

JULIA K. ELROD

Updated April 20, 2026

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SUMMARY

I am a fourth-year PhD student advised by Dr. Will Townes in the Department of Statistics & Data Science at Carnegie Mellon University (CMU). I am passionate about applying and developing statistical methods for health data. Before coming to CMU, I worked on cancer epidemiology at NIH. My current research focuses on genomics, and I am thrilled to be collaborating with the Torok lab at the University of Pittsburgh Medical Center (UPMC) studying pediatric scleroderma single-cell data. After completing my PhD, I plan to pursue a postdoctoral fellowship in statistical genomics or computational biology before becoming faculty at an academic institution.

EDUCATION

Carnegie Mellon University, Pittsburgh, PA

- *Ph.D. Candidate in Statistics & Data Science.* Expected May 2027
Committee: Will Townes (Chair), Kathryn Roeder, Wei Chen, & Kathryn Torok.
- *Master of Science in Statistics.* May 2024

Kenyon College, Gambier, OH

- *Bachelor of Arts in Mathematics & Statistics, magna cum laude.* May 2020

RESEARCH EXPERIENCE

CMU & University of Pittsburgh Medical Center (UPMC), Pittsburgh, PA

Spring 2024-Present

Statistics Ph.D. Student | Advisor: Will Townes, Ph.D. (CMU)

Co-advised by Kathryn Torok, M.D. (UPMC)

- *CITE-seq analysis of juvenile systemic sclerosis (jSSc) monocytes over time since autologous stem cell transplant (ASCT).*
 - Collaboration with Dr. Torok's pediatric scleroderma lab at UPMC Children's Hospital.
 - *Goal:* Characterize cellular activity in jSSc patients before ASCT, over time since ASCT, and compared to healthy controls.
 - *Data preprocessing:* Implemented comprehensive single-cell data processing pipeline in R, including quality control filtering, ambient RNA removal, and doublet detection, and culminating in multimodal cell type annotation based on CITE-seq (RNA + protein) measurements.
 - *Longitudinal differential expression analysis:* Many methods exist for identifying differentially expressed genes (DEGs) between *two groups*, but they are insufficient to capture trends in longitudinal data. To address this challenge, I implemented a negative binomial generalized linear model regressing total gene expression per patient sample against time since ASCT. The model included an offset term to adjust for differing numbers of viable cells per sample, inspired by [Lee and Han \(2024\)](#).
 - We are currently preparing to submit our manuscript covering this work.

National Cancer Institute, National Institutes of Health (NIH), Bethesda, MD

Fall 2020-Spring 2022

Postbaccalaureate CRTA Research Fellow | Supervisor: Philip Rosenberg, Ph.D.

- Developed novel statistical methodology in cancer surveillance.
- Created RStudio software for the application of these methods by biomedical researchers.
- Methodology includes age-period-cohort modeling, kernel smoothing algorithms, model selection techniques, changepoint detection, and generalized linear models.
- Applications include quantification of trends in breast, pancreas, and oral cancer incidence, as well as clinical recommendations for patient hip fracture risk assessment.

- Compared the efficacy of three multivariate methods for detecting relationships between genes and disease risk in Genome Wide Association Study (GWAS) data to three similar methods popular in the field of statistics.
- Conducted simulation studies and applied methods to Dallas Heart Study data, noting which methods picked up on the known relationship between rare variations in the ANGPTL5 gene and reduced triglyceride levels.
- Participated in a weekly journal club with Ohio State doctoral students in statistics, biostatistics, and epidemiology. Met with faculty in these departments to learn about their career paths and areas of research.

PUBLICATIONS

- Storandt, M. H., Tella, S. H., Wieczorek, M. A., Hodge, D., **Elrod, J. K.**, Rosenberg, P. S., Jin, Z., & Mahipal, A. (2024). Projected Incidence of Hepatobiliary Cancers and Trends Based on Age, Race, and Gender in the United States. *Cancers*, 16(4), Article 4. <https://doi.org/10.3390/cancers16040684>
- Rosenberg, P. S., Filho, A. M., **Elrod, J.**, Arsham, A., Best, A. F., & Chernyavskiy, P. (2023). Smoothing Lexis diagrams using kernel functions: A contemporary approach. *Statistical Methods in Medical Research*, 09622802231192950. <https://doi.org/10.1177/09622802231192950>
- Zumsteg, Z. S., Luu, M., Rosenberg, P. S., **Elrod, J. K.**, Bray, F., Vaccarella, S., Gay, C., Lu, D. J., Chen, M. M., Chaturvedi, A. K., & Goodman, M. T. (2023). Global Epidemiologic Patterns of Oropharyngeal Cancer Incidence Trends. *JNCI: Journal of the National Cancer Institute*, djad169. <https://doi.org/10.1093/jnci/djad169>
- Allbritton-King, J. D., **Elrod, J. K.**, Rosenberg, P. S., & Bhattacharyya, T. (2022). Reverse engineering the FRAX algorithm: Clinical insights and systematic analysis of fracture risk. *Bone*, 159, 116376.

TALKS

- **“Cross-tissue RNA-seq prediction with reduced rank regression”** August 2026
 - Joint Statistical Meetings (JSM) 2026, Boston, MA (accepted for oral presentation)
- **“Tips and tricks for a smooth workflow on the department Linux servers”** April 2026
 - CMU Statistics & Data Science Department (StatBytes seminar series)
- **“Longitudinal model of paired peripheral blood CITE-seq and skin scRNA-seq data in juvenile systemic sclerosis (jSSc) patients following autologous stem cell transplant (ASCT) reveals reduced expression of SSc marker genes”** October 2025
 - American College of Rheumatology (ACR) Convergence 2025, Chicago, IL (Selected for oral abstract session).
- **“Longitudinal cross-tissue modeling of single-cell multi-omics data, with an application in juvenile systemic sclerosis”** October 2025
 - CMU Statistics & Data Science Department (Thesis proposal).
- **“Longitudinal CITE-seq analysis of stem cell transplants in pediatric scleroderma”**
 - Paul Szabolcs Lab (UPMC, bone marrow transplantation and cellular therapies) June 2025
 - Robert Lafyatis Lab (UPMC, systemic sclerosis). June 2025
 - Kathryn Torok Lab (UPMC, pediatric scleroderma). April 2025, May 2025
 - Kathryn Roeder Lab (CMU, statistical genetics). April 2025
- **“Evaluating genetic colocalization analysis techniques with an application in schizophrenia etiology”** Nov. 2023
 - CMU Statistics & Data Science Department (Advanced Data Analysis project presentation).
- **“An R Package for Kernel Filtration of Rates on a Lexis Diagram”** April 2021
 - NIH Postbac Poster Day.
- **“Using Multivariate Association Measures to Identify Relationships Among Genetic Variants and Multi-Dimensional Structured Traits”** July 2018
 - The Ohio State University Comprehensive Cancer Center & Kenyon College Pelotonia Partnership Undergraduate Research Symposium.

TEACHING & MENTORING EXPERIENCE

Carnegie Mellon University, Pittsburgh, PA

Statistics Teaching Assistant

- Undergraduate Statistical Computing (36-350), Head TA Spring 2026
- Deep Learning (46-937) & Natural Language Processing (46-924) for M.S. in computational finance Fall 2025
- Machine Learning II for M.S. in computational finance (46-927) Spring 2025
- PhD Regression Analysis (36-707) Fall 2024
- Foundations of Data Science Online Graduate Certificate (36-640 and 36-641) Spring 2024
- Statistical Methods in Health Sciences (36-470) Spring 2024
- Undergraduate Advanced Data Analysis (36-402) Spring 2023
- Modern Regression (36-401) Fall 2022

National Institutes of Health, Bethesda, MD

College Summer Opportunities to Advance Research (CSOAR) Mentor

Summer 2021

- Served as a primary mentor through CSOAR, which provides research opportunities to college students disadvantaged by circumstances that have negatively impacted their educational opportunities.
- Taught student age period cohort analysis and oversaw final project, “Recent Trends in Oral Tongue Cancer Incidence in the United States by Region”.

Summer Internship Program (SIP) Mentor

Summer 2021

- Co-mentored a college student through SIP, sharing the ins and outs of government biomedical research.
- Introduced student to statistical methodology in changepoint detection and complementary RStudio software.
- Showed student how to run simulation studies comparing methods, resulting in the final presentation, “Estimating Changes in Average Annual Percentage Change of Disease Rates: Alternatives to Join-Point Regression”.

Kenyon College, Gambier, OH

Career Services Associate

Spring 2018-Spring 2020

- Workshopped résumés and cover letters with college students, helping students effectively market their skills.

Apprentice Teacher of Spanish

Fall 2017 & Spring 2020

- Planned language-learning activities for college students in introductory Spanish classes using online resources, games, and activities designed to facilitate listening, speaking, reading, and writing practice.
- Taught supplementary Spanish lessons four times per week, with an emphasis on conversation practice.

Association for Women in Mathematics Secretary

Spring 2018-Spring 2020

- Nominated for national membership by Kenyon mathematics faculty.
- Planned and organized mathematics education outreach events, such as a campus-wide STEM activities fair.

STEM and Data Teaching Assistant

Summer 2017

- Collaborated with science faculty to introduce underrepresented first-year students to STEM at Kenyon.
- Facilitated evening homework help sessions for students five nights per week.

AWARDS & CERTIFICATES

- Health Science Communication & Policy Workshop Certificate, NIH Office of AIDS Research Spring 2021
 - Gained practical knowledge in developing and evaluating a health communication campaign.
 - Studied the health policy legislative process, including securing research funding and resources.
- Fulbright English Teaching Assistant Award, Spain, 2020-2021 Spring 2020
 - Declined due to the COVID-19 pandemic.
- Sigma Xi – Scientific Research Honor Society, Kenyon-Denison Chapter Spring 2020
- Wendell D. Lindstrom Memorial Prize Spring 2018
 - Recognizes first or second-year college students who have demonstrated great promise in mathematics.
- Pi Mu Epsilon – Honorary National Mathematics Society Spring 2018
- Kenyon College National Merit Scholarship Fall 2016-Spring 2020

MEMBERSHIPS

- American Statistical Association