow. Basic: SQL, Java.
Language skills: Marathi (Fluent). German, Classical Greek, Latin, French (UK A-level)
Other: Hindustani classical singing. Cycling and the outdoors.