Tushar V. Kamath

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Education

Harvard Medical School — Boston, MA
M.D. candidate — *Aug. 2016 – May 2024 (expected)*

Harvard Graduate School of Arts and Sciences - Program in Biophysics — Boston, MA
Ph.D. in Biophysics, Thesis advisor: Evan Z Macosko — *Aug. 2018 - May 2022*

Massachusetts Institute of Technology (MIT) — Cambridge, MA
M.Eng. in Biological Engineering — *Aug. 2015 – May 2016*

Massachusetts Institute of Technology (MIT) — Cambridge, MA
B.S. in Biological Engineering — *Aug. 2012 – May 2015*

Experience

Broad Institute - Stanley Center for Psychiatric Research — May 2018 – May 2022
Graduate Student, Macosko Lab — *Cambridge, MA*

- Analyzed large-scale transcriptional data from human surgical biopsy tissue to define the landscape of early state changes associated with Alzheimer's pathology
- Defined a molecularly-defined subpopulation of dopaminergic neurons highly susceptible to degeneration in Parkinson's disease
- Developed stem cell models to verify amyloid beta protein production in human stem cell-derived oligodendrocytes

Broad Institute - Cancer Program — January 2017 – May 2017
Graduate Rotation Student, Beroukhim Lab — *Cambridge, MA*

- Developed lightweight tools for analyzing 10x long-read sequencing data based on barcoding technology
- Used genome assembly-based algorithms to identify somatic structural variants in breast and prostate cancer genomes
- Developed a clustering method for phasing complex structural variants based on synthetic long read sequencing technology

MIT Dept. of Biological Engineering — August 2015 – June 2016
Graduate researcher and teaching assistant, Thilly Lab — *Cambridge, MA*

- Used single cell analysis to determine the sensitivity of colorectal cancer cell lines to pamoic acid, a small-molecule polymerase beta inhibitor
- Applied fluorescence microscopy to identify bell-shaped nuclei as a marker for cancer stem cell populations
- Taught introductory thermodynamics (20.110) to a 50-person class and currently teaching mass transport (20.330) to a 50-person class. Responsibilities include: preparing recitation material, holding office hours, writing problem set questions, and proctoring exams

LV Prasad Eye Institute — June 2015 – August 2015
Research intern and hospital volunteer — *Hyderabad, India*

- Analyzed screening data taken from rural populations in India to determine primary risk factors associated with diabetic retinopathy and diabetes
- Assisted ophthalmologists in their screening efforts to identify retinopathy of prematurity in government hospitals
- Helped with development of Braille textbooks for school children at the hospital's rehabilitation center

US House of Representatives, House Budget Committee — May 2014 - August 2014
House of Representatives Summer Intern — *Washington, DC*

- Drafted doc fix to patch bypass of sustainable growth rate Medicare physician fee schedule
- Analyzed bills and developed one-pagers for budget analysts on health care affairs, veterans affairs, and early childhood care policies
- Attended round table discussions at think tanks focusing on early childhood care policies

Koch Institute for Integrative Cancer Research — April 2013 – May 2014
Undergraduate researcher, Love Lab — *Cambridge, MA*

- Characterized the CellSqueeze device (Scientific American's 2014 "Top 10 World-Changing Ideas") to identify circulating tumor cells in pancreatic ductal adenocarcinoma patient blood
- Performed whole genome sequencing of circulating tumor cells (CTCs) to determine common mutations with primary tumor
- Conducted spiking studies to determine the sensitivity/selectivity of CellSqueeze platform in CTC enrichment

Publications

Gazestani, V.*, **Kamath, T.***, Nadaf, N. M., Dougalis, A., Burris, S. J., Rooney, B., Junkkari, A., Vanderburg, C., Pelkonen, A., Gomez-Budia, M., Välimäki, N.-N., Rauramaa, T., Therrien, M., Koivisto, A. M., Tegtmeyer, M., Herukka, S.-K., Abdulraouf, A., Marsh, S. E., Hiltunen, M., ... Macosko, E. Z. (2023). Early Alzheimer's disease pathology in human cortex involves transient cell states. *Cell*, 186(20), 4438–4453.e23. * = contributed equally.

Dolan, M.-J., Therrien, M., Jereb, S., **Kamath, T.**, Gazestani, V., Atkeson, T., Marsh, S. E., Goeva, A., Lojek, N. M., Murphy, S., White, C. M., Joung, J., Liu, B., Limone, F., Eggan, K., Hacohen, N., Bernstein, B. E., Glass, C. K., Leinonen, V., ... Stevens, B. (2023). Exposure of iPSC-derived human microglia to brain substrates enables the generation and manipulation of diverse transcriptional states in vitro. *Nature Immunology*, 24(8), 1382–1390.

Maury, E. A., Sherman, M. A., Genovese, G., Gilgenast, T. G., **Kamath, T.**, Burris, S. J., Rajarajan, P., Flaherty, E., Akbarian, S., Chess, A., McCarroll, S. A., Loh, P.-R., Phillips-Cremins, J. E., Brennand, K. J., Macosko, E. Z., Walters, J. T. R., O'Donovan, M., Sullivan, P., Marshall, C. R., ... Walsh, C. A. (2023). Schizophrenia-associated somatic copy-number variants from 12,834 cases reveal recurrent NRXN1 and ABCB11 disruptions. *Cell Genomics*, 0(0). https://doi.org/10.1016/j.xgen.2023.100356

Kamath, T., Macosko, E. Z. (2023). Insights into Neurodegeneration in Parkinson's Disease from Single-Cell and Spatial Genomics. *Movement Disorders*, 38(4), 518–525.

Kamath, T.*, Abdulraouf, A.*, Burris, S. J., Langlieb, J., Gazestani, V., Nadaf, N. M., Balderrama, K., Vanderburg, C., Macosko, E. Z. (2022). Single-cell genomic profiling of human dopamine neurons identifies a population that selectively degenerates in Parkinson's disease. *Nature Neuroscience*, 25(5), 588–595. * = Contributed equally

Marsh, S. E., Walker, A. J., **Kamath, T.**, Dissing-Olesen, L., Hammond, T. R., de Soysa, T. Y., Young, A. M. H., Murphy, S., Abdulraouf, A., Nadaf, N., Dufort, C., Walker, A. C., Lucca, L. E., Kozareva, V., Vanderburg, C., Hong, S., Bulstrode, H., Hutchinson, P. J., Gaffney, D. J., ... Stevens, B. (2022). Dissection of artifactual and confounding glial signatures by single-cell sequencing of mouse and human brain. *Nature Neuroscience*, 25(3), 306–316.

Wang, J. S., **Kamath, T.**, Mazur, C. M., Mirzamohammadi, F., Rotter, D., Hojo, H., Castro, C. D., Tokavanich, N., Patel, R., Govea, N., Enishi, T., Wu, Y., da Silva Martins, J., Bruce, M., Brooks, D. J., Bouxsein, M. L., Tokarz, D., Lin, C. P., Abdul, A., ... Wein, M. N. (2021). Control of osteocyte dendrite formation by Sp7 and its target gene osteocrin. *Nature Communications*, 12(1), 6271.

Viswanathan, S. R., Ha, G., Hoff, A. M., Wala, J. A.,... **Kamath, T.**, Zhang, Z., Gydush, G. J., Rotem, D., PCF/SU2C International Prostate Cancer Dream Team, ... Meyerson, M. (2018). Structural Alterations Driving Castration-Resistant Prostate Cancer Revealed by Linked-Read Genome Sequencing. *Cell*, 174(2), 433–447.e19.

Gostjeva, E. V., Koledova, V. V., Bai, L., Duan, K. C., **Kamath, T.**, Nelson, M., Agnihotri, P., Moshinski, D. J., Wu, L. P., Zukerberg, L., Chung, D. C., Tsai, S., Evans, D. B., Tomita-Mitchell, A., Mitchell, M., Thilly, W. G. (2016). Metakaryotic Cancer Stem Cells are Constitutively Resistant to X-Rays and Chemotherapeutic Agents, but Sensitive to Many Common Drugs.

Saung, M. T., Sharei, A., Adalsteinsson, V. A., Cho, N., **Kamath, T.**, Ruiz, C., Kirkpatrick, J., Patel, N., Mino-Kenudson, M., Thayer, S. P., Langer, R., Jensen, K. F., Liss, A. S., Love, J. C. (2016). A Size-Selective Intracellular Delivery Platform. *Small* , 12(42), 5873–5881.

Kini, L. G., Herrero-Jimenez, P., **Kamath, T.**, Sanghvi, J., Gutierrez, E., Jr, Hensle, D., Kogel, J., Kusko, R., Rexer, K., Kurzweil, R., Refinetti, P., Morgenthaler, S., Koledova, V. V., Gostjeva, E. V., Thilly, W. G. (2013). Mutator/Hypermutable fetal/juvenile metakaryotic stem cells and human colorectal carcinogenesis. *Frontiers in Oncology*, 3, 267.

Presentations and Posters

Kamath T., V. Gazestani, N. Nadaf, SJ Burris, Antonios Dougalis, Brendan Rooney, A. Junkkari, C. Vanderburg, A. Pelkonen, M. Gomez-Budia, N. Välimäki, T. Rauramaa, M. Therrien, A. Koivisto, M. Tegtmeyer, S. Herukka, A. Abdulraouf, S. Marsh, M. Hiltunen, R. Nehme, T. Malm, B. Stevens, V. Leinonen, EZ Macosko. (March, 2023) Early Alzheimer's disease pathology in human cortex is associated with a transient phase of distinct cell states. *Oral presentation, AD/PD 2023.* Gothenburg, Sweden

Kamath T. A. Abdulraouf, SJ Burris, J. Langlieb, V. Gazestani, N. Nadaf, K. Balderrama, C. Vanderburg, EZ Macosko, (September, 2022) Vulnerabilities of midbrain dopaminergic neurons to Parkinson's disease revealed by single-cell genomics. *Invited speaker, Drivers Seat Seminar.* Lund, Sweden

Kamath T. A. Abdulraouf, SJ Burris, J. Langlieb, V. Gazestani, N. Nadaf, K. Balderrama, C. Vanderburg, EZ Macosko, (April, 2022) Vulnerabilities of midbrain dopaminergic neurons to Parkinson's disease revealed by single-cell genomics. *Invited speaker, Cajal Neuroscience.* Seattle, WA

Kamath T. A. Abdulraouf, SJ Burris, J. Langlieb, V. Gazestani, N. Nadaf, K. Balderrama, C. Vanderburg, EZ Macosko, (March, 2022) Vulnerabilities of midbrain dopaminergic neurons to Parkinson's disease revealed by single-cell genomics. *Oral presentation, AD/PD 2022.* Barcelona, Spain

Kamath T. A. Abdulraouf, SJ Burris, J. Langlieb, V. Gazestani, N. Nadaf, K. Balderrama, C. Vanderburg, EZ Macosko, (December, 2021) Vulnerabilities of midbrain dopaminergic neurons to Parkinson's disease revealed by single-cell genomics. *Nominated plenary speaker, Broad Institute Scientific Retreat* Cambridge, MA

Kamath T. A. Abdulraouf, SJ Burris, J. Langlieb, V. Gazestani, N. Nadaf, K. Balderrama, C. Vanderburg, EZ Macosko, (March, 2022) Vulnerabilities of midbrain dopaminergic neurons to Parkinson's disease revealed by single-cell genomics. *Invited speaker, Program in Quantitative Genetics seminar, Harvard School of Public Health* Boston, MA

Kamath T. V. Gazestani, N. Nadaf, A. Abdul, C. Vanderburg, S. Marsh, V. Leinonen, B. Stevens, EZ Macosko, (June, 2021) Transcriptional characterization of molecular and cellular alterations associated with amyloid-beta and hyperphosphorylated tau in frontal cortex brain biopsies. *Nominated speaker, Broad Institute, Board of Scientific Counselors* Cambridge, MA

Kamath T., Adalsteinsson V., Sharei A., Liss A., Cho N., Langer R., Thayer S., Jensen K., Love J.C. (October, 2014) Intracellular labeling and isolation of circulating tumor cells (CTCs) using the CellSqueeze device. *Broad Institute Scientific Retreat.* Cambridge, MA

Teaching

Teaching Assistant, HST Matlab for Medicine/Biostatistics, August 2019 - August 2021

- Helped develop lectures and teaching material for introductory probability, statistics, and coding course
- Built a lesson surrounding analyzing single-cell RNA-sequencing data with R programmming
- Held regularly-scheduled office hours to help students gain an appreciation for probability theory and statistics in medicine

MCAT tutor, Cambridge Coaching, August 2018 - May 2019

- Taught MCAT subject material including mathematics, physics, chemistry, and sociology
- Helped develop an MCAT tutoring curriculum

Teaching Assistant, Department of Biological Engineering, MIT, August 2015 - May 2016

- Developed and graded problem sets focused on fields, forces, and flows in biological systems
- Held office hour sessions for one-on-one tutoring for students

Honors and Awards

- Nomination for scientific speaker, Broad Institute Board of Scientific Counselors - May 2020
- NIH Ruth Kirschstein National Research Service Award - June 2019
- Nominated for MIT News Office Profile - October 2015
- MIT International Science and Technology Initiatives India Travel Grant Awardee - June 2015
- Maurice N. Katz Family Fund for Cancer Research Undergraduate Grant - June 2013