

Elizabeth Spear, PhD

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Education

PhD. in Microbiology

May 2026

University of Colorado Anschutz Medical Campus, Aurora, CO

BS in Biochemistry

December 2019

Metropolitan State University of Denver, Denver, CO

Research Experience

Graduate Student

March 2021-Present

University of Colorado Anschutz Medical Campus, Aurora, CO

My research focused on uncovering important molecular interactions necessary for host proteins to process viral non-coding RNAs. First, I focused on how dengue virus uses host Xrn1 exonuclease to generate subgenomic flaviviral RNAs (sfRNAs). I identified an adenine rich linker sequence that facilitates interactions necessary for the host Xrn1 to process virus RNA into specific sfRNAs. My data and analyses led to 1 published manuscript and 2 successful grant applications. Second, I tested how gammaherpesviruses use transfer RNA mimicry in pathogenesis. I designed and generated a panel of mutant viruses to define the elements required for host RNaseZ processing of viral tRNAs and their capacity for virulence. These studies are in the final stage, and serve as the basis for a manuscript in preparation.

I employed a broad range of techniques in virology, biochemistry and structural biology, including cell culture, plaque assays, DNA transfections, in vitro translation assays, Xrn1 RNA degradation assays, northern blotting, western blotting, protein expression and purification, molecular cloning, RNA extraction from infected cells, prepping cell samples for flow cytometry, SHAPE-MaP chemical probing, gel electrophoresis, nanopore sequencing, cryoEM, brightfield microscopy, Small-angle X-ray scattering, and NMD RNA degradation assays.

Research Assistant

August 2019-August 2020

Metropolitan State University Denver, Denver, CO

Purified and tested mutated DCC protein to identify which region binds to the ribosome and regulates translation of mRNA during neuronal development. Reinforced techniques such as molecular cloning and luciferase translation assays, while learning new techniques including protein purification via FPLC and western blot analysis. I also continued to work on communication skills as a scientist by presenting my research and contributing to the paper that was published on this work after moving on to graduate school.

Research Intern

August 2018-August 2019

University of Colorado Anschutz Medical Campus, Aurora, CO

Worked in a group of 3-6 interns to uncover mechanism of selective pausing of host RNA polymerase during Varicella Zoster Virus (VZV) infection. We identified several sequences homologous to sequences located in the Herpes Simplex Virus genome related to regulating transcription in the VZV genome. Learned essential techniques in microbiology (such as cell culture and molecular cloning), virology (plaque assays), and biochemistry (luciferase translation assays). I also learned how to collaborate and communicate with a group of scientists through this internship.

Research Assistant

August 2017-December 2017

Fayetteville State University, Fayetteville, NC

Studied Kudzu isoflavone content. Focused on isolating and quantifying levels of two phytoestrogen molecules called daidzein and daidzin from the evasive Kudzu plant due to their proposed health benefits. We showed that Kudzu contains a higher concentration daidzein and daidzin when compared to the levels isolated from other health foods such as soy. Acquired skills in plant sample collection, HPLC, and ethical and legal keeping of a lab notebook.

Grant Funding and Fellowships

Fellowships

Ruth L. Kirschstein National Research Service Award (NRSA) Individual Predoctoral Fellowship (Parent F31) 2023 – 2026

National institute of Allergy and infectious Disease F31AI176728

Title: Investigating the Formation and Function of Subgenomic Flavivirus RNAs During Flavivirus Infection of the Mosquito Vector

Role: PI: Graduate trainee

Molecular Pathogenesis of Infectious Diseases T32 2022 – 2023

National institute of Allergy and infectious Disease T32AI052066

Role: Appointed graduate trainee

MSU Denver Undergraduate Research Mini-grant 2019 – 2020

Metropolitan State University of Denver

Title: Identifying how DCC regulates translation by binding to the ribosome

Role: Undergraduate trainee

Contributions to Funded Research Grants

Mechanisms of viral RNA maturation by co-opting cellular exonucleases (NIH R01AI133348)

National Institute of Allergy and infectious Disease; \$2,246,946 total (2022-2027)

June 2017 – May 2027. PI: Dr. Jeffrey Kieft

University of Colorado Anschutz Medical Campus and New York Structural Biology Center

Role: I designed experiments, collected and analyzed data that were part of the preliminary data for the renewal of this grant, then continued as a key researcher, resulted in a first-author paper.

Structure, function, and dynamics of viral RNAs and RNA-containing complexes (5R35GM118070); renewal application for 2027-2032

National Institute of General Medical Sciences; \$3,489,788 total (2001-2026)

August 2016 – July 2026. PI: Dr. Jeffrey Kieft

University of Colorado Anschutz Medical Campus and New York Structural Biology Center

Role: I designed experiments, provided key preliminary data and analysis for initiation of a new research area/project described in grant renewal. The grant scored well and is expected to be funded.

Publications and Presentations

Peer-reviewed Publications

Paukovich N, **Spear EA**, MacFadden A, Nowling NN, Henen MA, Vogeli B, Filbin ME. 2025. Intrinsically disordered cytoplasmic tail in netrin receptor DCC binds the large ribosomal subunit to inhibit translation. *J Biol Chem* 301:110741.

Submitted manuscripts

Spear E, O'Donoghue Z, Bonilla SL, Larsen KP, Sherlock ME, Kieft JS. 2026. A structural bridge between dengue virus tandem xrRNAs facilitates coordination of exonuclease resistance. *bioRxiv* doi:10.64898/2026.03.04.709395. (Recently accepted at *MBio*)

Manuscript in preparation

Spear E, Gamez P, Sherlock ME, Kieft JS, Clambey ET and van Dyk LF. Structural and functional impact of tRNA elements of viral ncRNAs on RNA processing and virulence.

Oral Presentations

"The structural basis for coordination between tandem exonuclease resistant RNAs (xrRNAs) in dengue virus." American Society for Virology, Montreal Convention Centre, Montreal CA, July 2025

"Understanding the structure/function relationship of viral non-coding RNA." RNA Bioscience Initiative Summer Presentation, University of Colorado Anschutz Medical Campus, Aurora CO, July 2024

"Understanding the molecular interactions of viral non-coding RNAs during viral infection." MSU Denver Chemistry and Biochemistry Seminar Series, MSU Denver, Denver CO, March 2024

"The viral tRNA-miRNA encoded RNAs: 1) Distinct roles in pathogenesis, and 2) Investigating the role of tRNA mimicry." RNA Bioscience Initiative Chalk Talk, University of Colorado Anschutz Medical Campus, Aurora CO, January 2024

"Communication Between Dengue Virus Tandem xrRNAs Facilitates Specific sfRNA Accumulation Important for Viral Infection." Hepacivirus and Flavivirus Meeting, Rydal Hall, Ambleside UK, May 2023

Poster Presentations

"The structural basis for coordination between tandem exonuclease resistant RNAs (xrRNAs) in dengue virus." Molecular Pathogenesis of Infectious Disease (MPID) Symposium, University of Colorado Anschutz Medical Campus, Aurora CO, October 2025

"Determining the importance of RNaseZ Processing of tRNA-like structures in MHV68 infection." MPID Symposium, University of Colorado Anschutz Medical Campus, Aurora CO, October 2024

"Unveiling tRNA-like mimicry used in MHV68 gammaherpesvirus infection." 2024 Rocky Mountain RNA Symposium, University of Colorado Anschutz Medical Campus, Aurora CO, April 2024

“Dissecting inter-domain communication within flavivirus RNAs that regulate subgenomic flavivirus RNA formation.” RNA Society Meeting, University of Colorado Boulder, Boulder CO, June 2022

“Deleted in Colorectal Cancer Inhibits Protein Synthesis, But How?” Metropolitan State University of Denver Undergraduate Research Conference, Metropolitan State University of Denver, Denver CO, April 2020.

“Functional Analysis of Predicted CTCF Sites in the VZV Genome.” American Society for Microbiology Rocky Mountain Branch, University of Colorado Anschutz Medical Campus, Aurora CO, May 2019.

“Methods Used to Investigate the Varicella Zoster Virus Life Cycle.” Metropolitan State University of Denver Undergraduate Research Conference, Metropolitan State University of Denver, Denver CO, April 2019.

“Investigations of Paused RNA Polymerase II in VZV Infected Cells.” American Society for Microbiology Rocky Mountain Branch, Colorado State University, Fort Collins CO, November 2018.

Teaching and Mentoring

RNA Bioscience Initiative Summer Mentor

May 2024-August 2024

- Co-taught the program bootcamp to get students ready to do research over the summer.
- Assisted mentee in designing a testable hypothesis and experiments that could test that hypothesis. Trained mentee to use lab equipment, sterile technique for cell culture work, and RNA biology. Helped write initial and final project documents detailing protocols and results performed over the summer. Oversaw maintenance of my mentee’s lab notebook. Attended final presentations.
- Contributed to letters of recommendation and interview preparation for mentee graduate applications; mentee now PhD student in RNA Biology at University of Houston

Mad Science of Colorado

October 2023-December 2024

- Traveled to Jefferson County elementary schools and taught science workshops to K-5th grade level students. Encouraged students to question how the world around them works and to test their theories with science by providing instructional take home experiments.

CURE Mentor; Metropolitan State University

August 2023-May 2024

- Attended lectures and lab hours to help students grasp the concepts for the experiments they were setting up. Assisted in designing well thought out mutations of viral RNA for the students to test throughout the semester. Reviewed lab notebooks to help students keep careful notes of their experiments. Attended final presentations.
- Mentored one to two students individually by providing an hour each week to meet with them and discuss their research project and career goals.

Think Like a Scientist Volunteer; Paris Elementary School

March 2022-May 2022

- Facilitated hands on learning on the fundamentals of the scientific method. Built confidence in students that anyone can become a scientist.

Learning Assistant; Fayetteville State University

August 2017-December 2017

- Tutored general chemistry students following lecture. Assisted instructor in grading student materials. Maintained an additional 5 hours a week dedicated to tutoring hours.
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Professional Development and Service

Annual STEM Poster Day at the Capitol event for Project Bridge Colorado (2025)

- Coordinated with the Colorado State Capitol to pick a date and time for the event. Reviewed abstracts for the event to select presenters. Reviewed poster drafts and provided comments to presenters to make sure all posters were jargon free. Advertised the event to Colorado legislators, fellow scientists, and the general public. Met with our host senator State Senator Dafna Michaelson and was introduced on the senate floor to encourage legislator participation.

Science Policy Coordinator for Project Bridge Colorado (2024-2025)

- Host and organize events that facilitate science communication with legislators and the public in a jargon free manner. Write for grant funding to fund events and Project Bridge Colorado expenses. (I was awarded the ResearchAmerica grant for 2025 to help fund our annual STEM Poster Day at the Capitol event.)

Student representative on the Microbiology Graduate Program admissions committee (2023-2024)

- Read applications and ranked them based on the provided rubric. Attended discussion session to pick top candidates to invite for interviews. Participated during the interview weekend to determine student's interest in the program and provide feedback to the admissions committee faculty.

Co-organizer MPID T32 Trainee Symposium-Infectious Disease Models: Utility and Limitations (2023)

- Invited guest speakers to the event. Procured necessary bookings for the event (location, food and beverage, and poster presentation equipment). Ensured the event was well advertised to the university by coordinating emails to be sent out and hanging up flyers across campus.

Honors and Awards

MPID Symposium 3 rd Place Poster Award	2025
Dwain Hagerman (Biochemistry and Molecular Genetics) Travel Award	2025
C. Werner and Kitty Hirs Graduate Student Enrichment Fund Travel Award	2025
RNA Society 2022 Poster Award	2022
Dwain Hagerman (Biochemistry and Molecular Genetics) Travel Award	2022
3rd Place for Undergraduate Research Poster, Spring ASM Meeting	2019
Chancellor's List, Fayetteville State University	2016-2017