

Curriculum Vitae  
Laura Beth Chopp

Education

University of Michigan. 2022-present  
MD Candidate

University of Pennsylvania/National Institutes of Health Joint Program. 2015 to 2022  
Ph.D. Immunology  
Thesis Advisor: Dr. Rémy Bosselut  
Thesis Committee: Drs. Jorge Henao-Mejia, David Allman, Yasmine Belkaid, Nancy Speck

Minnesota State University. 2010-2015  
B.S. Biomedical Science, Chemistry minor.

Research Positions

Department of Dermatology, University of Michigan Medical School. 2023-present  
Principal investigator: Dr. Johann Gudjonsson  
Researching cell signatures of pre-eclamptic placental tissue

Department of Pathology, University of Michigan Medical School. 2023-present  
Principal investigator: Dr. Andrew Lieberman  
Investigating mouse models of neuromuscular disease using single cell genomics

National Cancer Institute, National Institutes of Health. 2016 to 2023  
Research Advisor: Dr. Rémy Bosselut  
Researched mouse and human T cell development. Specific projects include 1) Transcriptomic and epigenomic maps of mouse and human T cell development 2) Role of Zfp281 and Zfp148 in helper T cell development and function

Department of Biology, Minnesota State University. 2011-2015  
Research Advisors: Drs. Daniel Toma and Kelly Grussendorf  
Studied behavioral genetics in the honeybee (*Apis mellifera*)

Department of Immunology and Microbiology, The Scripps Research Institute. Summer 2014  
Research Advisor: Dr. Laura Solt  
Researched the transcriptional control of Th17 cell differentiation and function

Department of Immunology, Mayo Clinic College of Medicine. Summer 2013  
Research Advisors: Drs. Larry Pease and Aaron Johnson  
Designed an assay to assess the structural integrity of a widely used reagent for studying T cell responses in mice and human patients

Technical Experience & Skills

Lab skills (molecular):	Next-generation sequencing (RNA-seq, ATAC-seq, and ChIP-seq), single cell sequencing (scRNA-seq, scATAC-seq, multiomics), qRT-PCR, western blot, co-immunoprecipitation
Lab skills (cellular):	Tissue culture, high-dimensional flow cytometry analysis and sorting, transfection, transduction, <i>in vitro</i> T cell activation, CRISPR-Cas9 editing, bacterial culture.
Lab skills (organismal):	Mouse: Tissue and cellular isolation (thymus, spleen, bone marrow, and lymph nodes), CRISPR-Cas9 knockout design, injections (retro-orbital, intraperitoneal,

intrathymic), bone marrow chimeras, mouse models of asthma, and adoptive cell transfer.

Human: Cellular isolation from human thymus, BSL-2 level training. T cell activations.

Bioinformatics skills:

Population based analyses for gene expression and epigenomics (RNA-seq, ATAC-seq, ChIP-seq). Single-cell analyses (scRNA-seq, scATAC-seq, multiomics), gene regulatory network inference, spatial RNA-seq dataset analyses.

## Publications

1. **Chopp LB**, Zhu X, Gao Y, Nie J, Singh J, Kumar P, Young KZ, Patel S, Li C, Balmaceno-Criss M, Vacchio MS, Wang MM, Livak F, Merchant JL, Wang L, Kelly MC, Zhu J, Bosselut R. Zfp281 and Zfp148 control CD4<sup>+</sup> T cell thymic development and TH2 functions. *Sci Immunol*. 2023 Nov 10;8(89):eadi9066. doi: 10.1126/sciimmunol.adi9066. Epub 2023 Nov 10. PMID: 37948511.
2. Gao Y, Wang Y, Chauss D, Villarino AV, Link VM, Nagashima H, Spinner CA, Koparde VN, Bouladoux N, Abers MS, Break TJ, **Chopp LB**, Park JH, Zhu J, Wiest DL, Leonard WJ, Lionakis MS, O'Shea JJ, Afzali B, Belkaid Y, Lazarevic V. Transcription factor EGR2 controls homing and pathogenicity of TH17 cells in the central nervous system. *Nat Immunol*. 2023 Aug;24(8):1331-1344. doi: 10.1038/s41590-023-01553-7. Epub 2023 Jul 13. PMID: 37443284
3. Georgiev H, **Chopp LB**, Hogquist KA. Ultrasound-Guided Intra-thymic Cell Injection. *Methods Mol Biol*. 2023;2580:283-292. doi: 10.1007/978-1-0716-2740-2\_17. PMID: 36374464.
4. Carpenter AC, **Chopp LB**, Kim JK, Bosselut R. Purification of Thymocyte and T Cell Subsets. *Methods Mol Biol*. 2023;2580:151-163. doi: 10.1007/978-1-0716-2740-2\_8. PMID: 36374455.
5. **Chopp L\***, Redmond C\*, O'Shea JJ, Schwartz DM. From thymus to tissues and tumors: a review of T cell biology. *J Allergy Clin Immunol*. 2022 Oct 19:S0091-6749(22)01378-1. doi: 10.1016/j.jaci.2022.10.011. Epub ahead of print. PMID: 36272581. *\*authors contributed equally*
6. Zhao Y, Vartak SV, Conte A, Wang X, Garcia DA, Stevens E, Kyoung Jung S, Kieffer-Kwon KR, Vian L, Stodola T, Moris F, **Chopp L**, Preite S, Schwartzberg PL, Kulinski JM, Olivera A, Harly C, Bhandoola A, Heuston EF, Bodine DM, Urrutia R, Upadhyaya A, Weirauch MT, Hager G, Casellas R. "Stripe" transcription factors provide accessibility to co-binding partners in mammalian genomes. *Mol Cell*. 2022 Sep 15;82(18):3398-3411.e11. doi: 10.1016/j.molcel.2022.06.029. Epub 2022 Jul 20. PMID: 35863348; PMCID: PMC9481673.
7. Gao Y, Zamisch M, Vacchio M, **Chopp L**, Ciucci T, Paine EL, Lyons GC, Nie J, Xiao Q, Zvezdova E, Love PE, Vinson CR, Jenkins LM, Bosselut R. NuRD complex recruitment to Thpok mediates CD4<sup>+</sup> T cell lineage differentiation. *Sci Immunol*. 2022 Jun 10;7(72):eabn5917. doi: 10.1126/sciimmunol.abn5917. Epub 2022 Jun 10. PMID: 35687698; PMCID: PMC9484726.
8. Nie J, Carpenter AC\*, **Chopp LB\***, Chen T, Balmaceno-Criss M, Ciucci T, Xiao Q, Kelly MC, McGavern DB, Belkaid Y, Bosselut R. The transcription factor LRF promotes integrin  $\beta 7$  expression by and gut homing of CD8 $\alpha\alpha^+$  intraepithelial lymphocyte precursors. *Nat Immunol*. 2022 Apr;23(4):594-604. doi: 10.1038/s41590-022-01161-x. Epub 2022 Mar 30. PMID: 35354951; PMCID: PMC9290758. *\*authors contributed equally*
9. Ciucci T, Vacchio MS, Chen T, Nie J, **Chopp LB**, McGavern DB, Kelly MC, Bosselut R. Dependence on Bcl6 and Blimp1 drive distinct differentiation of murine memory and follicular helper CD4<sup>+</sup> T cells. *J Exp Med*. 2022 Jan 3;219(1):e20202343. doi: 10.1084/jem.20202343. Epub 2021 Nov 18. PMID: 34792530; PMCID: PMC8605495.
10. Stamos DB, Clubb LM, Mitra A, **Chopp LB**, Nie J, Ding Y, Das A, Venkataganesh H, Lee J, El-Khoury D, Li L, Bhandoola A, Bosselut R, Love PE. The histone demethylase Lsd1 regulates multiple repressive gene programs during T cell development. *J Exp Med*. 2021 Dec 6;218(12):e20202012. doi: 10.1084/jem.20202012. Epub 2021 Nov 2. PMID: 34726730; PMCID: PMC8570297.
11. **Chopp LB**, Gopalan V, Ciucci T, Ruchinskis A, Rae Z, Lagarde M, Gao Y, Li C, Bosticardo M, Pala F, Livak F, Kelly MC, Hannenhalli S, Bosselut R. An Integrated Epigenomic and Transcriptomic Map of

- Mouse and Human  $\alpha\beta$  T Cell Development. *Immunity*. 2020 Dec 15;53(6):1182-1201.e8. doi: 10.1016/j.immuni.2020.10.024. Epub 2020 Nov 25. PMID: 33242395; PMCID: PMC8641659.
12. Amir M, Chaudhari S, Wang R, Campbell S, Mosure SA, **Chopp LB**, Lu Q, Shang J, Pelletier OB, He Y, Doebelin C, Cameron MD, Kojetin DJ, Kamenecka TM, Solt LA. REV-ERB $\alpha$  Regulates T<sub>H</sub>17 Cell Development and Autoimmunity. *Cell Rep*. 2018 Dec 26;25(13):3733-3749.e8. doi: 10.1016/j.celrep.2018.11.101. PMID: 30590045; PMCID: PMC6400287.
  13. Wang H, Owen DL, Qian LJ, **Chopp LB**, Farrar MA, Hogquist KA. Ultrasound Guided Intra-thymic Injection to Track Recent Thymic Emigrants and Investigate T Cell Development. *Bio Protoc*. 2018 Dec 5;8(23):e3107. doi: 10.21769/BioProtoc.3107. PMID: 35921147.
  14. Carpenter AC, Wohlfert E, **Chopp LB**, Vacchio MS, Nie J, Zhao Y, Shetty J, Xiao Q, Deng C, Tran B, Cam M, Gaida MM, Belkaid Y, Bosselut R. Control of Regulatory T Cell Differentiation by the Transcription Factors Thpok and LRF. *J Immunol*. 2017 Sep 1;199(5):1716-1728. doi: 10.4049/jimmunol.1700181. Epub 2017 Jul 28. PMID: 28754678; PMCID: PMC5576567.
  15. Reed BK\*, **Chopp LB\***, Malo CS, Renner DN, Van Keulen VS, Girtman MA, Nevala WN, Pavelko KD, Gil D, Schrum AG, Johnson AJ, Pease LR. A Versatile Simple Capture Assay for Assessing the Structural Integrity of MHC Multimer Reagents. *PLoS One*. 2015 Sep 21;10(9):e0137984. doi: 10.1371/journal.pone.0137984. PMID: 26389800; PMCID: PMC4577079. *\*Authors contributed equally*

### Oral Presentations

1. The transcription factors Zfp148 and Zfp281 cooperate to support CD4<sup>+</sup> T cell development and function. Cold Spring Harbor Gene Expression and Signaling in the Immune System. November 2022 (Cold Spring Harbor, NY).
2. Integration of single cell transcriptomics and epigenomics to find new regulators of T cell development. 10X Genomics Bethesda User Group Meeting (Invited Keynote). March 2022 (Bethesda, MD).
3. Integration of single cell transcriptomics and epigenomics to find new regulators of T cell development. NIH Single Cell Users Group Seminar Series. October 2022 (Virtual).
4. E pluribus unum: deciphering T cell development from single-cell transcriptome and chromatin analyses. NIH-FDA Immunology Interest Group Seminar Series. March 2021 (Virtual).
5. Unraveling T Cell Development in Mice and Humans. Minnesota State University Biology Seminar Series, Mankato, MN, February 2021 (Virtual).
6. An Integrated Epigenomic and Transcriptomic Map of Mouse and Human T Cell Development. Global Thymus Network ThymUS Conference. November 2020 (Virtual).
7. An Integrated Epigenomic and Transcriptomic Map of Mouse and Human T Cell Development. Molecular Immunology and Inflammation Branch Group Seminar. October 2019 (Bethesda, MD).
8. An unbiased transcriptomic analysis identifies Zfp281 as a novel controller of CD4 T cell development. Global Thymus Network ThymE Conference. May 2019 (Rehovot, Israel).
9. An unbiased transcriptomic analysis identifies Zfp281 as a novel controller of CD4 T cell development. NIH-FDA Immunology Interest Group Workshop. September 2019 (Leesburg, VA).
10. Investigating CD4 T cell development in the thymus. NIH-FDA Immunology Interest Group Workshop. September 2018 (Leesburg, VA).
11. Investigating CD4 T cell development in the thymus. UPenn Immunology Graduate Group Retreat. November 2018 (Lancaster, PA).
12. Investigating CD4 T cell development in the thymus. Chesapeake Cytometry Consortium, Johns Hopkins University. November 2017 (Rockville, MD).

### Poster Presentations

1. Chopp LB and Bosselut R. Leveraging single-cell genomics to build gene regulatory networks involved in  $\alpha\beta$  T cell development. Cold Spring Harbor Laboratories Systems Immunology Meeting. Virtual. 2021.
2. Chopp LB and Bosselut R. The transcription factors Zfp281 and Zfp148 cooperate to control CD4 T cell development. The Molecular Mechanisms of Immune Cell Development and Function Conference (FASEB), Palm Springs, CA. 2019.

3. Chopp LB and Bosselut R. CD4 T cell specification in the thymus is independent of the transcription factor Thpok. *Gene Expression and Signaling in the Immune System*, CSHL. Cold Spring Harbor, NY. 2018.
4. Chopp LB and Bosselut R. Investigating CD4 T cell Differentiation in the Thymus. NIH Graduate Research Symposium. Bethesda, MD. 2018.
5. Chopp LB and Bosselut R. Investigating CD4 T cell Differentiation in the Thymus. NIH Immunology Interest Group Workshop. Leesburg, VA. 2017.
6. Chopp LB and Bosselut R. Investigating CD4 T cell Differentiation in the Thymus. NIH Graduate Research Symposium. Bethesda, MD. 2017.
7. Chopp LB and Bosselut R. Investigating CD4 T cell Differentiation in the Thymus. NIH Immunology Interest Group Workshop. Leesburg, VA. 2016.
8. Chopp LB and Solt L. REV-ERB regulation of Th17 cell development and function. *Keystone Symposium, T Cells: Regulation and Effector Function*, Snowbird, UT. 2015.
9. Chopp LB and Solt L. REV-ERB regulation of Th17 cell development and function. *Scripps Research Institute Summer Undergraduate Research Symposium*, Jupiter, FL. 2014.

### Teaching, Mentorship, and Leadership

NIH summer intern mentor. Summer 2019.

Mentored and supervised a summer intern in bioinformatics analysis, including population and single-cell genomics.

NIH Immunology Interest Group Steering Committee, 2019-2020

Organized speaker seminar series, a research symposium, and hosted invited speakers for luncheons.

Instructor for Immunology 521, Foundation for Advanced Education in the Sciences, NIH. 2018.

Taught the lecture on T cell development and worked with other instructors to design and grade exams. Posted discussion questions to class website.

NIH Post-Baccalaureate Poster Day competition judge. 2017, 2018

Lead judge in 2017. Provided feedback and encouragement to NIH post-baccalaureate research fellows on their poster presentation and scientific communication.

Teaching Assistant, Fall 2014.

Undergraduate Organic Chemistry, Minnesota State University. Instructor: Dr. Michael Lusch

Graded homework and exams and provided feedback to students.

Minnesota State University Tri-Beta National Biological Honor Society (2013-2015)

Served as the president and initiated the development of scientific outreach and volunteer opportunities for students.

### Volunteering & Outreach

Doctors of Tomorrow, University of Michigan. 2022-Present

Meet monthly with high school students who hope to become medical professionals.

University of Michigan Medical School Frog Island Track Club. 2022-Present

Coach weekly track practices during the Summer for elementary school children in Ypsilanti, MI

The Children's Inn at the National Institutes of Health.

Tutor Children's Inn residents in mathematics (2020-present--virtual).

Supervised grocery store trips (2021-2022)

Supervised Gingerbread Gift Shop (2021)

Set-up and ran evening recreational activities for Inn residents and families (2018-2020)

Prepared and served hot breakfast twice monthly (2019-2020)

Planned and supervised DNA isolation experiments for Inn residents as part of the ExploreInn program (2016 & 2019).

Prince George's County High School Biomedical Mentoring Program. 2020-2022.

Met monthly with underprivileged high school students who have an interest in pursuing STEM careers.

Advise my students on strategies for academic success and on pursuing a career in STEM.

University of Pennsylvania Immunology Graduate Group. 2020 and 2021

Mentored underrepresented minority applicants to the immunology graduate group to prepare them for the application and interview process.

Minnesota State University Biological Honor Society. 2014-2015.

Designed and performed scientific experiments with children who typically have few opportunities to participate in "wet-lab" experiments, including children with differing physical abilities, neurodiverse children, and home-schooled children in the Mankato, MN community.