

Education

Duke University , Durham, NC Doctor of Philosophy, Chemistry Cumulative GPA 3.8/4.0	2015-2022
Texas Woman’s University , Denton, TX Bachelor of Science, <i>Summa Cum Laude</i> , Chemistry with ACS Certification Cumulative GPA 4.0/4.0	2010-2015
Chandler-Gilbert Community College , Chandler, AZ Cumulative GPA 4.0/4.0	2007-2010

Research Experience

Howard Hughes Medical Institute Janelia Research Campus, Ashburn VA

Advisor: Hari Shroff, Ph.D.

Overview:

- Developed microscopes from empty optical table for rapid and robust adaptive optics (*in progress*)

Duke University, Durham, NC

Advisor: Prof. Kevin D. Welsher, Ph.D.

Overview:

- Developed microscopes from empty optical table
- Spearheaded development for automation of all acquisition, processing, and visualization.
- Mentored 2 undergraduate students.
- Led a 4-person team on the 3D-TrIm project consisting of myself, a postdoctoral scholar, junior graduate student, and undergraduate student.

Project 1: 3D-FASTR – Rapid Point-Scan Volumetric Microscopy

Aims:

- Develop new microscope capable of rapid volumetric imaging a moving sample

Results:

- Conceived theory of volumetric point-scan using tessellating pattern
- Developed 3D-FASTR volumetric two-photon laser-scanning microscope
- Performs 3D point-scan imaging 4-8x faster vs. conventional z-stack

Importance:

- Generalizable theory for multi-dimensional scanning using tessellating pattern
- Ideal platform to integrate with active-feedback tracking systems

Project 2: 3D-TrIm – Simultaneous Single-Virus Tracking and 3D Imaging

Aims:

- Develop new microscope capable of single virus tracking with simultaneous 3D imaging of surrounding environment.

Results:

- Developed 3D-TrIm microscope which generates volume spaces with co-registered single particle trajectories and 3D cellular imaging

Importance:

- First Observation of virus “skimming” behavior
- Discovered distinct diffusional modes on actin-rich protrusions
- Extension of virus tracking to live tissue systems demonstrated using multi-layer epithelial cells.

Texas Woman’s University, Denton, TX

Advisor: Prof. Richard D. Sheardy, Ph.D.

Studied structure and physical properties of i-motif DNA conformation using spectroscopic and calorimetric instrumental methods to evaluate sequence context of conformation physical and chemical properties.

Skills

Optical Microscopy – Design, Calibration and Operation

- Multi-Photon Fluorescence microscopes
- Active-feedback single particle tracking microscopes
- Dynamic focusing using tunable lenses
- Multi-Modal Correlative Imaging

Software Development

- Labview VI development for microscope control using FPGA interface and automation of calibration and acquisition routines.
- MATLAB data analysis, image processing and automated script generation.
- TCL programming for Amira-Avizo 3D visualization automation.

Multimedia Production

- Adobe Suite (Photoshop, Illustrator, Premiere, InDesign and Media Encoder)

Computers - Certified IT Professional

- Design, build, upgrade, maintain, troubleshoot, and repair instrument and computational PCs.
- Networking and remote operation of lab PCs.
- Design and maintenance of NAS for Data Storage and External drives for Data Archival.
- Save time by reducing reliance on external IT department.

3D Visualization

- Amira-Avizo 3D Direct volume rendering including generation of compatible binary/ASCII data files and automated TCL script generation.

Publications

Capturing the start point of the virus-cell interaction with high-speed 3D single-virus tracking 2022

Courtney Johnson, Jack Exell, Jonathan Aguilar, and Kevin Welsher

Nature Methods **2022**, 19, 1642–1652

DOI: [10.1038/s41592-022-01672-3](https://doi.org/10.1038/s41592-022-01672-3)

Continuous Focal Translation Enhances Rate of Volumetric Imaging 2019

Courtney Johnson, Jack Exell, Jonathon Kuo, and Kevin Welsher

Opt. Express **2019** 27, 36241–36258

DOI: [10.1364/OE.27.036241](https://doi.org/10.1364/OE.27.036241)

Real-Time 3D Single Particle Tracking: Towards Active Feedback Single Molecule Spectroscopy in Live Cells 2019

Shangguo Hou, Courtney Johnson, and Kevin Welsher

Point-Scan Volumetric Imaging Rate Increased by an Optimized Linear Sparse Sampling Pattern 2019

Courtney Johnson and Kevin Welsher

Frontiers in Optics + Laser Science APS/DLS 2019 OSA Technical Digest (Optical Society of America), paper JTU4A.101.

DOI: [10.1364/FIO.2019.JTU4A.101](https://doi.org/10.1364/FIO.2019.JTU4A.101)

Loop Sequence Context Influences the Formation and Stability of the i-Motif for DNA Oligomers of Sequence (CCCXX)₄, where X = A and/or T, under Slightly Acidic Conditions 2016

Mikeal McKim, Alexander Buxton, Courtney Johnson, Amanda Metz, and Richard D. Sheardy
The Journal of Physical Chemistry B **2016** *120* (31), 7652-7661

DOI: [10.1021/acs.jpccb.6b04561](https://doi.org/10.1021/acs.jpccb.6b04561)

Sequence Context Effects in a DNA i-Motif: Analysis of Structure and Stability 2015

Courtney Johnson and Richard D. Sheardy
(Senior Thesis)

Presentations

- Invited Speaker** – SERMACS 2023 (Single-molecule Dynamics in Complex Chemical and Biological System Symposium) Oct. 2023
- Selected Speaker** – Janelia Symposium 2023 Jan. 2023
- Janelia/EMBL Optical Interest Group Jan. 2023
- [*High-Speed 3D Tracking and Imaging Microscopy Captures Early Events of the Virus-Cell Interaction*](#)
- Invited Speaker/Panelist** – TWU Celebration of Women in Science Oct. 2022
- Invited Speaker** – TWU Jane Nelson Institute for Women's Leadership May 2022
- Invited Speaker** – Southeast Biophysics Consortium Meeting May 2022
- Selected Speaker** – Fitzpatrick Institute of Photonics Seminar Series Mar. 2022
- SPIE Photonics West (Poster) Jan. 2022
- Just Another (Chemistry) Webinar series (www.JAWSchem.com) Nov. 2021
- [*"Multi-Scale 3D Visualization of the Cellular Landscape through Single-Virus Tracking"*](#)
- Duke Chemistry Research Symposium (Talk) Sep. 2021
- 1st Prize Poster** – Fitzpatrick Institute of Photonics Annual Meeting May 2021
- [*"Real-Time 3D Tracking and Imaging Microscopy"*](#)
- Invited Speaker** - 65th Annual Meeting of the Biophysical Society (Nanoscale Approaches to Biology Subgroup Symposium) Feb. 2021
- [*"Synchronous 3D Tracking and Imaging at Multiple Scales to Overcome Spatiotemporal Disparity"*](#)
- 65th Annual Meeting of the Biophysical Society (Poster) Feb. 2021
- Fitzpatrick Institute of Photonics Annual Meeting (Poster) Mar. 2020
- Invited Speaker** – 259th ACS National Meeting (ACS Award for Encouraging Women into Careers in the Chemical Sciences: Symposium in honor of Katherine Franz) Mar. 2020
- Duke Chemistry Research Symposium (Poster) Oct. 2019
- ALIS Kickoff and Southeast Ultrafast Laser Conference Oct. 2019
- Frontiers in Optics + Laser Science (Lighting Talk + Poster) Sep. 2019
- Duke Chemistry Research Symposium (Talk) Oct. 2018
- Fitzpatrick Institute of Photonics Annual Meeting (Poster) Mar. 2018
- Invited Speaker** – STEM Education in Mississippi: Issues and Innovations Oct. 2017
- Invited Speaker/Panelist** – TWU Celebration of Women in Science Oct. 2016

Duke Chemistry Research Symposium (Poster)	Oct. 2016
247th ACS National Meeting (Poster)	Mar. 2014
Workshop Facilitator	Dec. 2014
<i>Designing a SENCER Course (UT San Antonio)</i>	
Commendation of Excellence – National Society for Experiential Education 43rd Annual Conference (Poster)	Oct. 2014
TWU Quality Enhancement Program Experiential Scholar Program (Talk)	Apt. 2014

Grants and Scholarships

Joe Taylor Adams Fellowship (Duke Chemistry Department)	Fall 2021
Marcus Hobbs Fellowship (Duke Chemistry Department)	Spring 2020
TWU S-STEM QuaSARS Program - Full Scholarship (Tuition, Fees, Textbooks)	2013-2015
Robert A. Welch Foundation Grant for Undergraduate Research in Chemistry	SU 2013, 2014
Helen Ludeman Scholarship (TWU Chemistry Department)	AY 2012, 2014
TWU Quality Enhancement Plan Experiential Student Scholar Award to develop a laboratory exercise for a freshman chemistry course.	SU 2014
TWU Undergraduate Research Microgrant Program Award	Spring 2015

Awards and Honors

1 st Prize Student Speaker for Fitzpatrick Institute of Photonics Seminar Series	2022
1st Prize Poster at Fitzpatrick Institute of Photonics Annual Meeting 2021	2021
TWU Chancellor's Student Research Scholar Award for outstanding achievement in research.	2015
Commendation of Excellence for poster presentation "Practice Makes Perfect Proficient: Reflections on the Impact of Experiential Learning" (from the National Society for Experiential Education)	2014
TWU Chancellor's List for achieving 4.0 GPA with full-time student status	2010-2015
Nominated to membership in the Honor Society of Phi Kappa Phi	2014

Professional Development Activities

Duke Senior Leadership Insights Interviewer Selected by the assistant dean to interview a senior executive for a professional development seminar featured on the main Duke Youtube page .	Oct. 2021
Nationally competitive University of Michigan NextProf Science Workshop Workshop for promising future faculty candidates.	May 2021
Duke Preparing Future Faculty Program Prepared and delivered guest lecture for Analytical Chemistry at NCCU	AY 2020
"Unity in Diversity – Leading Through a Crisis" Published blog post, Duke Professional Development Blog	August 2020
Duke Emerging Leaders Institute Program Competitive application process selects only 20 total postdocs and grad students campus-wide to study leadership, culminating in a team project.	Spring 2020
"Letting Go, and Other Lessons from the Mat" Published blog post, Duke Professional Development Blog	July 2019

Teaching Experience

Duke University <i>Graduate Teaching Assistant</i> CHEM 210 – Modern Applications of Chemistry Laboratory CHEM 202 – Organic Chemistry II Laboratory CHEM 110 – Core Concepts in Chemistry Discussion	2015-2019
<i>Grader</i> CHEM 201 – Organic Chemistry I Lecture	2015-2016
<i>Tutor</i>	2016-2019

CHEM 101 – General Chemistry, Duke Athletics Tutor Program. Designed individualized program of instruction for 20+ student-athletes. Developed and taught 8-week summer preparation course for a small group of athletes taking CHEM101 in the fall.

Texas Woman's University

<i>Undergraduate Teaching Assistant</i>	2012- 2015
CHEM 1011 – Introduction to Chemistry Laboratory	
CHEM 1111 – General Chemistry I Laboratory	
CHEM 1121 – General Chemistry II Laboratory	
<i>Grader</i>	2012, 2014
CHEM 1013 – Introduction to Chemistry Lecture	

Service and Outreach Activities

Science Beyond the Bench	Spring 2023
Gave a talk at Science National Honor Society meeting at Broad Run High School	
Regeneron Science Talent Search	Spring 2023
Gave a talk to finalists of the Regeneron Science Talent Search during their tour of Janelia.	
Duke Women in Science and Engineering (WiSE)	Fall 2020
Invited to plan and organize women's self-defense programming	
Duke Brazilian Jiu-Jitsu Club	2019-Present
Elected Safety Officer	
Ensure safe behavior and assist with first aid for injuries of athletes	
Duke Graduate Chemistry Council	2016-2018
Elected Media Coordinator	
Promoted GCC activities and outreach events through social media and photographed events.	
Kappa Epsilon Mu "KEM Club"	2014
Presented Chemistry Magic Shows at Events	
Assisted in Preparation of Chemical Reagents for Magic Shows.	

Professional Certifications

CompTIA A+ Certified IT Professional	2006
Certified to build, troubleshoot and repair Windows-based PCs.	
Certificate verification ID: N959CCKC6KQE5WRM	

Professional Society Memberships

American Chemical Society
Optical Society of America
American Physical Society
Biophysical Society
SPIE