

Matthew Philip Mulè PhD

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Education & Training

University of Cambridge	PhD (2023) NIH Oxford-Cambridge Scholars Program Supervisors: John Tsang (NIAID), Ken Smith (Cambridge)
University of North Carolina	MD in progress expected graduation 2025 UNC Chapel Hill Medical Scientist Training Program
National Institutes of Health	Postbaccalaureate IRTA Fellowship (2014–2016) Supervisor: Christopher Hourigan (NHLBI)
Tufts University	Bachelor of Science in Biology (2014) <i>Cum Laude with Highest Thesis Honors</i> Honors thesis supervisor: Andrew Camilli

Doctoral Thesis – University of Cambridge

Systems immunology frameworks link multicellular immune perturbation phenotypes and setpoints to response outcomes [\[pdf\]](#)

Examiners: Sarah Teichmann (internal), Petter Brodin (external)

Publications & Preprints

Mulè M.P et al. Multilevel integration of human and single-cell variations reveals high responders to an unadjuvanted vaccine are naturally adjuvanted at baseline *Immunity (in press)* (2024) [\[pdf\]](#)

Hanson AL, **Mulè MP** et al. Iron Dysregulation and Inflammatory Stress Erythropoiesis Associates with LongTerm Outcome of COVID-19 *Nature Immunology (in press)* (2024) [\[pdf\]](#)

Mulè M.P*, Zhao, C*. et al. Contrasting autoimmune and treatment effects reveals baseline set points of immune toxicity following checkpoint inhibitor treatment. *BioRxiv* (2022) [\[pdf\]](#)

Mulè MP*, Martins AJ*, Tsang JS. Normalizing and denoising protein expression data from droplet-based single cell profiling. *Nature Communications* (2022) [\[pdf\]](#)

Hagan, T., Gerritsen B, Tomalin, LE, Fourati S, **Mulè MP** et al. Transcriptional atlas of the human immune response to 13 vaccines reveals a common predictor of vaccine-induced antibody responses. *Nature Immunology* (2022) [\[pdf\]](#)

Fourati, S. Tomalin LE, **Mulè MP** et al. Pan-vaccine analysis reveals innate immune endotypes predictive of antibody responses to vaccination *Nature Immunology* (2022) [\[pdf\]](#)

Diray-Arce, J. et al. The Immune Signatures data resource, a compendium of systems vaccinology datasets. *Scientific Data* (2022) [pdf](#)

Liu, C. et al. Time-resolved systems immunology reveals a late juncture linked to fatal COVID-19. *Cell* 184, 1836–1857 (2021) [\[pdf\]](#)

Kotliarov Y[#], Sparks R[#], (#equal contribution) **Mulè MP***, Martins AJ*, Lu Y*, (*equal contribution) *et.al.* Broad immune activation underlies shared set point signatures for vaccine responsiveness in healthy individuals and disease activity in patients with lupus. *Nature Medicine* 26, 618–629 (2020) [\[pdf\]](#)

Baharom, F. et al. Intravenous nanoparticle vaccination generates stem-like TCF1+ neoantigen-specific CD8+ T cells. *Nature Immunology* (2020). [\[pdf\]](#)

Wong HY, et al. Molecular measurable residual disease testing of blood during AML cytotoxic therapy for early prediction of clinical response. *Frontiers in Oncology* 8, 669 (2019) [\[pdf\]](#)

McReynolds LJ, et al. Rapid progression to AML in a patient with germline GATA2 mutation and acquired NRAS Q61K mutation *Leukemia Research Reports* 12, 100176 (2019) [\[pdf\]](#)

McReynolds LJ, et al. MDS-associated mutations in germline GATA2 mutated patients with hematologic manifestations. *Leukemia Research* 76, 70–75 (2019) [\[pdf\]](#)

Mulè MP, Mannis GN, Wood BL, Radich JP, Hwang J, Ramos NR, Andreadis C, Damon L, Logan AC, Martin TG, Hourigan CS. Multigene measurable residual disease assessment improves acute myeloid leukemia relapse risk stratification in autologous hematopoietic transplantation. *Biology of Blood Marrow Transplantation* 11, 1974-1982 (2016) [\[pdf\]](#)

Hokland, P, Ommen HB, **Mulè MP**, Hourigan CS. Advancing the MRD concept in Acute Myeloid Leukemia. *Seminars in Hematology* 52(3) 184-192 (2015) [\[pdf\]](#)

Mulè MP, Giacalone D, Lawlor K, Golden A, Cook C, Lott T, Aksten E, O'Toole GA, Bergeron, LJ. Iron-dependent gene expression in *Actinomyces oris*. *Journal of Oral Microbiology* 7:298000 (2015) [\[pdf\]](#)

Shainheit MG, **Mulè MP** and Camilli A. The core promoter of the capsule operon of *Streptococcus pneumoniae* is necessary and sufficient for colonization and invasive disease. *Infection and Immunity* 82, 694-705 (2014) [\[pdf\]](#)

Open source software

Created and continue to maintain these open source software repositories:

- dsb: Normalize & Denoise Droplet Single Cell Protein Data. [R package on CRAN](#)
- scglmmr: Sample-level Single-cell Generalized Linear Multilevel Models in R. [GitHub](#)

Research Awards

NIH Fellows Award for Research Excellence (FARE) award (2022)

Award based on peer reviewed blind study section competition recognizing outstanding scientific research performed by NIH intramural postdoctoral fellows.

NIH Bioinformatics Special Interest Group award (2022)

Selection by the NIH Bioinformatics special interest group of one winning abstract from the NIH FARE Competition deemed to be of high scientific merit.

NIH Systems Biology Special Interest Group award runner up (2022)

Selection of abstract from the FARE Competition by the NIH Systems Biology special interest group.

Cambridge Trust NIH Scholarship (August 2018–August 2022)

The Cambridge Trust grants scholarships to international students to study at Cambridge.

NIH Oxford-Cambridge Scholars program Scholarship (August 2018–August 2022)

Awarded to pursue PhD in an international collaborative systems immunology project between University of Cambridge (Lab of Ken Smith) and National Institutes of Health (Lab of John Tsang)

University Cancer Research Fund MD/PhD Scholar Award (July 2017-August 2018)
Funding from UNC Lineberger Comprehensive Cancer Center to support MD-PhD training.

National Institutes of Health Intramural Research Training Award (2014- 2016)
Postbaccalaureate Funding award to support research fellowship in the lab of of Christopher Hourigan in the Myeloid Malignancies Section at National Institutes of Health (NHLBI).

Tufts Summer Scholars Nathan T. Gantcher Scholarship Award (2013-2014)

Tufts Summer Scholars Award (2013-2014)
Funding award from Tufts University to support research in the lab of Andrew Camilli at Tufts University School of Medicine / Howard Hughes Medical Institute.

NH-INBRE Undergraduate Research Fellowship (2010-2012)
Funding to support my research on transcriptional dynamics in *Actinomyces Oris* in the lab of Lori Bergeron at New England College.

Invited Seminars and conference talks

Invited Seminars

GlaxoSmithKline Immunology Network Summit: Immunology of Vaccines (Stevenage UK Nov 16, 2022)
Talk title: Systems immunology frameworks link multicellular immune perturbation phenotypes and setpoints to vaccine response outcomes

NIH Bioinformatics Special Interest Group FARE Award Lecture (Nov 18, 2021)
Talk title: An analysis framework for multi-subject CITE-seq perturbation studies

National Cancer Institute DCTD Biometric Research Program Seminar (June 8, 2021)
Talk title: Evaluation of single cell multiomics technologies for human perturbation cohort studies

Invited Refereed Conference Talks

Systems Immunology 2021 – Cold Spring Harbor (April 22, 2021)
Talk title: Pinpointing cell states associated with vaccination response with new computational tools for nested-group CITE-seq analysis [\[link\]](#)

Human Immunology Project Consortium Annual Meeting (March 24, 2021)
Talk title: Experimental and computational noise deconvolution inspires dsb, an open source R package for normalizing and denoising CITE-seq protein data

UNC Chapel Hill John B Graham Research Day (November 11, 2016)
Talk title: Multigene relapse risk prediction in autologous transplantation for acute myeloid leukemia.
*One of six students selected for oral presentation.

Medical Service

Open Door Clinic of Alamance County, NC Diabetes Management & Prevention Program
Leadership Position: Clinical Coordinator (April 2017- 2018)
Volunteered to provide healthcare to uninsured diabetes patients in North Carolina.
Responsible for patient continuity of care and attending physician recruiting and scheduling.

Timmy Global Health Tufts University Chapter (September 2012-May 2014)
Leadership Position: Tufts University Chapter Trip Leader and Executive Board Member (2014)
- 2014: Organized trip to Guatemala, helped integrate mobile EMR to improve continuity

- 2013: Volunteered and assisted physicians in medical service trip in Guatemala.

The Sharewood Project of Tufts Medical School, Boston, MA (June 2013-January 2014)

Leadership Position: Demographics project undergraduate Leader (2013-2014)

- Volunteered in medical clinic serving uninsured in Boston, served on public health committee.
- Lead the Sharewood Demographics Tracking Project to help secure funding for the program.

Selected Conference Poster Presentations (Presenting / first author)

Systems Immunology 2023 – Cold Spring Harbor (CSHL April 18, 2023)

Talk title: Multicellular immune networks of disease activity and clinical outcome in vasculitis [\[link\]](#)

European Advanced School in the Philosophy of the Life Sciences (Bordeaux, Fr Sept 5-9 2022)

2022 summer school on dealing with complexity in the life sciences

Poster: Avoiding the mind projection fallacy in interpreting complex single cell systems biological data

NIH Graduate Student Research Symposium 2021 (NIH, February 21 2021)

Poster: Pinpointing Cell States Induced by Vaccines using New Computational Tools for Multimodal Single Cell Analysis [\[link\]](#)

NIH Global Doctoral Partnerships Research Workshop 2020 (June 15-20 2020)

Talk title: Mapping human immune system variation to clinical outcome with systems immunology

NIH Oxford Cambridge Scholars Program Annual Colloquium, (Oxford, June 25-27 2019)

Poster: Human vaccine response signatures revealed through simultaneous transcriptome and protein profiling in single cells

Cold Spring Harbor Systems Immunology 2019 (CSHL March 14-16 2019)

Poster: Human vaccine response signatures revealed through simultaneous transcriptome and protein profiling in single cells [\[link\]](#)

NHLBI Research Day Festival (Bethesda, MD April 29, 2016)

Talk and poster title: Comprehensive residual disease assessment improves AML relapse risk stratification in autologous hematopoietic cell transplantation.

NIH Postbac Poster Day (Bethesda, MD April 20, 2016)

Poster: High sensitivity personalized residual disease monitoring predicts acute myeloid leukemia relapse. **Best poster award**

57th American Society of Hematology Annual Meeting (Orlando FL December 5-8 2015)

Poster: (Abstract # 4350) Multigene MRD Assessment Improves AML Relapse Risk Stratification in Autologous Hematopoietic Cell Transplantation. [\[pdf\]](#)

NHLBI Research Day Festival (June 12, 2015. Bethesda, MD)

Oral presentation and poster: Measurable residual disease in patients undergoing autologous stem cell transplant for acute myeloid leukemia.

NIH Postbac Poster Day (April 30, 2015. Bethesda, MD)

Poster: A complementary multigene strategy to quantify residual disease in acute myeloid leukemia patients prior to autologous stem cell transplant.

Tufts University Summer Scholars Annual Research Symposium (October 30, 2013. Somerville MA)

Poster: Characterizing transcriptional regulation of *Streptococcus pneumoniae* capsule in host colonization and disease

Tufts Summer Scholars Biochemistry and Biomedicine Panel (July 17, 2013, Somerville, MA.) Oral Presentation: Characterizing transcriptional regulation of *Streptococcus pneumoniae* capsular polysaccharide.

5th Annual Northeast Undergraduate Research and Development Symposium (Biddeford ME, March 2-3, 2013 Biddeford, ME) Poster: Characterization of AmdR, an iron dependent transcriptional repressor. **Best Poster Award**

New Hampshire-INBRE 2012 Annual Meeting (July 13-14, 2012. Whitefield, NH) Oral Presentation: Metal Dependent Transcriptional Regulation in *Actinomyces naeslundii* *One of four students state wide selected to give oral presentation

2012 Eastern New England Biology Conference (April 24, 2012. Easton, MA) Poster: *Actinomyces naeslundii* Metal Dependent Repressor Binds to Siderophore Promoters

New England College Undergraduate Research Showcase (April 7, 2012. Henniker, NH) Poster: *Actinomyces naeslundii* Metal Dependent Repressor Binds to Siderophore Promoters

Other refereed conference presentations (co-author)

Society for Immunotherapy of Cancer (SITC) 36th Anniversary Annual Meeting (2021)
Abstract 540: Baseline mTOR transcriptional signatures in CD8 T cells are associated with immune-related adverse events but not anti-tumor responses in patients receiving immune checkpoint inhibitors [\[pdf\]](#)

Cold Spring Harbor Systems Immunology 2019 (March 14-16 2019) Integrated surface protein and gene expression analysis of cord blood mononuclear cells from pre-term and full-term births. [\[link\]](#)

58th American Society of Hematology Annual Meeting (December 3-6 2016)
Abstract # 1664: Increased Frequencies of PD-1+ CD8+ Marrow-Infiltrating Lymphocytes Associated with Highly Clonal T-Lymphocyte Expansions in Relapsed and Refractory AML Patients but Not Healthy Adults. [\[pdf\]](#)

American Society of Clinical Oncology (ASCO) Annual Meeting (June 1-8 2018)
Abstract 7047: Molecular testing during AML treatment for early prediction of clinical response [\[pdf\]](#)

Clinical Trials

Biomarkers for personalized early assessment of response during salvage chemotherapy in people with relapsed or refractory acute myeloid leukemia (PEARL15) [NCT02527447](#) Associate investigator
- I optimized the custom molecular assays and liquid handling robotics and created laboratory standard operating procedures following CLIA guidelines for this clinical trial at NIH.

Academic Service and mentorship

Peer reviewer
Nature Communications (1)
Cell Reports (1)
Bone Marrow Transplant (1)

John B. Graham Research Day organizing committee – UNC Chapel Hill School of Medicine (2017)

Hematology/oncology block focus group – UNC Chapel Hill School of Medicine (2017)

UNC Medical Mentors Program 2016-2017
Volunteer mentor to pre-health students navigating medical school application

Other Clinical Training

National Institutes of Health Clinical Research Training Course (Completed May 25 2015)
NIH course detailing ethical issues in human subject research and regulation of clinical trials.