Alex J Guseman, PhD
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Education

2014-2018 **University of North Carolina at Chapel Hill**
Ph.D., Chemistry,
Advisor: Dr. Gary J. Pielak

2010 - 2014 **University of Maryland College Park**
B.S. Biochemistry
Research Advisor(s): Drs. David Fushman and David Hawthorne

Research Experience

2018-present **University of Pittsburgh School of Medicine – Department of Structural Biology**
Postdoctoral Scholar, Advisor: Dr. Angela Gronenborn
Merck Fellow of the Life Science Research Foundation
Burroughs Wellcome Fund Postdoctoral Enrichment Program Fellow
Projects: Mechanism of cataract formation in lens-like environments
- Performed biophysical and structural characterization of deamidation variants of human γD crystallin

Expanding the toolbox of in cell Nuclear Magnetic Resonance
- Developed methods for ^{19}F Nuclear Magnetic Resonance (NMR) in mammalian cells

2014-2018 **University of North Carolina at Chapel Hill– Department of Chemistry**
Ph.D. Student, Ruth L. Kirschstein Predoctoral Fellow, Advisor: Dr. Gary Pielak
Dissertation: Protein Dimerization in Physiologically Relevant Environments
- Developed GB1 homodimers into model system for studying dimerization in living cells.
- Determined influence of macromolecular crowding on protein dimerization using ^{19}F Nuclear Magnetic Resonance spectrometry.
- Demonstrated importance of crowding-induced chemical interactions to protein dimerization
- Adapted and tested Scaled Particle Theory to predict influence of macromolecule crowding on two GB1 homodimers
- Developed methods to quantify test protein concentration in *Escherichia coli* using combination of LC-MS and flow cytometry.
- Developed GB1 variant to probe cytoplasmic pH of living *E. coli* using in-cell NMR
- Determined structural perturbations to heterochromatin protein-1 upon mutation of trimethyl lysine binding pocket using NMR

2012 - 2014 **University of Maryland- Department of Chemistry and Biochemistry**
HHMI Undergraduate Research Fellow, Advisor: Dr. David Fushman
Project: Chemical methods to ubiquitinate histones H2A and H2B.
- Purification, chemical ligation, and structural characterization of ubiquitin histone conjugates.
- Developed chemical methods to generate nonnative histone-ubiquitin conjugates

- Performed NMR studies on the folding and binding of histones H2A and H2B

2010 - 2012 **University of Maryland- Department of Entomology**
Undergraduate Researcher, Advisor: Dr. David Hawthorne
Project: Multi-Drug Resistance Transporters and a Mechanism-Based Strategy for Assessing risks of Pesticide Combinations on Honey Bees

- Maintained populations of *A. mellifera and D. melanogaster* and *A. mellifera* in fields using standard beekeeping methods
- Developed mortality-based bioassays to screen pesticide combinations that result in detrimental synergisms in *A. mellifera and D. melanogaster.*
- Developed behavior-based bioassays to determine neurological impacts of sub-lethal doses of pesticides to *D. melanogaster.*

2009 - 2010 **Igene Biotechnologies**
Research Intern, Advisor: Dr. Anu Sunderarajan
Project: Optimization of P. Rhodozyma *for fermentation of the Carotenoid Astaxathan*

- Performed random mutagenesis and screens of *P. Rhodozyma* to discover hyperproducers of Astaxanthin
- Generated auxotrophic strains of *P. Rhodozyma* for downstream use in protoplast fusions

<u>Grants & Fellowships (Total value $400,308)</u>

2020 - present **NIH Loan Repayment Program Grant ($19,400)**
National Eye Institute Health Disparities LRP
University of Pittsburgh, Department of Structural Biology

2019 - present **Merck Fellow of The Life Science Research Foundation ($186,000)**
Life Science Research Foundation Postdoctoral Fellow
Sponsor: Merck
University of Pittsburgh, Department of Structural Biology

2019 - present **Burroughs Wellcome PDEP Awardee ($60,000)**
Burroughs Wellcome Fund Postdoctoral Enrichment Program
University of Pittsburgh, Department of Structural Biology

2017 - 2018 **National Institutes of Health – F31 GM126763 ($66,808)**
Ruth L. Kirschstein NRSA Predoctoral Fellowship to Promote Diversity
University of North Carolina at Chapel Hill, Department of Chemistry

2016 - 2017 **National Science Foundation- Supplement to MCB1051819 ($30,000)**
Diversity Supplement
University of North Carolina at Chapel Hill, Department of Chemistry

2015 - 2016 **National Institutes of Health – T32 GM008570-20 ($24,000)**
Molecular and Cellular Biophysics Training Program
University of North Carolina at Chapel Hill, Department of Chemistry

2014 - 2015 **National Institutes of Health- R25 GM055336 ($25,000)**
Diversity Excellence Fellowship, Initiative for Maximizing Student Diversity
University of North Carolina at Chapel Hill, Biological and Biomedical Sciences Program

2013 - 2014 **Howard Hughes Medical Institute Undergraduate Research Fellow ($6,000)**
HHMI, University of Maryland Howard Hughes Medical Institutional Grant
University of Maryland, Department of Chemistry and Biochemistry

2013 **Maryland Summer Scholars Fellowship ($2,500)**

Office of Undergraduate Research University of Maryland
University of Maryland, Department of Chemistry and Biochemistry

Publications (*denotes equal contribution co-first authorship)

14.) Speer, S.L.; Zheng, W.; Jiang, X.; Chu, I.; **Guseman, A.J.;** Liu, M.; Pielak, G.J; Li, C.; "The intracellular environment tunes protein-protein interactions" (Submitted)

13.) **Guseman, A.J.;** Whitley, M.J.; Gonzalez, J.J.; Rathi, N.; Ambarian, M; Gronenborn, A.M.; "Assessing the Structures and Interactions of γD-Crystallin Deamidation Variants" Structure (In Press)

12.) Krone, K.W.*; Albanese K.I.*; Leighton, G.O.; He, C.Q.; Lee, G.Y.; Garcia-Borras, M.; **Guseman, A.J.;** Williams D.C.J; Houk, K.N.; Brustad, E.M.; Waters, M.L.; (2020) "Thermodynamic Consequences of Tyr to Trp Mutations in the Cation-π-Mediated Binding of Trimethyllysine by the HP1 Chromodomain" Chemical Science 11 (13) 3495-3500

11.) **Guseman, A.J.;** Pielak, G.J.; (2020) Chapter 12: Protein Stability and weak intracellular interactions: In-cell NMR Spectroscopy: From Molecular Sciences to Cell Biology Shirakawa, M. Döstch, V. and Ito, Yutaka. (The Royal Society of Chemistry) pp 188-206

10.) Free, M.E.; Stember, KG.; Hess, H.J.; McInnis, E.A.; Lardinois, O.; Hogan, S.L.; Hu, Y.; Mendoza, C.; Le, A.K.; **Guseman A.J.**; Pilkinton, M.A.; Bortone, D.S.; Cowens, K.; Sidney, F.; Karosiene, E.; Peters, B.; James, E.; Kwok, W.W.; Vincent, B.G.; Mallal, S.A.; Jennette, C.J.; Ciavatta, D.J.; Falk, R.J. (2019) "Restricted Myeloperoxidase Epitopes Drive the Adaptive Immune Response in ANCA Vasculitis" Journal of Autoimmunity 106:102306

9.) Speer, S.L.; **Guseman, A.J;** Patteson, J.B.; Ehrmann B.M.; Pielak, G.J.; (2019) "Controlling and quantifying protein concentration in *Escherichia coli* cells" Protein Science 28:1307-1311

8.) **Guseman, A.J.;** Gronenborn A.M.; (2019) "Isomerization, an Achilles Heel to Long-Lived Proteins" Journal of Biological Chemistry 294:7556-7557

7.) Piszkiewicz, S.P.; Gunn, K.H.; Warmuth, O.; Propst, A.; Mehta, A.; Nguyen. K.H.; Kuhlman, E.; **Guseman, A.J.;** Stadmiller. S.S.; Boothby T.C.; Neher, S.B.; Pielak, G.J.; (2019) "Protecting Activity of Desiccated Enzymes" Protein Science 28:5 941-951

6.) **Guseman, A.J.;** Perez Goncalves, G.M.; Speer, S.L.; Young, G.B.; Pielak G.J.; (2018) "Protein Shape Modulates Crowding Effects" Proceedings of the National Academies of Sciences 115 (43):10965-10970

5.) **Guseman, A.J.*;** Speer, S.L.*; Perez Goncalves, G.M.; Pielak G.J.; (2018) "Surface-Charge Modulates Protein-Protein Interactions in Physiologically Relevant Environments" Biochemistry 57:1681-1684.

4.) Stadmiller, S.S.; Gorensek-Benitez, A.H; **Guseman, A.J.;** Pielak, G.J.; (2017) "Osmotic-Shock Induced Protein Destabilization and its Reversal by Glycine Betaine" Journal of Molecular Biology 429 (8), 1155-1161

3.) **Guseman, A.J.;** Pielak, G.J.; (2017) **"**Cosolute and Crowding Effects on a Side-By-Side Protein Dimer" Biochemistry 56 (7):971-976

2.) **Guseman, A.J.**; Miller, K.; Kunkle, G.; Dively, G.J.; Pettis, J.S.; Evans, J.D.; vanEngelsdorp, D.; Hawthorne, D.J.; (2016) "Multi-Drug Resistance Transporters and a Mechanism-Based Strategy for Assessing Risks of Pesticide Combinations on Honey Bees" PLoS ONE 11(2): e0148242.

1.) Cohen, R.D.; **Guseman, A.J.;** Pielak, G.J.; (2015) "Intracellular pH Modulates Quinary Structure" Protein Science 24 (11):1748-1755

Presentations

2020 **International Council for Magnetic Resonance in Biological Systems Early Career Series**
Deamidation of γD-crystallin – Effects on Structure and Interactions Properties - Invited Talk

2020 **64th Annual meeting of the Biophysical Society**
Deamidation of γD-crystallin – Effects on Structure and Interactions Properties -Invited Talk

2019 **Rising Stars in Biomedical URM, Massachusetts Institute of Technology**
Expanding the tool box of NMR in living mammalian cells - Invited Talk

2019 **Frontiers of Biophysics, International School of Biological Magnetic Resonance**
Expanding the toolbox of NMR in living mammalian cells - Invited Talk

2018 **Duke University BioCoRE symposium**
Developing zebrafish oocytes as a model system for in-cell NMR– Invited Talk

2018 **Gordon Research Symposium on Protein Folding Dynamics**
Protein dimerization in physiologically relevant conditions – Invited Talk and Poster

2018 **Graduate Student Research and Policy Expo**
Protein Dimerization in living cells – Invited Talk

2017 **University of Virginia Invited Candidate Symposium**
Protein Dimerization in physiologically relevant environments and in living cells– Invited Talk

2017 **Diversity in STEM**
Crowding and protein dimerization– Poster

2017 **31st Annual Meeting of the Protein Society**
Dimer Shape determines effect of macromolecular crowding– Poster

2016 **30th Annual Meeting of the Protein Society**
Crowding and Protein Dimerization- Poster

2016 **60th Annual Meeting of the Biophysical Society**
Crowding and Protein Dimerization– *Poster*

2015 **UNC Initiative for Maximizing Student Diversity Symposium**
Crowding and protein dimerization – *Poster*

2015 **Mid-Atlantic Prep and IMSD Research Symposium (MAPRS)**
Using ^{19}F NMR to probe the solvation of GB1 in living cells. — Poster

2014 **Howard Hughes Medical Institute Undergraduate Research Symposium**
Generating site specific ubiquitin histone conjugates for study by NMR— Poster

2013 **Vanderbilt VU-EDGE symposium**
Generating site specific ubiquitin histone conjugates for study by NMR—Invited Talk

2012 **University of Maryland Baltimore County Undergraduate Research Symposium**
Multipesticide exposure and Honeybee mortality– Poster (award)

2010 **Howard County Public Schools High School Internship Expo**
Optimization of P. Rhodozyma *for production of Carotenoids— Invited Talk*

Honors and Awards

2020 NIH Loan Repayment Program Grant, National Eye Institute
2019 Rising Star in Biomedical URM, Massachusetts Institute of Technology
2019 Life Science Research Foundation Postdoctoral Fellowship, Sponsored by Merck
2019 Burroughs Wellcome Fund Postdoctoral Enrichment Program Fellowship
2018 Sigma Xi Research Honor Society
2018 Carl Storm Travel Fellowship to attend the Protein Folding Dynamics GRC

2017 Ruth L. Kirschstein NRSA Predoctoral Fellowship to Promote Diversity
2017 Ledoux travel award to attend the Protein Society
2016 National Science Foundation Diversity Supplement
2015 NIH T32 NRSA Predoctoral
2014 NIH R25 Diversity Excellence Fellowship
2014 UNC Biological and Biomedical Sciences Program Directors Award
2013 Howard Hughes Medical Institute Undergraduate Research Fellowship
2013 Maryland Summer Scholars Fellowship
2012 University of Maryland Department of Entomology Cory Scholarship
2012 University of Maryland College Park Scholars Life Sciences Citation
2012 UMBC Undergraduate Research Symposium Poster Award
2010 Karl Wolfe Scholarship

Teaching & Mentoring Experience

2015 - 2016 **BIOC 649 Mathematics and Macromolecules**- Co-Instructor
2016 - 2019 **Graduate Students Mentored**
Shannon Speer, Rotation 2017 (UNC)
Joseph Thole, Rotation 2018 (UNC)
Jacob Wolfe, Rotation (Pitt)
2014-2018 **Undergraduates mentored and where they are now**
Gerardo Perez Goncalves, Graduate Student Massachusetts Institute of Technology
Stephen Lanier, Post Baccalaureate Research UNC
2019-Present Jeremy Gonzalez-Roman, (Back to University of Puerto Rico)
Shivam Khairnar, Pitt
2011-2014 **Undergraduate Chemistry Lab, UMD** – Teaching Assistant for leading lab activities

Memberships and Scientific Service

2022 Gordon Research Symposium Protein Folding Dynamics Co-Chair
2020-2021 Biopolymers *In Vivo* Postdoctoral Member
2020 Discussion leader Protein Folding Dynamics Gordon Research Symposium
2020 – present Member of the Biophysical Society
2019 Gibbs Biothermodynamics Session Moderator
2019 - present SACNAS abstract and travel award reviewer
2019 - present Society for the Advancement of Chicano/Hispanic and Native American Scientist (SACNAS)
2018 - present Peer Review ACS Biochemistry, Cell Press Structure, ACS OMEGA, and ACS Journal of Physical Chemistry B
2018 - present Sigma Xi Research Honor Society
2014 - present University of North Carolina Initiative for Maximizing Student Diversity
2011 - present Alpha Chi Sigma Professional Chemistry Fraternity

Conferences Organized

2022 Gordon Research Symposium Protein Folding Dynamics
2018 Diversity in STEM, Co-Organizer and Fundraising Chair, UNC-CH
2017 Diversity in STEM, Co-Organizer, UNC-CH
2016 Initiative for Maximizing Student Diversity Symposium, Co-Organizer, UNC-CH
2015 Initiative for Maximizing Student Diversity Symposium, Co-organizer, UNC-CH