MARY CATHERINE ADAMS

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EDUCATION

Georgia Institute of Technology *Atlanta, GA*
Ph.D. in Materials Science and Engineering **May 2025**
Dissertation: "Competitive Binding of Synthetic Oligonucleotides"
B.S. in Materials Science and Engineering **May 2016**
B.S. in Biomedical Engineering **May 2016**

RESEARCH PROJECTS

Illumina sequencing of low diversity amplicon libraries

- Optimized the Next Generation Sequencing (NGS) sample preparation of low diversity DNA libraries used in aptamer screening experiments
- Conducted NGS data analysis to maximize sequencing data yield and identify sequencing artifacts on the Illumina MiSeq platform

Aptamer screening platform using a barcoded library

- Developed a series of ten random DNA libraries with identifiable "barcodes" and optimized library preparation through droplet digital polymerase chain reaction (ddPCR) and enzymatic digests
- Conducted DNA aptamer screening experiments against graphene and the IgG F_c protein using the barcoded libraries to gain insight into the multicyclic aptamer selection process

Nucleic acid detection platform

- Developed a rapid (15-min) PCR-free flow cytometry-based detection of unlabeled, specific nucleic acid sequences using double-stranded probes with fluorophore/quencher functionalities
- Optimized an efficient screening protocol to identify thermally stable, yet highly responsive double-stranded probe candidates for specific, label-free RNA and DNA sequence detection.

RESEARCH EXPERIENCE

Milam Research Group at Georgia Institute of Technology *Atlanta, GA*
PI: Prof. Valeria Milam
Graduate Research Assistant **May 2018 – May 2025**

- Trained and managed six undergraduate researchers and two new graduate researchers
- Developed standardized experimental protocols for DNA aptamer screening, PCR, electrophoresis, and other molecular biology techniques
- Maintained laboratory inventory and purchased supplies and equipment

Post-Baccalaureate Research Assistant **August 2016 – May 2018**

- Developed protocol for aptamer selection against mesenchymal stem cells

Undergraduate Research Assistant **January 2016 – May 2016**

- Developed computational analysis tools for motif identification from a pool of nucleic acid sequences
- Assisted graduate researcher, Dr. Richard Sullivan, in performing aptamer experiments

Air Force Research Laboratory at Wright-Patterson Air Force Base *Dayton, OH*
PI: Dr. Patrick Dennis
Graduate Student Internship funded by NSF **September 2022 – December 2022**

- Screened for DNA aptamers using library of ~10^{12} random DNA sequences against graphene targets in collaboration with researchers at the Materials and Manufacturing Directorate
- Identified ~10^5 aptamer candidates using NGS analysis of target-binding sequence pool

Computational Nanobiotechnology Lab at Georgia Institute of Technology *Atlanta, GA*
PI: Prof. Seung-Soon Jang
Undergraduate Research Assistant **May 2014 – December 2015**

- Designed and ran computational simulations to investigate interaction between nucleobases and graphene
- Modeled systems using Density Functional Theory (DFT) and Molecular Dynamics (MD)
- Led a team of four other undergraduate researchers

PROFESSIONAL EXPERIENCE

East Cobb Tutoring Center *Marietta, GA*
Private Tutor **August 2025 – Present**

- Conduct one-on-one tutoring sessions with middle school, high school, and college students in Math, Physics, and Biology

School of Materials Science and Engineering at Georgia Institute of Technology *Atlanta, GA*
Graduate Teaching Assistant **August 2019 – May 2022**

- Grader for Introduction to Materials Science and Engineering (core engineering course), Biomaterials (senior-level engineering technical elective) and Transport Phenomena (junior-level engineering course)
- Guest lecturer for Biomaterials (senior-level engineering technical elective)
- Writing and communications TA for Materials Science and Engineering Senior Design (senior-level course for MSE majors)

Georgia Tech Aquatic Center *Atlanta, GA*
Student Operations Manager **September 2015 – September 2016**

- Maintained the schedule for more than eighty lifeguards and supervisors
- Planned and led staff meetings and lifeguard certification courses

Lifeguard Supervisor and Instructor **January 2014 – March 2017**

- Managed three pools and events held at the aquatic center
- Trained new lifeguards in water skills and first aid techniques

PATENTS

V.T. Milam and **M.C. Adams**, "Detection platform for unlabeled oligonucleotides," US Patent Application 18/707,940 Filed May 7, 2024.

W.J. Ready, **M.C. Adams**, et al., "Method of disinfecting ports in central venous catheter systems," Patent US10166085B2, 2019.

JOURNAL PUBLICATIONS

In preparation: **M.C. Adams**, N. Djeddar, S. Ochoa, A. Bryksin, V.T. Milam, "Aptamer screening library sequencing artifacts on the Illumina MiSeq platform," **2025**

M.C. Adams, V.T. Milam, "Uncovering molecular quencher effects on FRET phenomena in microsphere-immobilized probe systems," *Analytical Chemistry*, **2023** (DOI: 10.1021/acs.analchem.3c01064) (***Supplementary Cover Art featured online by Analytical Chemistry***)

R.S. Sullivan, **M.C. Adams**, R. Naik, V.T. Milam, "Analyzing secondary structure patterns in DNA aptamers identified via CompELS," *Molecules*, **2019** 24 (8) 1572 (DOI: 10.3390/molecules24081572) (*Invited original research article included in a special issue in Molecules entitled "Oligonucleotides Application to Nano- and Biotechnology (DNA Origami, DNA Machine)*")

CONFERENCE AND SYMPOSIUM PRESENTATIONS

**Presenter noted with an asterisk*

V.T. Milam*, **M.C. Adams**, S. Ochoa, "Moving beyond 'black box' DNA aptamer screening approaches using barcoded libraries," 2024 Fall MRS Meeting, Boston, MA (December 2024)

V.T. Milam*, **M.C. Adams**, "Shining a light in the black box of aptamer screening using barcoded libraries," Australasian Colloid and Interface Society, Terrigal, Australia (February 2024) *V.T.M. was a keynote speaker*

V.T. Milam*, **M.C. Adams**, "Surprising long-range quenching effects between double-stranded probes immobilized on microspheres," 7th International Conference on Nucleic Acids & CRISPR: Research and Therapeutics, Virtual conference for all attendees (September 15, 2023) *V.T.M. was a plenary speaker*

M.C. Adams, V.T. Milam*, "Short and long-range FRET phenomena in microsphere-immobilized probes" 97th American Chemical Society Colloid & Surface Science Symposium, Raleigh, NC (June 2023)

V.T. Milam*, M. Tapp, **M.C. Adams**, P. Dennis, R. Naik, "DNA aptamers for material targets," 2022 Southeastern Regional American Chemical Society (SERMACS), San Juan, PR (October 2022)

V.T. Milam*, **M.C. Adams**, "Identifying stable, yet selective double-stranded probes for unlabeled RNA targets," 2022 Southeastern Regional American Chemical Society (SERMACS), San Juan, PR (October 2022)

V.T. Milam*, M. Tapp, **M.C. Adams**, P. Dennis, R. Naik, "Finding and analyzing DNA aptamers for gold nanospheres targets," 96th American Chemical Society Colloid & Surface Science Symposium, Golden, CO (July 2022)

V.T. Milam*, **M.C. Adams**, "Detecting label-free SARS CoV-2 using high throughput analysis of colloidal suspensions," 96th American Chemical Society Colloid & Surface Science Symposium, Golden, CO (July 2022)

M.C. Adams*, V.T. Milam, "Flow cytometry-based nucleic acid detection platform," Spring 2022 American Chemical Society, San Diego, CA (March 2022)

V.T. Milam*, M. Tapp, **M.C. Adams**, P. Dennis, R. Naik, "Expanding a non-evolutionary aptamer screening approach to gold nanoparticle targets," Spring 2022 American Chemical Society, San Diego, CA (March 2022)

M.C. Adams*, V.T. Milam, "Exploration of flow-cytometry-based detection of label-free RNA," poster presentation at 2021 Southeastern Regional American Chemical Society (SERMACS), Birmingham, AL (November 2021)

S. Ochoa*, **M.C. Adams**, A. Saad-Falcon, D. Hufnagel, V.T. Milam, "Competition-enhanced aptamer selection against a chiral ligand," poster presentation at 2021 Southeastern Regional American Chemical Society (SERMACS), Birmingham, AL (November 2021)

M.C. Adams*, V.T. Milam, "Structural Comparison of Gold-Binding DNA Aptamer Candidates," 12th Annual Southeast Soft Matter Symposium, Atlanta, GA (August 2020)

M.C. Adams*, R.S. Sullivan, M. Tapp, R.R. Naik, V.T. Milam, 93rd American Chemical Society Colloid & Surface Science Symposium, "Comparative analysis of DNA aptamers identified via CompELS," Atlanta, GA (June 2019)

V.T. Milam*, R.S. Sullivan, **M.C. Adams**, R. Naik, American Chemical Society National Meeting, "Finding Secondary Structure Motifs Among DNA Aptamers Selected via CompELS Screening," Orlando, FL (April 2019)

V.T. Milam*, R.S. Sullivan, **M.C. Adams**, P. Dennis, R. Naik, 92nd American Chemical Society Colloid & Surface Science Symposium, "Developing potential designer rules for aptamer libraries," State College, PA (June 2018)

V.T. Milam*, R.S. Sullivan, **M.C. Adams**, P. Dennis, R. Naik, 91st American Chemical Society Colloid & Surface Science Symposium, "Identifying secondary structure patterns among gold nanorod aptamers selected via CompELS screening," New York, NY (July 2017)

TECHNICAL PROFICIENCIES

Nucleic acid handling and purification
PCR, ddPCR, PCR optimization, and primer design
Electrophoresis, electrophoretic mobility shift assays
NGS library preparation and sequencing analysis
Mammalian and bacterial cell handling
Plasmid cloning and bacterial expression
Protein handling and purification
Flow cytometry and FACS
Confocal microscopy
MATLAB
Experimental design
Maintaining detailed experimental records

LEADERSHIP AND AWARDS

GAANN Fellowship **January 2022 – August 2023**

FLAMEL NSF Training Fellowship **August 2018 – August 2019**

Student Government Association **August 2013 – May 2019**

- Allocated a budget of over $5 million to chartered student organizations
- Authored bills for student organizations to receive funds from the Student Activity Fee

Winner, Best Overall Capstone Design Project **May 2016**

- Designed and produced a device for the disinfection of central line port

Girl Scout Gold Award **August 2012**