

# Alexis N. Williams, PhD

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## EDUCATION

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University of Texas Medical Branch, Galveston PhD – Biochemistry and Biophysics Concentration –Virology and Immunology	Galveston, TX May 2021
University of Tennessee BS – Biochemistry, Cellular, and Molecular Biology Minor – German	Knoxville, TN May 2013

## RESEARCH EXPERIENCE

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### **R&D Staff Scientist 2022-current**

Oak Ridge National Lab – Center for Nanophase Materials Sciences  
Physical Sciences Directorate

Field: High-performance computing, AI/ML, and Electron Microscopy

*Combining high-performance computing and machine learning to low-dose imaging of beam-sensitive materials for biodefense, bioenergy, and materials design.*

Field: Facility/Capability development

*Helped establish DOE's only BES cryoEM user facility for beam/environmentally sensitive samples.*

Field: Structural Biology

*Determined the 3D structures of purified protein, BSL1 pathogens, and bacteria.*

Field: Materials Sciences

*Development of nanoparticles for radiotherapeutic delivery; characterization of isotope structures; development and structural characterization of designed materials for pathogen detection and pandemic response.*

### **Postdoctoral Research 2021-2022**

Vanderbilt University Medical Center – NIH Gastroenterology Research Fellow  
Division of Diabetes, Endocrinology and Metabolism

Advisor: Prof. Ray Blind, PhD

Field: Structural analysis of nuclear receptor ligands in Inflammatory Bowel Disease

*Determine how potentially therapeutic small molecules control the structure and function of full-length nuclear receptor Liver Receptor Homolog-1 (LRH-1).*

### **PhD Thesis Research 2015-2021**

University of Texas Medical Branch – McLaughlin Infectious Disease and Biodefence Fellow  
Department of Biochemistry and Molecular Biology

Advisor: Prof. Thomas Smith, PhD

Field: Structural Biology, Viral Infection/Immune Evasion, and Vaccine Design

*Characterized how host metabolites enable viruses to evade the host immune system and how allosteric changes in the viral capsid need to be considered during vaccine design.*

Field: Structural Biology and Fungal Infections

*Identified the atomic-resolution mechanism of L-type calcium channel response to activators and inhibitors and defined the role of these channels in fungal infection and growth.*

Field: Structure and Enzyme Kinetics in Drug Design

*Identified the atomic-resolution mechanism of glutamate dehydrogenase by characterizing agonists and antagonists in collaboration with Astra Zeneca targeting several metabolic diseases.*

### **Pre-doctoral Research Positions 2008 - 2015**

Oak Ridge National Research Laboratory – Post-Baccalaureate Research Fellow  
Center for Structural and Molecular Biology Oak Ridge National Lab

Advisor: Prof. Hugh O'Neill, PhD

Field: Structural Biology and Environmental Sciences

*Characterized biofilm formation and degradation pathways using small angle neutron scattering, x-ray crystallography, and molecular biology techniques. Secondary project in understanding cellulose formation and degradation through determining the mechanism of action for cellulose synthase.*

UT Knoxville – Research Assistant

Department of Biochemistry, Cellular, and Molecular Biology

Advisor: Prof. James Hall, PhD

Field: Electrophysiology and Neuroscience

*Identified the neuronal pathway for auditory and vibrational response in fiddler crabs (Uca) and the role of these pathways during mating.*

## PRESENTATIONS AND INVITED TALKS

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**2023 AReMS** – Invited talk on cryoEM facility development and capabilities

**2023 UTK** – Invited Speaker for talk on vaccine design and structural studies of pathogens

**2023 M&M** – Invited Talk on low-dose cryoEM methods

**2023 M&M** – Talk on low-dose imaging and characterization of fire-fighting surfactants

**2022 ORNL Soft Matter Symposium** – Invited talk on CryoEM for beam sensitive materials

**2021 SERLC** – Lina Obeid Young Scientist Invited Talk

**2021 SERLC** – Invited Talk on lipid binding proteins

**2020 BPS Conference** – Poster Presentation

**2019 ASV Conference** – Poster Presentation

**2016 – 2021 Sealy Center for Structural Biology Symposium** – Poster Presentation

**2018 – 2021 BMB annual retreat** – Oral Presentation

**2016 – 2017 BMB annual retreat** – Poster presentation

**2014 American Conference on Neutron Scattering** – Poster Presentation

**2013 Second Annual NeuroNet Conference** – Poster Presentation

## SKILLS

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**Structure:** Cryo-EM (SPA, cryoET, and MicroED), X-ray crystallography, NMR, analytical ultracentrifugation, GC-MS, protein expression (bacteria, yeast, insect, and mammalian) and purification, ELISA, enzyme kinetics (fluorometry, stop-flow, SPR, ITC), proteomics.

**Computation:** Computer languages (C, C++, and Python); 3D reconstruction (CryoSPARC, Relion, EMAN2, Scipion3, IMOD); Structural visualization (Chimera, Pymol); Protein prediction (RoseTTAfold, AlphaFold2, RFdiffusion); Protein MD simulation Force Fields (CHARMM, AMBER, GROMACS, NAMD); Google Collab and AWS cloud service integration.

**Molecular Biology:** PCR, next-generation sequencing, cloning, mutagenesis, reverse genetics, plaque assays, tissue culture of BSL2 viruses, RNA extraction, virus purification, electrophysiology (patch and current), HTS drug screening, and enzyme engineering.

**Materials Sciences:** S/TEM cryogenic and low-dose operation (EBSD and EELS), Ga and pFIB sample prep (lift out and on grid milling) at cryogenic and room temps, automated electron microscopy development, nanoparticle analysis.

## COMMITTEE RESPONSIBILITIES AND LEADERSHIP ROLES

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2022 – current	MSA Diversity Committee
2019 – 2020	UT Systems Student Advisory Committee
2019 – 2020	UTMB Biophysics Student Organization – Treasurer
2018 – 2020	UTMB Professionalism Committee
2017 – 2019	UTMB SGA – Executive Treasurer
2016 – 2019	BMB Curriculum Committee Student Rep
2016 – 2018	Graduate School Org – President
2016 – 2017	UTMB SGA – GSBS Senator
2016 – 2016	Graduate School Org – Vice President
2019	Leadership & Management Certification from UH-ClearLake

## MEMBERSHIP IN SCIENTIFIC SOCIETIES

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Microanalysis Society

Microscopy Society of America  
American Crystallographic Association  
American Society for Virology  
The Biophysical Society  
American Chemical Society

## HONORS AND AWARDS

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2023	CNMS Special Team Award for cryoEM facility development
2021	Lina Obeid Young Scientist Award
2018	Albert Sanders Scholarship
2018	UTMB GSBS Travel Award
2018	BMB Departmental Travel Award
2017	Steunebrink Scholarship
2016	Title IX Distinguished Service Award

## FELLOWSHIPS AND FUNDING

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2023 - current	DOE BRaVE Funding for surface design for pandemic response
2023 - current	ORNL LDRD Funding for advancing radioisotope development
2022 - current	ORNL LDRD Funding for enzyme engineering
2022 - 2023	ORNL Strategic Hire Funding for cryoEM capability development
2021-2022	NIH T32 Postdoc Fellowship
2019-2021	UTMB McLaughlin PhD Fellowship

## PROFESSIONAL, TEACHING, AND MENTORING EXPERIENCE

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<b>2023 - current</b>	<b>GEM mentor to PhD students</b> <i>Catelyn Bridges (PhD at UC-Davis) faculty at Nebraska 2024</i> <i>Kiara Parker (PhD student UNCA&amp;T)</i>
<b>2022 – current</b>	<b>CryoEM prep, data collection, and analysis mentor to staff/students</b> <i>Biva Tilkadua (PostDoc at ORNL) currently PostDoc at PNNL</i> <i>Lynda Amichi (PostDoc at ORNL) currently PostDoc at ORNL</i> <i>Lynnica Massenburt (PhD at Penn St) currently PostDoc at ORNL</i> <i>Lance Li (Intern at ORNL)</i>
<b>2020 – 2022</b>	<b>Mentored undergrad and MD students in biophysics labs</b> <i>Derek Anderson (MD student at UTMB) currently physician at BCM</i> <i>Harry Choi (undergrad at Vanderbilt) is currently VUMC MD student</i>
<b>2016 – 2018</b>	<b>Bench Program Mentor – UTMB/Ball High partnership</b> <i>Sage Hall (senior at Ball High) currently MD student at UT-Austin</i> <i>Victoria Garcia (senior at Ball High) currently PhD student at UNT-Dallas</i>
<b>2016 – 2021</b>	<b>Biochemistry TA – UTMB</b>
<b>2018 – 2021</b>	<b>PALM SOM 1&amp;2 TA – UTMB</b>

## LANGUAGE PROFICIENCY

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English – native speaker  
German – business fluent

## PUBLICATIONS

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- Cryogenic FIB and (S)TEM for Energy Storage and Conversion Materials Research.  
Michael J. Zachman, Alexis N. Williams, Lena F. Kourkoutis, and David A. Cullen. M&M Meeting Report. **2023**  
*This paper details the workflow for the preparation and EM data collection of beam/air-sensitive material.*
- Cryo-EM reveals that N-terminal domain tethers plant cellulose synthesis machinery.  
Lynnica Massenburt, **Alexis Williams**, Welligton Leite, Sung Hyun Cho, Carol Baxter, Hugh O'Neill, B. Tracy Nixon.  
**2023. (Submitted)**  
*This paper is the first to elucidate the role of a flexible N-term region that governs cellulose production and rosette formation.*
- Chemical Specificity Due to Metastability in Polyzwitterion-Polyelectrolyte Coacervates: Polycations vs Polyaniions.

Jong K. Keum, Panagiotis Christakopoulos, Zening Liu, Tianyu Li, Jihua Chen, **Alexis Williams**, Dale K. Hensley, Kunlun Hong, Yangyang Wang, Rigoberto Advincula, Rajeev Kumar. **2023** (Submitted).

*This paper uses functional, simulation-based, and 3D structures to show how polymer behavior in solution is dependent on ionic composition.*

6. PI-5-P-MOB1 interaction connects PI5P4K and Hippo signaling.

Palamiuc, L., Johnson, J.\*, **Williams, AN\***, Tieu V., Arora, G., Loughran, R., Cantley, LA., Blind, RD., Emerling, BM. **2023** (Submitted). \*Co-Second Author

*This paper connects a non-canonical phospholipid kinase (PI5P4K) and the minor phosphoinositol family member (PI5P) to the major cell growth pathway (Hippo) implicated in multiple cancer subtypes.*

5. Structural Studies on the Shapeshifting Murine Norovirus.

Sherman, MB., **Williams, AN.**, Smith, HQ., Pettitt, MB., Wobus, CE., Smith TJ. MDPI Viruses. **2021** Oct.

*This paper is a review on how host factors seen at the site of infection alter the capsid structure and how this structural flexibility allows the virus to infect cells and avoid the host immune system.*

4. Multiple signals contract mouse norovirus capsid to block antibody binding while enhancing receptor affinity in the gut.

**Williams AN**, Sherman, MB. Smith, HQ., Taube, S., Pettitt, MB., Wobus, CE., Smith, TJ. J Virol. **2021** (Accepted Manuscript, July 2021).

*This paper uses CRYO-EM to build on the role for bile acids in norovirus gut infectivity by showing multiple, endogenous signaling molecules can also play a structural role in norovirus infectivity.*

3. A norovirus uses bile salts to escape antibody recognition while enhancing receptor binding.

**Williams AN**, Sherman MB, Smith HQ, Taube S, Pettitt BM, Wobus CE, Smith TJ. J Virol. **2021** Jun 10;95(13):e0017621. doi: 10.1128/JVI.00176-21. PMID: 33827952

*This was the first paper to show how bile acids interfere with norovirus recognition by the host immune system. Bile acids also function to enhance virus interaction with known viral receptors in the gut.*

2. Bile salts alter mouse norovirus capsid conformation: possible implications for cell attachment and immune evasion.

\*Sherman MB, \***Williams AN**, Smith HQ, Nelson C, Wilen CB, Fremont DH, Virgin HW, Smith TJ. J Virol. **2019** Sep 12;93(19):e00970-19. doi: 10.1128/JVI.00970-19. PMID: 31341042

\*Co-First Author

*This paper showed gut bile acids could alter the structure of the Norovirus capsid, suggesting bile acids can regulate Norovirus infectivity.*

1. *Ustilago maydis* virus and their killer toxins. Encyclopedia of Virology 4<sup>th</sup> edition. Ed. (Review).

**Williams AN** and Smith, TJ. **2019**.

<https://doi.org/10.1016/B978-0-12-809633-8.20943-6>

*This review summarizes literature on the toxins produced by a particular strain of virus.*