Eric Scott Davis

CURRICULUM VITAE

The University of North Carolina at Chapel Hill
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CONTACT INFORMATION

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EDUCATION

The University of North Carolina at Chapel Hill, School of Medicine

Ph.D. in Bioinformatics and Computational Biology, 2018–2023

Advisor: Douglas H. Phanstiel

The University of North Carolina at Chapel Hill, College of Arts and Sciences

B.S. in Biology and B.A. in Chemistry, 2012–2016

TECHNICAL SKILLS

Scripting Languages

- R, Python, bash, Julia, C++, C#, Java (https://github.com/stars/EricSDavis/lists/projects)

Software & Web Development

- R/Bioconductor package development (https://github.com/stars/EricSDavis/lists/r-bioconductor-packages)
- Interactive data visualization with D3.js & Node.js (https://github.com/stars/EricSDavis/lists/interactive-data-visualization)
- R Shiny web applications (http://phanstiel-lab.med.unc.edu/lure/)
- .NET Core web applications with Microsoft SQL Server database (https://github.com/stars/EricSDavis/lists/net-core)

Bioinformatic Pipelines

- Snakemake and Nextflow pipelines for Hi-C, Micro-C, RNA/ATAC/ChIP some using Docker/Singularity. (https://github.com/stars/EricSDavis/lists/bioinformatic-pipelines)

Cloud Computing

- High-performance computing environments (HPC) on Linux with SLURM
- Amazon Web Services (AWS)

GRADUATE RESEARCH EXPERIENCE

Phanstiel Lab, Graduate Research Assistant SPRING | 2019 – PRESENT

- Developed the lab's computational infrastructure including data processing pipelines, data organization, and analytical methodology.
- Led multiple research projects focused on understanding 3D chromatin structure, gene regulation, and human disease resulting in over 20 co-authored publications in high impact journals such as Nature, Genetics, Cell Reports, and Bioinformatics.
- Developed and contributed to 3 R/Bioconductor packages and 2 R Shiny applications.
- Highly collaborative with external research groups including ENCODE.
- Presented research at major national and international conferences earning multiple awards.
- Directly mentored graduate students, postdocs, and visiting research professors.

Dominguez Lab, Rotation Student WINTER, 14 WEEKS | 2019

- Used computational and wet-lab techniques to explore the autoregulatory interactions between the intrinsically disordered, phase-separation domains of proteins and their precursor mRNA structures.

Vincent Lab, Rotation Student FALL, 10 WEEKS | 2018

- Conducted statistical analysis of metastatic melanoma microarray data to determine prognostically favorable tumor microenvironments in metastatic brain melanoma patients resulting in a 2nd author publication in *Frontiers in Oncology*.
- Assessed the efficacy of chitosan-IL12 and neoantigen-derived vaccine combination immunotherapy in a bladder cancer mouse model. Began building a computational model to investigate tumor cell survival dynamics.

PREVIOUS RESEARCH EXPERIENCE

Research Technician 2016-2018

Marsico Lung Institute/UNC Cystic Fibrosis Research Center

- Generated data for and led multiple research projects under Robert Tarran, Ph.D. resulting in 7 co-authored publications.
- Designed, built, and managed an online e-liquid safety database in collaboration with *Deep Green Software* (https://www.eliquidinfo.org).
- Personally mentored undergraduate, graduate, and rotation students.
- Developed novel protocols for exposure of cultured cells to e-liquid aerosol.
- Performed a variety of specialized techniques including high-throughput screening, Ussing chambers, confocal microscopy, rodent surgery, and cell culture.

Undergraduate Researcher 2015-2016
The University of North Carolina at Chapel Hill
- Conducted independent research projects under Dr. Robert Tarran, Dr. Robert Fellner, and Dr. Tongde Wu.
- Investigated electrophysiological responses of primary airway epithelial cell cultures to treatments with peptide inhibitors.
- Used confocal microscopy to assess the ability for peptides to inhibit STORE-operated calcium release in HEK293 cells.

INDUSTRY EXPERIENCE

Front-end Developer (part-time consultant) 2022-2023
Exemplar Health
- Developed business applications using .NET Core and C# with a Microsoft SQL server database.

GRANTS & FUNDING

Bioinformatics & Computational Biology T32 Training Grant 07|2019 – 06|2020
Partial stipend, tuition and health insurance coverage

Graduate Student Transportation Grant SPRING|2019
$1,000 Travel award

HONORS & AWARDS

Best Innovative Poster Idea Award 08|2021
BioC2021: Bioconductor Conference

NSF Honorable Mention 04|2020
Graduate Research Fellowships Program

Poster Presentation Award 09|2019
UNC Department of Genetics Retreat

1st Place Predoctoral Poster Award 05|2017
Visiting Pulmonary Scholars Symposium

Dean's List Academic Honors 08|2012 - 05|2016
Eight semesters

TEACHING & MENTORING

Computational Office Hour 09|2022 – PRESENT
Informal and unstructured computational mentorship. We meet weekly for an hour at a local bar or café to discuss computational-oriented problems and how to solve them.

Leadership Team Member – Computational Biosciences Club 09|2021 – PRESENT
The Computational Biosciences Club (CBC) serves as an inclusive network of students centered around computational-first science. CBC connects students across programs by the methods and tools we use, rather than the biological topics we study. Our focus is to improve core computational skillsets, form a network for career development with academia and industry, and engage in outreach with our local community.

First Year Group (FYG) Peer Mentor 08|2019 – 04|2021
FYG peer mentors meet with first year UNC graduate students and advise students about choosing rotations, selecting dissertation labs, and on having a successful graduate student experience.

Teaching Assistant, BCB720: Introduction to Statistical Modeling FALL|2019
Responsibilities include teaching a class introducing/reviewing R, latex, calculus, and linear algebra, holding regular office hours, and grading homework assignments.

Teacher for How to Learn to Code SUMMER|2019
How to Learn to Code (HTLTC) is a student-led summer program designed to introduce the fundamentals of coding to biological researchers (students/postdocs/faculty/staff). HTLTC offers classes in beginning, and intermediate programming in both R and python.

Instructor for DNA Day 04|2019
DNA day commemorates the completion of the Human Genome Project in 2003 and the discovery of DNA structure in 1953. On DNA day, UNC sends graduate students, postdocs, faculty and staff to high schools around North Carolina to teach about genomic research.

ORAL PRESENTATIONS

BioC2023 Workshop (90 minutes) 2023
Dana Farber Cancer Institute, Boston, MA.
“Mariner: Explore the Hi-Cs”
Invited

Keystone Symposia: Chromatin Architecture in Development and Human Health 2023
Victoria, BC, Canada
“Mariner: Explore the Hi-Cs”

Thurston Arthritis Research Day 2022
Friday Center, UNC-Chapel Hill
“3D chromatin structure in chondrocytes identifies putative osteoarthritis risk genes”

UNC Department of Genetics Annual Retreat 2022 2022
Wilmington, NC
“Mariner: Explore the Hi-Cs”

BioC2022 Workshop (45 minutes) 2022
Seattle Children's Hospital, Seattle, WA.
"Nullranges: Modular Workflow For Overlap Enrichment"

BioC2021 Lightning Talk 2021
Virtual Conference
"Using nullranges::matchRanges() with BentoBox "

TCORS Annual Retreat 2017
Rizzo Conference Center, UNC-Chapel Hill
"The Physio-Chemical Properties of E-liquids"

POSTER PRESENTATIONS

Keystone Symposia: Chromatin Architecture in Development and Human Health 2023
Victoria, BC, Canada
"Mariner: Explore the Hi-Cs"

BioC2021: Bioconductor Conference 2021
Virtual Conference
"Covariate-matched null-hypothesis ranges with nullranges::matchRanges()"

CSHL: Epigenetics & Chromatin 2020
Virtual Conference
Attended – no poster presentation

UNC Department of Genetics Annual Retreat 2019 2019
Wilmington, NC
"Lure: A Probe Design Tool for Hybrid Capture Hi-C (Hi-C^2)"

Keystone Symposium 3D Genome: Gene Regulation and Disease 2019
Banff, AB, Canada
"LURE: Automated probe design for Hybrid Capture Hi-C (Hi-C^2)"

TCORS National Conference 2017
NIH Campus, Bethesda, MD
"Physio-chemical Properties of E-liquids as Biomarkers of Harm"

Visiting Pulmonary Scholars Symposium 2017
Friday Center, UNC-Chapel Hill
1st place in the predoctoral category

TCORS National Conference 2016
NIH Campus, Bethesda, MD
"Evaluating E-liquid Toxicity with an Open-source High-throughput Screening Method"

TCORS Annual Retreat 2016
Rizzo Conference Center, UNC-Chapel Hill
"Evaluating Toxicity and Electrophysiological Effects of E-liquids"

PUBLICATIONS

Eric S Davis, Wancen Mu, Stuart Lee, Mikhail G Dozmorov, Michael I Love, Douglas H Phanstiel, matchRanges: Generating null hypothesis genomic ranges via covariate-matched sampling, *Bioinformatics*, 2023;, btad197, https://doi.org/10.1093/bioinformatics/btad197. 04|2023

Wancen Mu, **Eric S Davis**, Stuart Lee, Mikhail G Dozmorov, Douglas H Phanstiel, Michael I Love, bootRanges: flexible generation of null sets of genomic ranges for hypothesis testing, *Bioinformatics*, Volume 39, Issue 5, May 2023, btad190, https://doi.org/10.1093/bioinformatics/btad190. 04|2023

Jonathan D Ogata, Wancen Mu, **Eric S Davis**, Bingjie Xue, J Chuck Harrell, Nathan C Sheffield, Douglas H Phanstiel, Michael I Love, Mikhail G Dozmorov, excluderanges: exclusion sets for T2T-CHM13, GRCm39, and other genome assemblies, *Bioinformatics*, Volume 39, Issue 4, April 2023, btad198, https://doi.org/10.1093/bioinformatics/btad198. 04|2023

Dozmorov, Mikhail G., Wancen Mu, **Eric S. Davis**, Stuart Lee, Timothy J. Triche Jr, Douglas H. Phanstiel, and Michael I. Love. 2022. "CTCF: An R/bioconductor Data Package of Human and Mouse CTCF Binding Sites." *Bioinformatics Advances* 2 (1): vbac097. 12|2022

Bond, Marielle L., **Eric S. Davis**, Ivana Y. Quiroga, Michael I. Love, Hyejung Won, and Douglas H. Phanstiel. 2022. "Chromatin Loop Dynamics during Cellular Differentiation Are Associated with Changes to Both Anchor and Internal Regulatory Features." *bioRxiv*. https://doi.org/10.1101/2022.10.31.514600. 11|2022

Kathleen S.M. Reed*, **Eric S. Davis***, Marielle L. Bond, Alan Cabrera, Eliza Thulson, Ivana Yoseli Quiroga, Shannon Cassel, Kamisha T. Woolery, Isaac Hilton, Hyejung Won, Michael I. Love, Douglas H. Phanstiel. Temporal analysis suggests a reciprocal relationship between 3D chromatin structure and transcription. *Cell Reports*. 41, 5 (2022). https://doi.org/10.1016/j.celrep.2022.111567 11|2022

Eliza Thulson*, **Eric S Davis***, Susan D'Costa*, Philip R Coryell, Nicole E Kramer, Karen L Mohlke, Richard F Loeser, Brian O Diekman, Douglas H Phanstiel. 3D chromatin structure in chondrocytes identifies putative osteoarthritis risk genes, *Genetics.* iyac141 (2022). https://doi.org/10.1093/genetics/iyac141 09|2022

Kelly, M.R., Wisniewska, K., Regner, M.J., Lewis, M.W., Perreault, A.A., **Davis, E.S.**, Phanstiel, D.H., Parker, J.S., Franco, H.L. A multi-omic dissection of super-enhancer driven oncogenic gene expression programs in ovarian cancer. *Nat Commun*. 13, 4247 (2022). https://doi.org/10.1038/s41467-022-31919-8 04|2022

Nicole E. Kramer, **Eric S. Davis**, Craig D. Wenger, Erika M. Deoudes, Sarah M. Parker, Michael I. Love, Douglas H. Phanstiel. Plotgardener: Cultivating 02|2022

precise multi-panel figures in R. *Bioinformatics.* btac057. *(*2022). https://doi.org/10.1093/bioinformatics/btac057

Gu, Huiya, Hannah Harris, Moshe Olshansky, Yossi Eliaz, Akshay Krishna, Achyuth Kalluchi, Mozes Jacobs, et al. 2021. "Fine-Mapping of Nuclear Compartments Using Ultra-Deep Hi-C Shows That Active Promoter and Enhancer Elements Localize in the Active A Compartment Even When Adjacent Sequences Do Not." *bioRxiv*. https://doi.org/10.1101/2021.10.03.462599. 10|2021

Eric S Davis, Arunava Ghosh, Raymond D Coakley, Joe A Wrennall, Bob A Lubamba, Temperance R Rowell, Hong Dang, Erica A Pawlak, Quefeng Li, Neil E Alexis, Carla M P Ribeiro, Robert Tarran. Chronic E-Cigarette Exposure Alters Human Alveolar Macrophage Morphology and Gene Expression. *Nicotine & Tobacco Research.* 24, 3. March 2022. Pages 395399. https://doi.org/10.1093/ntr/ntab186 09|2021

Jeong Hyun Ahn, **Eric S. Davis**, Timothy A. Daugird, Shuai Zhao, Ivana Quiroga, Jie Li, Aaron J. Storey, Yi-Hsuan Tsai, Daniel P. Keeley, Samuel G. Mackintosh, Ricky D. Edmondson, Stephanie D. Byrum, Alan J. Tackett, Deyou Zheng, Wesley R. Legant, Douglas H. Phanstiel, Gang Greg Wang. Phase separation drives aberrant chromatin looping and cancer development. *Nature.* 2021 06|2021

Ghosh A, Beyazcicek O, **Davis ES**, Onyenwoke RU, Tarran R. Cellular effects of nicotine salt-containing e-liquids. *J Appl Toxicol*. 2021 Mar;41(3):493-505. doi: 10.1002/jat.4060. Epub 2020 Oct 9. PMID: 33034066. 03|2021

Trembath DG, **Davis ES**, Rao S, Bradler E, Saada AF, Midkiff BR, Snavely AC, Ewend MG, Collichio FA, Lee CB, Karachaliou GS, Ayvali F, Ollila DW, Krauze MT, Kirkwood JM, Vincent BG, Nikolaishvilli-Feinberg N, Moschos SJ. Brain Tumor Microenvironment and Angiogenesis in Melanoma Brain Metastases. *Front Oncol.* 2021 Jan 21;10:604213. doi: 10.3389/fonc.2020.604213. PMID: 33552976; PMCID: PMC7860978. 01|2021

Woodall M, Jacob J, Kalsi KK, Schroeder V, **Davis E**, Kenyon B, Khan I, Garnett JP, Tarran R, Baines DL. E-cigarette constituents propylene glycol and vegetable glycerin decrease glucose uptake and its metabolism in airway epithelial cells in vitro. *Am J Physiol Lung Cell Mol Physiol.* 2020 Dec 1;319(6):L957-L967. doi: 10.1152/ajplung.00123.2020. Epub 2020 Sep 30. PMID: 32996783; PMCID: PMC7792687. 09|2020

Patwardhan MN, Wenger CD, **Davis ES**, Phanstiel DH. Bedtoolsr: An R package for genomic data analysis and manipulation. Journal of Open Source Software, 4(44), 1742, https://doi.org/10.21105/joss.01742 12|2019

Min A, Deoudes E, Bond ML, **Davis ES**, Phanstiel DH. CoralP: Flexible visualization of the human phosphatome. Journal of Open Source Software, 4(44), 1837, https://doi.org/10.21105/joss.01837 12|2019

Ghosh A, Coakley RC, Mascenik T, Rowell TR, **Davis ES**, et al. Chronic E-Cigarette Exposure Alters the Human Bronchial Epithelial Proteome. *Am J Respir Crit Care Med*. 2018;198(1):67-76. doi:10.1164/rccm.201710-2033OC — 07|2018

Davis ES*, Sassano MF*, Keating JE, et al. Evaluation of e-liquid toxicity using an open-source high-throughput screening assay. *PLOS Biology*. 2018;16(3):e2003904. doi:10.1371/journal.pbio.2003904 — 03|2018

Matson BC, Pierce SL, Espenschied ST, Holle E, Sweatt IH, **Davis ES**, et al. Adrenomedullin improves fertility and promotes pinopodes and cell junctions in the peri-implantation endometrium. *Biol Reprod*. 2017;97(3):466-477. doi:10.1093/biolre/iox101 — 08|2017

Davis ES, Sassano MF, Goodell H, Tarran R. E-Liquid Autofluorescence can be used as a Marker of Vaping Deposition and Third-Hand Vape Exposure. *Scientific Reports*. 2017;7(1):7459. doi:10.1038/s41598-017-07862-w — 08|2017

DISSERTATION COMMITTEE

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