

## Christopher A.L. Sharpe

Postdoctoral Research Associate, NUANCE BioCryo & EPIC-FIB

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### PhD, Materials Science & Engineering - Gianneschi Group, Northwestern University

"Unraveling the Web of Challenges Around Understanding How Black Widow Spiders Spin Silk"

Using a combination of cryogenic structural biology and scattering techniques, and exploiting spider silk's previously unknown cryoprotective properties, I developed protocols and workflows for HPF of very thick samples, cryo-WAXS, and sectioning to enable *in situ* characterization of dragline silk proteins prior to spinning; these findings directly support the micellar silk protein hypothesis, and have informed novel approaches to high-efficiency whole-tissue characterization.

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### EDUCATION

#### Materials Science & Engineering PhD

Northwestern University, Sept. 2018-Feb. 2025

Biomaterials & Electron Microscopy Focus

Cumulative Course GPA: 3.758

#### Management for Scientists & Engineers

Kellogg School of Management at Northwestern University, June-August 2023

#### Bachelor of the Arts

Grinnell College, Aug. 2014-May 2018

Chemistry Major with Honors (3.929 GPA)

Physics Major with Honors (3.845 GPA)

Environmental Studies Concentration

#### Skills & Careers in Science Writing

Northwestern University Medill School of Journalism, Sept.-Nov. 2021

#### Microfluidics Technology MRSEC Course

Brandeis University MRSEC, June 2019

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### HONORS & AWARDS

#### 2020/2021 Northwestern PPG Fellowship

Conference travel award; Awarded Dec. 4, 2020

#### ACS Undergraduate Award in

#### Analytical Chemistry for Grinnell College

Awarded May 3rd, 2017

#### Phi Beta Kappa Honor Society, Beta of Iowa Chapter

Recognition for breadth, depth, & excellence of academic work. Inducted May 3, 2018

#### Best Poster, ORISE Summer Student Poster Session (10-11am Session)

Oak Ridge National Laboratory Poster Session, Awarded August 11, 2017

#### Four-Time Academic All-Conference

Grinnell Swimming & Diving, 2015-2018

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### RESEARCH EXPERIENCE

#### Graduate Research Assistant

Northwestern University, Gianneschi Group

Sept. 2018-March 2025

Ultrastructure & cryo-TEM imaging of spider silk glands, & synchrotron x-ray scattering of biomaterials.

#### Student Undergraduate

#### Laboratory Intern

Oak Ridge National Lab, June-Aug. 2017

Solid-state synthesis, flame spray pyrolysis, XRD, & cathodoluminescence at Applied Technologies Group, Chemical Sciences Division

#### Senior Seminar Thesis Project

Grinnell College Environmental Studies

Senior Seminar, Aug.-Dec. 2017

Conducted a life cycle analysis of Grinnell College's Dining Hall to estimate its embedded resource footprint.

#### Student Researcher

Grinnell College Chemistry Department,

May 2015-Aug. 2016

Synthesis & characterization of thin film metal oxides for oxygen reduction & evolution and photocatalysis.

## LEADERSHIP

### **Guest Lecturer for Graduate Organic Nanomaterials Course**

*Northwestern University, Oct. 3, 5, & 10, 2023*  
Co-prepared 3 lectures on light, x-ray, & neutron scattering with 2 grad students. Delivered the 3rd lecture on Advanced Scattering Methods.

### **Scientific Consultant**

*Northwestern University, Sept. 2021-June 2022*  
Advised Acorn Genetics startup on microfluidic & separations devices for gene sequencing.

### **TA for Graduate Organic Nanomaterials**

*Northwestern University, Fall 2020 & 2021*  
Conducted TA sessions, reviewed proposals, helped write final exams, & graded homework.

### **Team Lead for Success & Inclusivity in the Department, MSE DEI Proposal**

*Northwestern MSE Dept., June-Aug. 2020*  
Led on-campus actions portion of MSE graduate students' proposal to improve DEI in Materials Science. My team proposed 7 action items: 4 were implemented, the other 3 are in progress.

### **Outreach Co-Chair**

*Northwestern Materials Science Student Association, June 2019-July 2020*  
Organized department outreach activities (Letters to a Pre-Scientist, Junior Science Club, & department coin & toy drives); helped plan Visit Weekends & other MSSA events.

### **Water Polo Team Captain**

*Grinnell College, August-December 2017*  
Organized team practices, rosters, gear, tournament travel, and hosting a tournament.

### **Peer Mentor & Tutor**

*Grinnell College Chemistry & Math Departments, Aug. 2014-May 2018*  
Mentored Organic Chemistry II, General Chemistry, & Environmental Chemistry lab for 1 semester each. Worked as drop-in Calculus I & II tutor and 1-to-1 tutored for 1-2 semesters each for Physics I, Physics II, General Chemistry, and Analytical & Inorganic Chemistry students.

## SERVICE & COMMUNITY

### **STEM Professional Pen Pal**

*Letters to a Pre-Scientist, August 2019-Present*  
Exchange 4 letters/year with 5th-10th grade STEM-underrepresented pen pal to demystify STEM, college, and overcoming obstacles.

### **Student Member, MSE Graduate Admissions Committee**

*Northwestern MSE Dept., Dec. 2021-Jan. 2022*  
As student representative, suggested clarifying admissions rubric in several areas & pushed to recognize social justice activities as equivalent to athletic and volunteering extracurriculars.

### **Visit Weekend Planning Committee**

*Northwestern MSE Department 2019, 2020, & 2021*  
Helped organize and carry out 2-3 admitted grad student visit weekends. In 2019-2020, pushed for streamlined flight booking by the department travel agent to make visit weekends more accessible to less affluent admitted students while decreasing department staff workload.

### **Junior Science Club Volunteer**

*Pedersen-McCormick Boys & Girls Club, Sept. 2018-Jan. 2020*  
Led elementary school-aged children in science-related activities like marshmallow tower construction, oobleck and slime making, and mini hovercrafts. Coordinated other graduate students in planning and leading these activities.

### **Admitted Graduate Student Visit Weekend Volunteer**

*March & April 2019, 2020, 2021, 2022, & 2023*  
Helped with a variety of visit weekend activities.

### **Admitted Students Phone Bank**

*2x per year, 2019-2023*  
Welcomed admitted students to Northwestern MSE and answered any initial questions.

### **Hosting Department Coffee Hour**

*Once per academic quarter, 2019-Present*  
Make & purchase snacks for ~80 coffee hour attendees with other Gianneschi MSE students.

## PUBLICATIONS

*Exploration of Micellar Silk Protein Structure in Black Widow Major Ampullate Silk Glands via Ultrastructure Transmission Electron Microscopy.* **Sharpe, C.**; Altunc, A.; Wilke, C.; Gnanasekaran, K.; Rix, J.; Weigand, S.; Keane, D.T.; Bleher, R.; Shapakidze, L.; Johnson, H.; Onofrei, D.; Burkart, M.; Holland, G.P.; Gianneschi, N.C. *In Prep.*

*Conformational modulation and polymerization-induced folding of proteomimetic peptide brush polymers.* Oktawiec, J.; Ebrahim, O.M.; Chen, Y.; Su, K.; **Sharpe, C.**; Rosenmann, N.D.; Barbut, C.; Weigand, S.J.; Thompson, M.P.; Byrnes, J.; Qiao, B.; Gianneschi, N.C. *Chem. Sci.*, **2024**, DOI: 10.1039/d4sc03420a.

*Biomimetic pheomelanin to unravel the electronic, molecular and supramolecular structure of the natural product.* Cao, W.; Mao, H.; McCallum, N.C.; Zhou, X.; Sun, H.; **Sharpe, C.**; Korpanty, J.; Hu, Z.; Ni, Q.Z.; Burkart, M.D.; Shawkey, M.D.; Wasielewski, M.R.; Gianneschi, N.C. *Chem. Sci.*, **2023**. DOI: 10.1039/D2SC06418A.

*LaFe<sub>x</sub>Co<sub>(1-x)</sub>O<sub>3</sub> Thin Film Oxygen Reduction Catalysts Prepared using Spray-Pyrolysis without Conductive Additives.* Dervishogullari, D.; **Sharpe, C.**; Sharpe, L. *ACS Omega*, **2017**, 2 (11), 7695–7701. DOI: 10.1021/acsomega.7b01428.

## PRESENTATIONS

*”Unraveling the Web of Challenges Around Understanding How Black Widow Spiders Spin Silk”* **Sharpe, C.** *PhD Defense*, Northwestern University, Evanston, IL, February 21, 2025.  
Committee Members: Nathan C. Gianneschi, Vinayak P. Dravid, Derk Joester, Gregory P. Holland. Recording available upon request.

*”Characterization of the silk spinning process in black widow spiders”* **Sharpe, C.**; Wilke, C.; Roth, E.; Weigand, S.; Rix, J.; Bleher, R.; Keane, D.; Onofrei, D.; Johnson, H.; Forman, C.; Holland, G.; Gianneschi, N. *Colloids & Surface Chemistry, American Chemical Society Fall 2022 National Meeting (ACS Fall 2022)*, Chicago, IL, August 24, 2022. 3740050-COLL.

*”Conformational studies of brush polymers of alpha-helical, beta-hairpin, and random coil peptides”* Oktawiec, J.; Hampu, N.; **Sharpe, C.**; Weigand, S.; Thompson, M.; Gianneschi, N. *Colloids & Surface Chemistry, American Chemical Society Fall 2022 National Meeting (ACS Fall 2022)*, Chicago, IL, August 22, 2022. 3741514-COLL.

*”Using X-ray Scattering to Illuminate and Characterize Soft Matter, Including Biomimetic Polymers, Thermoresponsive Assemblies, and Proteins”* Oktawiec, J.; **Sharpe, C.**; McCallum, N.C.; Korpanty, J.; Hampu, N.; Rosenmann, N.; Ebrahim, O.E.; Weigand, S.J.; Rix, J.; Keane, D.; Gianneschi, N.C. *Northwestern Synchrotron Research Center Symposium*, Evanston, IL, September 13, 2023.

"*ORR and OER catalysts based on thin-film  $\text{La}_x\text{Sr}_{(1-x)}\text{CO}_y\text{Fe}_{1-y}\text{O}_3$  materials produced by spray pyrolysis*" Sharpe, L.R.; Dervishogullari, D.; Rebelsky, J.; **Sharpe, C.** *2022 Midwest Regional Meeting of the American Chemical Society (MWRM 2022)*, Iowa City, IA, October 20, 2022. Paper #138.

"*How to achieve long persistent mechanoluminescence*"

**Sharpe, C.**; Lekavich, C.; Smith, B.; Thompson, C. *Oak Ridge Institute for Science and Education 2017 Summer Research Participant Poster Session*. Oak Ridge National Laboratory, Tennessee, August 10, 2017.

"*Synthesis of leading perovskite oxygen reaction catalysts by spray pyrolysis: A simpler and successful technique*" **Sharpe, C.**; Sharpe, L. *American Chemical Society Spring 2017 National Meeting (ACS Spring 2017)*, San Francisco, CA, April 4, 2017.

"*Optimization and characterization of high-performance CuFeMgW oxide based semiconductors for solar photocatalysis*" **Sharpe, C.**; Sharpe, L. *American Chemical Society Spring 2016 National Meeting (ACS Spring 2016)*, March 15, 2016.

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#### SKILLS

<i>Experimental Techniques (Expert)</i>	Scanning and Transmission Electron Microscopy (SEM & TEM) Black Widow Spider Handling & Dissection Plunge & High Pressure Freezing; Cryogenic TEM (Cryo-TEM) Ultramicrotomy, Serial Sectioning, & SerialEM Section Mapping Synchrotron Beamline Operation (APS Beamline 5-ID-D) Stereolithography (SLA) 3D Printing Plasma Focused Ion Beam (Plasma FIB)
<i>Experimental Techniques (Experienced)</i>	COMSOL Multiphysics Finite Element Modeling Life Cycle Analysis Microfluidics Cyclic, Linear Sweep, & Light-Chopped Linear Sweep Voltammetry Rotating Ring Disc Electrode Voltammetry Potentiometric, pH, and Ion-Selective Electrode Titrations Spectroelectrochemistry Ultraviolet-Visible (UV-Vis), Infrared, & Raman Spectroscopy Spectrofluorimetry Flame Spray Pyrolysis Cathodoluminescence Atomic Absorption Spectroscopy Gas Chromatography-Mass Spectroscopy (GC-MS) Liquid Chromatography-Mass Spectroscopy (LC-MS) Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS) Laser Ablation Inductively Coupled Mass Spectrometry (LA-ICP-MS) High Performance Liquid Chromatography (HPLC & UHPLC) $^1\text{H}$ , $^{13}\text{C}$ , HMQC, and COSY NMR Spectroscopy Powder X-Ray Diffraction Enzyme-Linked Immunosorbent Assay (ELISA) Acid Digestion Acid and Organic Refluxes

	Organic & Solid-State Syntheses
<i>Coding</i>	MATLAB, PYTHON, L <sup>A</sup> T <sub>E</sub> X, OpenSCAD
	MATHEMATICA, VISUAL BASIC FOR APPLICATIONS
<i>Languages</i>	Spanish (4 years)
	Latin (1 year)
<i>Hobbies &amp; Fun</i>	Baking - Bread, Pies, Cakes, Cookies, & Pastries
	Brewing - Stouts, ESBs, & IPAs
	Sailing - 420, Laser, & Hobie Catamarans
	Bassoon (Including Reedmaking)
	Scientific Glassblowing