

## Curriculum Vitae

**Natasha Lynn Smith, PhD**

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Contact

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PhD Chemist with 10+ years of experience working at the intersection of physical, materials, & analytical chemistry

- ◆ Development of photonic crystal hydrogel sensors for quantitative colorimetric chem/bio sensing (10+ yrs)
  - ◆ Design & fabrication of selectively responsive polymer thin films (10+ yrs)
  - ◆ Synthesis, functionalization, & self-assembly of colloidal nanoparticles (10+ yrs)
  - ◆ Functional protein polymers for sensing & catalysis in aqueous/non-aqueous solutions (5+ yrs)
  - ◆ Protein bioconjugation & protein immobilization (5+ yrs)
  - ◆ Science communication and technical writing for publications & grant proposals (8+ yrs)
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### Education

**University of Pittsburgh, Pittsburgh, PA** (2019)

**PhD, Physical Chemistry**

Research Advisor: Distinguished Professor of Chemistry, Sanford A. Asher, PhD

Dissertation: Development of 2-Dimensional Photonic Crystal Sensors and Pure Protein Organogel Sensing and Catalytic Materials

**West Virginia University, Morgantown, WV** (2009)

**B.S. Chemistry**

Undergraduate Research Advisors: Professors George O'Doherty, PhD and Charles Jaffe, PhD

Undergraduate Thesis: Synthesis of Goniotalamin-based Derivatives and GAMESS Computations

### Professional Experience

**Roxby Development, LLC, Wheeling, WV**

**Chief Scientific Officer, Roxby Labs & Roxby Decon** (April 2021- Present)

- Opening high complexity diagnostics laboratories in areas of need
- Expanding operations and diagnostic test menu
- Hydrogen Peroxide Vapor sterilization of N95 masks; designing & implementing real-world study for Roxby & Bioquell systems for the FDA
- Project management & day-to-day operations of diagnostic lab, COVID19 testing lab, & decon lab

**Scientific Consultant** (March 2020- March 2021)

- Optimized hydrogen peroxide vapor sterilization cycle parameters for the Roxby Development's Zoe-Ann Decontamination System
- Designed & completed validation studies showing Log 6 reduction of biological burden.
- Co-authored FDA EUA application & validation reports
- Obtained Emergency Use Authorization for N95 respirator sterilization from the FDA on October, 20<sup>th</sup> 2020

**University of Pittsburgh, Department of Chemistry, Pittsburgh, PA**

**Post-Doctoral Research Associate, PI: Professor Sanford Asher** (Oct. 2019- March 2021)

- Authored grant proposal on the development of novel photonic crystal sensing motifs for virus detection
- Authored grant proposal on the development of multiplexed photonic crystal sensing devices for protein biomarkers
- Discovered the mechanisms involved in the irreversible phase transition of pure protein polymer materials that enabled fabrication of water/humidity insensitive sensors
- Developed methods to safely test pathogen sensors using protein-coated nanoparticles as microbe simulants
- Optimized synthesis of protein hydrogel and fabrication
- Managed 4-6 person research projects, coordinated experimental work, and reviewed data analysis

Natasha L. Smith, PhD

*Graduate Research Assistant, Advisor: Professor Sanford Asher* (2011- 2019)

- Designed & developed novel functionalized polymers for colorimetric chem/biosensor applications using photonic crystal sensing technology
- Developed covalently crosslinked protein polymers for sensing and catalysis in aqueous & non-aqueous media
- Expanded photonic crystal sensing technology to gas detection by utilizing low vapor pressure liquids
- Cryo-Scanning Electron Microscopy for characterization of hydrated polymer nanostructure
- Increased fabricated area (3X) and improve ordering of self-assembled nano/micro particle monolayers
- Awarded two DTRA grants (co-author); both awarded funding for the 2 option years due to progress
- Produced final and annual technical reports to funding agencies
- Maintained lab safety & organized EH&S inspections

**Bayer Material Science, Pittsburgh, PA** (Summer 2009 & Summer 2010)

*R&D Chemistry Internship: Coatings/Adhesives/Specialties Division*

- Formulated zero-VOC polyaspartic coatings for inclusion of 5 pigments and metallic flake
- Optimized polyurethane coating formulations for customer applications
- Evaluated physical properties of coating formulations using dynamic mechanical analysis

**The Linsly School, Wheeling, WV** (August 2009-May 2010)

*Intern/Substitute Teacher- All Subjects, Grades 5-12*

- Developed and carried out lesson plans for AB & BC Calculus, AP Chemistry, AP Biology, & US History
- Academic mentor for college application process & Tutor for math & sciences

### **Publications** (7 publications; >270 citations)

1. **N. L. Smith**, A. Coukouma, R. Jakebek, S. Asher; "Mechanisms by which Organic Solvent Exchange Transforms Responsive Pure Protein Hydrogels into Responsive Organogels." *Biomacromolecules* **2020**, 21, 839- 853.
2. **N. L. Smith**, A. Coukouma, B. Ho, V. Gray, S. Asher; "Stimuli-Responsive Pure Protein Organogel Sensors and Biocatalytic Materials." *ACS Applied Materials & Interfaces* **2020**, 12, 238-249
3. **N. L. Smith**, A. Coukouma, S. Dubnik, S. Asher; "Debye Ring Diffraction Elucidation of 2D Photonic Crystal Self-Assembly and Ordering at the Air-Water Interface." *Physical Chemistry Chemical Physics* **2017**, 19, 31813-31822
4. **N. L. Smith**, Z. Hong, S. Asher; "Responsive Ionic Liquid-Polymer 2D Photonic Crystal Gas Sensors." *Analyst* **2014**, 139, 6379-6386.
5. A. Coukouma, **N. L. Smith**, S. Asher; "Removable interpenetrating network enables highly-responsive 2-D photonic crystal hydrogel sensors." *Analyst* **2015**, 140, 6517-6521.
6. Z. Cai, **N. L. Smith**, J. Zhang and S. Asher; "Two-Dimensional Photonic Crystal Chemical and Biomolecular Sensors, Review." *Analytical Chemistry* **2015**, 87, 5013-5025.
7. J. Zhang, **N. Smith** and S. Asher; "Two-Dimensional Photonic Crystals Surfactant Detection." *Analytical Chemistry* **2012**, 84, 6416-6420.

### **Presentations**

#### ***Technical***

18. Pittcon Conference and Expo 2021, Digital Conference March 9, 2021  
"Elucidating the Mechanisms Involved in the Transformation of Responsive Pure Protein Hydrogels into Responsive Organogels" N.L. Smith, A. Coukouma, R. Jakubek, S.A. Asher (oral presentation)
17. Covestro Lecture Series 2019, Pittsburgh, PA October 17, 2019  
"Mechanisms of the Pure Protein Hydrogel to Organogel Transformation and Their Applications" N.L. Smith, S.A. Asher (poster)
16. Doctoral Defense, Department of Chemistry, University of Pittsburgh August 12, 2019  
"Development of 2-Dimensional Photonic Crystal Sensors and Pure Protein Organogel Sensing and Catalytic Materials" Natasha L. Smith

## **Natasha L. Smith, PhD**

*Committee:* Distinguished Professor Sanford A. Asher, Professor Sean Garrett-Roe, Professor Seth Horne, & Professor Sachin Velankar

15. Intelligent Optical Systems, Torrence, CA June 27, 2019  
“Photonic Crystal Colorimetric Sensors and Biocatalytic Materials” N.L. Smith (oral presentation)
14. Oregon State University, Department of Chemical Engineering May 3, 2018  
“Smart Polymeric Materials: 2D Photonic Crystal Sensors & Pure Protein Hydrogels and Organogels” N.L. Smith (Invited Speaker)
13. Pittcon Conference and Expo 2018, Orlando, FL February 27, 2018  
“Organophosphate Sensing using 2D Photonic Crystal Protein Hydrogels and Organogels” N.L. Smith, B. Ho, S.A. Asher (oral presentation)
12. Chem & Bio Defense Science & Technology Conference 2017, Long Beach, CA November 28, 2017  
“Novel Color Shifting Responsive Protein Hydrogels and Organogels for Specific Detection and Decontamination of Chemical Warfare Agents” N.L. Smith, B. Ho, S.A. Asher (poster)
11. Covestro Lecture Series 2017, Pittsburgh, PA October 26, 2017  
“Novel Color Shifting Responsive Protein Hydrogels and Organogels for Specific Detection and Decontamination of Chemical Warfare Agents” N.L. Smith, B. Ho, S.A. Asher (poster)
10. Dynamic Multifunctional Materials for a Second Skin DTRA Program Review, Pittsburgh, PA May 17, 2017  
“2D Photonic Crystals: Self-Assembly at the Air-Water Interface, Ordering, and Diffraction” N.L. Smith, A. Coukouma, S.A. Asher (poster)
9. Adventures in Enhanced Spectroscopies: Resonance Raman, Surface Enhanced Raman, and Twisted Chiro Optical Spectroscopies. Celebrating 37 Years of Photonic Explorations by Distinguished Prof. Sanford Asher Pittsburgh, Pa May 11, 2017  
“2D Photonic Crystals: Self-Assembly, Order, and Diffraction” N.L. Smith, S.A. Asher (poster)
8. Phillips Lecture 2017, Pittsburgh, PA May 17, 2017  
“2D Photonic Crystals: Self-Assembly, Ordering, and Diffraction” N.L. Smith, S.A. Asher (poster)
7. Pittcon Conference and Expo 2017, Chicago, IL March 9, 2017  
“2D Photonic Crystals: Self-Assembly, Ordering, and Diffraction” N.L. Smith, A. Coukouma, S.A. Asher (oral presentation)
6. Pittcon Conference and Expo 2015, New Orleans, LA March 9, 2015  
“Responsive Ionic Liquid-Polymer Photonic Crystal Sensors” N.L. Smith, Z. Hong, S.A. Asher (oral presentation)
5. Pittcon Conference and Expo 2014, Chicago, IL March 2, 2014  
“Ionic Liquid Polymerized Photonic Crystal Gas Sensors” N.L. Smith, Z. Hong, S.A. Asher (oral presentation)
4. Bayer Lecture Series 2014, Pittsburgh, PA September 17, 2014  
“Responsive Ionic Liquid-Polymer 2D Photonic Crystal Gas Sensors” N.L. Smith, Z. Hong, S.A. Asher (poster)
3. PPG Young Innovator’s Showcase 2014, Pittsburgh, PA April, 7 2014  
“Responsive Ionic Liquid-Polymer 2D Photonic Crystal Sensors” N.L. Smith, Z. Hong, S.A. Asher (poster)
2. Bayer Lecture Series 2013, Pittsburgh, PA September, 23 2013  
“Novel 2D Polymerized Photonic Crystal Sensors for Visual Detection of Vaporous Analytes” N.L. Smith, G. Morgan, S.A. Asher (poster)
1. PPG Research Showcase 2012, Pittsburgh, PA November, 2 2012  
“Novel 2D Polymerized Photonic Crystal Sensors for Visual Detection of Vaporous Analytes” N.L. Smith, G. Morgan, S.A. Asher (poster)

## **Public Outreach**

9. ACS Student Affiliates Meeting, University of Pittsburgh, Pittsburgh, PA March, 1 2019  
“Creativity in Scientific Research; Producing Art from Science” N. L. Smith (oral presentation)
8. Julabo’s W.I.S.D.O.M. (Women in Science Demonstrating Outstanding Merit), Allentown, Pa April 12, 2018

## Natasha L. Smith, PhD

“Women Mentoring Women in STEM” N.L. Smith (Panel Member)

7. Pitt Program Council and The Pitt Pulse presents “Science & Art Night” Pittsburgh, Pa January 18, 2018  
“Science is Art: 2-Dimensional Photonic Crystal Art” N.L. Smith (oral presentation)
6. Chem & Bio Defense Science & Technology Conference 2017, Long Beach, CA November 29, 2017  
“Developing New Materials for Chem/Bio Sensing” T. Whitfield, N.L. Smith (outreach event)
5. Adventures in Enhanced Spectroscopies: Celebrating 37 Years of Photonic Explorations by Distinguished Prof. Sanford Asher, Pittsburgh, Pa May 11, 2017  
“2D Photonic Crystal Art” N.L. Smith (art installation & video presentation)
4. Phipps Conservatory & Center for Sustainable Landscapes “Lunch and Learn”, Pittsburgh, Pa April 6, 2016  
“Photonic Crystal Sensors: Color from Structure” N.L. Smith (oral presentation)
3. Cineshape Workshop, Pittsburgh, PA February 19, 2016  
“Collaboration between Disciplines: Art, Music, and Science” N.L. Smith, A. Henderson, and A. Williams (oral presentation and panel discussion)
2. Phipps Conservatory & Center for Sustainable Landscapes, Pittsburgh, Pa November 21, 2015/January 16, 2016  
Meet the Scientists Event “Photonic Crystal Sensors: Color from Structure” N.L. Smith (public outreach event)
1. The Linsly School Alumni Career Panel, Wheeling, WV October 9, 2015  
“The STEM PhD Process and Career Opportunities” N.L. Smith (speech & panel discussion)

### **Subject Matter Expertise**

#### **Polymer Physics & Responsive Materials**

- Flory polymer theory
- Polymer phase transitions
- Responsive hydrogel, organogel, and ionogel design
- Thermodynamics of responsive materials
- Selectively responsive hydrogels for chem/bio sensors

#### **Biomaterials/Biochemistry**

- Development of functional biomaterials
- Protein stabilization via immobilization
- Protein activity in organic solvents
- Protein hydration in organic solvents
- Protein biopolymer hydrogels/organogels

#### **Colloidal/Surface Chemistry**

- 2D & 3D photonic crystals
- Photonic crystal Bragg diffraction
- Charged colloidal particle self-assembly
- Particle functionalization

### **Soft Skills**

- Leading team projects
- Proposal/White paper
- Journal publication & technical report writing
- Oral presentations & public speaking
- Training/Mentoring
- Conflict resolution

### **Software**

- ImageJ (NIH)

-PyMol & Chimera

-Mathematica/MATLAB

### **Research/Laboratory Skills**

- Design of experiment
- Methods Development
- Data analysis
- Creative problem solving

### **Synthesis & Fabrication**

- Fabrication of pure protein polymers
- Bioconjugation techniques (protein-protein & protein-polymer)
- Polymer Functionalization
- Free radical polymerization (UV/Thermal initiation)
- Ionic liquid synthesis and purification
- Polymer nano/microparticle synthesis using emulsion and dispersion polymerization
- Fabrication of close packed colloidal particle monolayers

- Crystalline colloidal array self-assembly

### **Characterization/Instrumental Techniques**

- Physical properties of soft materials
- Photonic crystal particle ordering & particle spacing using light diffraction
- Polymer morphology & nanostructure
- Protein secondary structure determination using UV Resonance Raman spectroscopy
- Enzyme activity assays
- Nano/micro colloidal particle size & charge
- Optical Microscopy
- Electron Microscopy
- Cryo-SEM
- Dynamic Light Scattering (DLS)
- UV/Vis/IR Absorption spectroscopy

### **Society Memberships**

Sigma Xi Scientific Research Honor Society; American Chemical Society; Society for Analytical Chemistry of Pittsburgh; Women's Chemist Community; Phi Lambda Upsilon

### **Activities**

Pitt Chemistry Graduate Student Advisory Board; Pitt Chemistry Graduate Peer Mentor; Phipps Conservatory and Center for Sustainable Landscapes Science Communication Fellow; Photonic Crystal Artist