Sarah Maddox Groves

PERSONAL

MAIDEN NAME:	Sarah Frances Maddox
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EDUCATION

CURRENT	Postdoctoral Research Trainee in COMPUTATIONAL & SYSTEMS BIOLOGY **Vanderbilt University**, Nashville, TN Advisors: Vito Quaranta, M.D and Scott Hiebert, Ph.D.
2016-2022	Ph.D. in CHEMICAL AND PHYSICAL BIOLOGY (SYSTEMS BIOLOGY TRACK) **Vanderbilt University**, Nashville, TN Advisor: Vito Quaranta, M.D.
2012-2016	B.S. in Physics and Mathematics **College of William & Mary,** Williamsburg, VA

PAPERS

Groves, S.M., Ildefonso, G.V., McAtee, C.O., Ozawa, P.M.M., Ireland, A.S., Stauffer, P.E., Wasdin, P.T., Huang, X., Qiao, Y., Lim, J.S., Bader, J., Liu, Q., Simmons, A.J., Lau, K.S., Iams, W.T., Hardin, D.P., Saff, E.B., Holmes, W.R., Tyson, D.R., Lovly, C.M., Rathmell, J.C., Marth, G., Sage, J., Oliver, T.G., Weaver, A.M., Quaranta, V. (2022). Archetype tasks link intratumoral heterogeneity to plasticity and cancer hallmarks in small cell lung cancer. *Cell Systems,* doi: 10.1016/j.cels.2022.07.006

Groves, S.M., Panchy, N., Tyson, D.R., Harris, L.A., Quaranta, V., and Hong, T. (2022) Analysis of transcriptome datasets reveals involvement of epithelial-mesenchymal transition genes in small cell lung cancer phenotypic plasticity. *BioRxiv,* doi: 10.1101/2022.09.09.507376

Olsen, R.R., Ireland, A.S., Kastner, D.W., **Groves, S.M.,** Spainhower, K.B., Pozo, K., Kelenis, D.P., Whitney, C.P., Guthrie, M.R., Wait, S.J., Soltero, D., Witt, B.L., Quaranta, V., Johnson, J.E., Oliver, T.G. (2021) ASCL1 represses a SOX9+ neural crest stem-like state in small cell lung cancer. *Genes & Development*, doi:10.1101/gad.348295.121.

Thomas, P.L., **Groves, S.M.**, Zhang, Y.-K., Li, J., Gonzalez-Ericsson, P., Sivagnanam, S., Betts, C.B., Chen, H.-C., Liu, Q., Lowe, C., Chen, H., Boyd, K.L., Kopparapu, P.R., Yan, Y., Coussens, L.M., Quaranta, V., Tyson, D.R., Iams, W., Lovly, C.M. (2021) Beyond PD-L1: B7-H6 emerges as a potential immunotherapy target in small cell lung cancer. *Journal of Thoracic Oncology,* doi:10.1016/j.jtho.2021.03.011.

Gay, C. M., Stewart, A., Park, E.M., Diao, L., **Groves, S.M**., S.M., Heeke, S., Nabet, B.Y., Fujimoto, J., Solis, L.M., Lu, W., Xi, Y., Cardnell, R.J., Wang, Q., Fabbri, G., Cargill, K.R., Vokes, N.I., Ramkumar, K., Zhang, B., Della Corte, C.M., Robson, P., Swisher, S.G., Roth, J.A., Glisson, B.S.,

Shames, D.S., Wistuba, I.I., Wang, J., Quaranta, V., Minna, J., Heymach, J.V., Byers, L.A. (2021) Patterns of transcription factor programs and immune pathway activation define four major subtypes of SCLC with distinct therapeutic vulnerabilities. *Cancer Cell,* doi:10.1016/j.ccell.2020.12.014.

Wooten, D.*, **Groves, S.M.***, Tyson, D.R., Liu, Q., Lim, J.S., Albert, R., Lopez, C.F., Sage, J., and Quaranta, V. (2019). Systems-level network modeling of Small Cell Lung Cancer subtypes identifies master regulators and destabilizers. *PLOS Computational Biology* 15, e1007343.

Griffioen, K., Carlson, C., **Maddox, S.** (2016). Consistency of electron scattering data with a small proton radius. *Physics Review C*, 93, 065207.

* Authors contributed equally to this work.

RESEARCH & PROFESSIONAL EXPERIENCE

CURRENT	Postdoctoral Researcher at **Vanderbilt University,** Nashville, TN *Data-driven Models for Predicting Drivers of Plasticity in Small Cell Lung Cancer* Analyzing chromatin accessibility and transcriptomics datasets (scATAC-seq & scRNA-seq) to understand epigenetic regulation of lung cancer phenotypes. Facilitating collaboration between two labs at Vanderbilt to plan experimental design and coordinate omics data collection. The goal of this project is to combine computational modeling and bioinformatics tools to predict lineage drivers for variant SCLC models.
CURRENT	Data Science Intern, **Decode Health**, Nashville, TN Developing pipelines for data processing and analysis such as feature selection, machine learning models, and visualization. Decode Health is a healthcare AI company that unlocks discovery with data.
2017-2022	Graduate Researcher at **Vanderbilt University**, Nashville, TN *Dissertation: Network Control of Cell Identity and Plasticity in Small Cell Lung Cancer (SCLC)* Developed and applied a network inference algorithm to determine the epigenetic regulation and stability of phenotypic subtypes of SCLC. Developed a bioinformatics pipeline for analyzing changes in cell identity (scRNA-seq) in classic and variant models of SCLC. Overall, this project led to insights into how intratumoral heterogeneity and plasticity may allow SCLC tumors to overcome therapy and gain resistance.
2016-2017	Graduate Researcher at **Vanderbilt University**, Nashville, TN *Laboratory Rotations* Completed four 8-week rotations in labs studying myosin tracking to tips of microvilli, effect of ECM stiffness on cancer cell growth, modeling of drug-induced dynamics in melanoma, and fetal membrane developmental dynamics.
2015-2016	Undergraduate Researcher at the **College of William & Mary,** Williamsburg, VA *Senior Thesis: Quantitative Analysis of Vital Signs in Preterm Infants* Programmed a biophysical 'Query User Data Interface' in MATLAB for the Apnea of Prematurity group at UVA and William & Mary. The goal of this project was to streamline data acquirement for the neonatal intensive care unit at UVA.
SUMMER 2015	Undergraduate Researcher at **University of Michigan & CERN**, Geneva, Switzerland *Design of Experiments for the 2015 CLOUD Run* Worked under Hamish Gordon and Jasper Kirkby. Used statistical analysis and coding in R of a Kriging model emulator, based on a 5-dimensional Maximin Latin Hypercube, to determine how cloud formation depends on five atmospheric variables. The goal of this project was to design experiments for the fall 2015 run of the CERN CLOUD experiment.
2014-2015	Undergraduate Researcher at the **College of William & Mary**, Williamsburg, VA *Properties of Silk Studied by Atomic Force Microscopy* Investigated the structure and physical properties of brown recluse spider silk by atomic force microscopy in the Nanomaterials and Imaging Laboratory of Applied Science.

SUMMER 2014	Undergraduate Researcher at **University of Chicago and Argonne National Laboratory**, Chicago, IL *Analyzing the Viscoelastic Properties of Langmuir Monolayers* Worked at the University of Chicago and Argonne National Laboratory APS Sector 15 with ChemMatCARS under the MRSEC program (Materials Research Science and Engineering Center). Analyzed the rheology of nanoparticle and phospholipid monolayers under oscillatory compression to quantitatively describe the viscoelastic properties of the films.
2014-2015	Undergraduate Researcher at the **College of William & Mary**, Williamsburg, VA *Global Fits to the Precision Proton Form Factor Data from Mainz* The goal of this project was to statistically analyze data from an electron scattering experiment in Mainz, and to seek an empirical model of the electron charge distribution in the proton to determine its RMS radius, which would address a discrepancy in proton size from varying experiments. Work published in Physics Review C (see Papers section above).

GRANTS AND FELLOWSHIPS

2022-CURRENT	NIH Postdoctoral Training Grant (T32), Hiebert Laboratory **Vanderbilt University**
2017-2022	NSF Graduate Research Fellowship Program (GRFP) Fellow **Vanderbilt University**
2016-2017	Trainee in Vanderbilt Training Program for Big Biomedical Data Science (BIDS), NIH Grant 1T32LM012412-01 **Vanderbilt University, Department of Biomedical Informatics**

AWARDS AND CERTIFICATES

2022	Certificate in College Teaching **Vanderbilt Center for Teaching**
SPRING 2022	Certificate in Data Science Essentials BRET Office of Career Development: ASPIRE Program **Vanderbilt University**
AUGUST 2021	Podium Presentation Award: Junior Investigators Annual Meeting **Cancer Systems Biology Consortium**
FALL 2019	Vanderbilt Graduate School Travel Grant Awardee **Vanderbilt University**
FALL 2018	Vanderbilt Graduate School Travel Grant Awardee **Vanderbilt University**
2012-2016	James Monroe Scholar **College of William & Mary**
2012-2016	Academic Dean's List **College of William & Mary**

TEACHING EXPERIENCE

FALL 2022	Guest Lecturer for *Introduction to Bioinformatics*, **Vanderbilt University**

	Taught two lectures on introduction to analysis of sequencing data, including data generation and data cleaning, exploratory data analysis, and unsupervised learning methods such as PCA and clustering.
SPRING 2022	Teaching Assistant for *Scientific Communication in Chemical and Physical Biology* (CPB), **Vanderbilt University**
	Mentored second year CPBP students in preparing for their qualifying exams by assisting them in grant writing components such as identification of Specific Aims, development of a Research Strategy, and composition of Research Significance and Innovation.
SPRING 2020	Guest Lecturer for *Introduction to Single Cell Analysis*, **Vanderbilt University**
	Taught lectures on dynamical modeling of single-cell data, such as trajectory inference methods and Markov Chain-based modeling (using RNA velocity). Lectures included an introduction to the computation tools and packages used for such modeling.
2018-2020	Course Director & Instructor for *Introduction to Cancer Systems Biology*, **Vanderbilt University**
	Organized, planned and developed course content, and taught lectures to introduce non-computational students to modeling approaches of high-dimensional biomedical data. Course included lectures on introduction to modeling complexity; data preprocessing and visualization; network analysis and modeling (including Boolean networks of signaling pathways and ODE models); and an introduction to machine learning methods.
FALL 2019	Teaching Assistant for *Introduction to Bioinformatics*, **Vanderbilt University**
	Taught two lectures on analysis of sequencing data, held out-of-class office hours, wrote and graded weekly quizzes, and graded students on several project presentations throughout the semester.
FALL 2013	Teaching Assistant for *Foundations of Higher Mathematics*, **College of William & Mary**
	Graded weekly assignments and held office hours for support outside of class time.

MENTORING EXPERIENCE

FALL 2021	Mentor for Lab Rotation Student, **Vanderbilt University**
	Assisted rotation student with 4-week project on analysis and visualization of epigenetic sequencing data in SCLC. Taught introduction to Python and Jupyter notebooks.
SPRING 2021	Mentor for Lab Rotation Student, **Vanderbilt University**
	Assisted rotation student with 8-week project on analyzing single cell sequencing data to quantify changes in cell identity for an SCLC tumor before and after treatment.
FALL 2020	Mentor for Lab Rotation Student, **Vanderbilt University**
	Assisted rotation student with 8-week project with single cell RNA-sequencing data analysis and modeling on the role of the Notch pathway in Small Cell Lung Cancer phenotypic heterogeneity.
2018-2020	Mentor for Fisk-Vanderbilt Bridge Masters student, **Fisk University & Vanderbilt University**
	Assist student with data collection and analysis in Python and R, literature review, and thesis project formation on Small Cell Lung Cancer phenotype biomarkers.
FALL 2019	Mentor for Lab Rotation Student, **Vanderbilt University**
	Assisted rotation student with 8-week project on transcription factor network structure inference of Small Cell Lung Cancer subtypes.
FALL 2018	Mentor for Lab Rotation Student, **Vanderbilt University**

SPRING 2018	Assisted rotation student with 8-week project on pathway mutational load of Small Cell Lung Cancer cell lines. Taught the student to analyze genomic datasets for mutational signatures. Mentor for Lab Rotation Student, **Vanderbilt University** Assisted rotation student with 8-week project on drug response assays and drug sensitivity analysis of Small Cell Lung Cancer cell lines to various perturbagens.

INVITED TALKS

AUGUST 2021	PNEC Tasks Define a Continuum of Plastic Cell States between SCLC Archetypes *Cancer Systems Biology Consortium Junior Investigators Annual Meeting,* **NIH**, Virtual Meeting This talk won a Podium Presentation Award.
MAY 2021	What is plasticity (and why should we care)? *Small Cell Lung Cancer Consortium Meeting,* **National Cancer Institute (NCI),** Virtual Meeting
MARCH 2021	Cancer Hallmarks Define a Continuum of Plastic Cell States between Small Cell Lung Cancer Archetypes *Southern California Systems Biology Conference,* **City of Hope**, Virtual Conference
MARCH 2021	Cancer Hallmarks Define a Continuum of Plastic Cell States between Small Cell Lung Cancer Archetypes *Disease Atlas Weekly Meeting,* **Harvard University***,* Virtual Meeting
MARCH 2021	Cancer Hallmarks Define a Continuum of Plastic Cell States between Small Cell Lung Cancer Archetypes *Cancer Systems Biology Consortium Steering Committee Meeting,* **NIH**, Virtual Conference
DECEMBER 2020	Quantifying Plasticity of Single Cells in SCLC *Vanderbilt Center for Cancer Systems Biology (CCSB) Tumor Plasticity Virtual Think Tank Meeting,* **Vanderbilt University,** Nashville, TN
OCTOBER 2020	Cell Transport Potential (CTrP), a novel metric of cancer cell plasticity based on RNA velocity *2020 Core-to-Core Online Meeting,* **Japan Society for Promotion of Science (JSPS)**, Tokyo, JAPAN
JULY 2020	A new ASCL1+ subtype, A2, resembles a plastic, transit amplifying compartment of SCLC tumors *Small Cell Lung Cancer Consortium Biweekly Meeting,* **National Cancer Institute,** Virtual Meeting
OCTOBER 2019	Network Control of Phenotypic Plasticity in Cancer *Quantitative Systems Biology Consortium,* **Vanderbilt University**, TN
MARCH 2019	Introduction to RNA Velocity *Single Cell RNA-seq Group Meeting,* **Vanderbilt University**, TN

OCTOBER 2018	Introduction to SCLC Mouse Models *SCLC U54 Data Club,* **Vanderbilt University**, TN

POSTER PRESENTATIONS

JUNE 2022	Archetype tasks link intratumoral heterogeneity to plasticity and cancer hallmarks in small cell lung cancer *International Conference on Systems Biology of Human Diseases* **Vanderbilt University,** Nashville, TN
MARCH 2021	Cancer Hallmarks Define a Continuum of Plastic Cell States between Small Cell Lung Cancer Archetypes *Southern California Systems Biology Conference,* **City of Hope**, Virtual Meeting
MARCH 2020	A new ASCL1+ subtype, A2p, forms a plastic, transit-amplifying compartment of SCLC tumors *Small Cell Lung Cancer Consortium Annual Meeting,* **National Cancer Institute (NCI)**, Washington, DC**
NOVEMBER 2019	Uncovering Stochastic and Drug-Induced Phenotypic Transitions in Small Cell Lung Cancer *Single Cell Analysis Meeting,* **Cold Spring Harbor Laboratory (CSHL),** Long Island, NY
OCTOBER 2019	Uncovering Stochastic and Drug-Induced Phenotypic Transitions in Small Cell Lung Cancer *Second Annual Symposium on Multiscale Cell Fate,* **NSF-Simons Center at University of California, Irvine (UCI),** Irvine, CA
SEPTEMBER 2018	A Phenotypic Variant of Small Cell Lung Cancer with Drug-Resistant and Immuno-modulatory Properties Identified by Computational Modeling *Cancer Systems Biology Consortium Annual Meeting,* **NIH**, Bethesda, MD
JUNE 2018	Characterizing Phenotypic Heterogeneity in Small Cell Lung Cancer with Computational Modeling *International Conference on Systems Biology of Human Diseases,* **University of California, Los Angeles (UCLA),** Los Angeles, CA
OCTOBER 2017	Deciphering Phenotypic Heterogeneity in Small Cell Lung Cancer *Cancer Systems Biology Consortium Annual Meeting,* **Broad Institute**, Cambridge, MA
AUGUST 2017	Characterizing Phenotypic Heterogeneity in Small Cell Lung Cancer with Computational Modeling *International Conference on Systems Biology,* **Virginia Tech**, Blacksburg, VA

ACADEMIC AND COMMUNITY SERVICE

2019-2021	Volunteer at Vanderbilt Student Volunteers for Science, **Vanderbilt University** Led 4 science lessons each semester (Fall and Spring) to elementary and middle school classes on various scientific topics such as vacuums, ocean currents, fossils, and electrical currents.†

2019-2020	Vice President of Social Affairs for Chemical and Physical Biology Program, **Vanderbilt University**
	Plan and organize social events to build community in our graduate program.
SEPTEMBER 2019	Leader at Expand Your Horizons STEM Conference, **Middle Tennessee State University**
	Lead a group of young women through various activities and experiments to encourage women to choose STEM fields.
2018-2019	Committee Member for Chemical and Physical Biology Program Retreat Planning Committee, **Vanderbilt University**
	Assisted in planning the annual retreat for my program.
2017-2018	Outreach Chair at Vanderbilt University Women in Science and Engineering, **Vanderbilt University**
	Planned and organized various scientific outreach activities with local organizations. Supervised committee of students and acted as liaison to Vanderbilt's Center for Scientific Outreach and Nashville Adventure Science Center.
2012-2016	Society of Physics Students Member, **College of William & Mary**
	Assisted with planning and setup of annual Physics Fest event.

† Last two science lessons in Spring 2020 session were canceled due to coronavirus restrictions.

TECHNICAL SKILLS

COMPUTATIONAL	• Python, R, Github, MATLAB, SQL, UNIX, LATEX
	• Sequencing analysis tools such as Pandas, Scanpy, CellRank, Seurat
	• Machine learning: Sci-kit learn, clustering, classification methods
THEORY	• Data Science: Data mining, cleaning, preprocessing, analysis, and visualization
	• ODE modeling, statistical modeling (Markov chain models, Bayesian inference), agent-based modeling
	• Gene regulatory network structure and dynamical inference, Boolean models, Bayesian networks, gene pathways analysis