

GABRIEL A. COOK

Assistant Professor
Department of Chemistry
Oklahoma State University
107 Physical Sciences, Stillwater, OK 74078
Phone: 405.744.5941 Email: gabriel.cook@okstate.edu
<http://chemistry.okstate.edu/cook>

EDUCATION AND PROFESSIONAL EXPERIENCE

Assistant Professor 2014 – current Oklahoma State University, Stillwater, OK
Assistant Project Scientist 2011 – 2014 University of California, San Diego, CA
Postdoctoral Research Associate 2005 – 2011, University of California, San Diego, CA
Ph.D. (Biochemistry) 2005, Kansas State University, Manhattan, Kansas
B.S. (Biology) 2000, Concordia University, Seward, Nebraska

PERSONAL STATEMENT

I have held my current position in the Department of Chemistry at Oklahoma State University since 2014 after moving from the University of California San Diego where I worked as a Staff Scientist at the Center for NMR Spectroscopy and Imaging of Proteins. I graduated from Concordia University with a Bachelor's degree as a Biology major and Chemistry minor. I then attended Kansas State University where I earned a PhD in Biochemistry in the lab of Dr. John Tomich. My research dissertation focused on the channel activity and structures of several channel-forming peptides derived from the human M2 glycine receptor in an effort to develop therapeutics for the treatment of channelopathies such as Cystic Fibrosis. I then moved to the University of California San Diego as a Post Doctoral Scholar in the lab of Dr. Stanley Opella where my studies focused on the structural and dynamic characterization of the membrane viroporin protein p7 from Hepatitis C Virus for the development of anti-HCV drugs.

My current interest is in determining the structure, dynamics and interactions of membrane glycoproteins. Glycoproteins are a large class of proteins, taking part in nearly every biological process. They participate in the immune system as antibodies and as factors in the major histocompatibility complex interacting with T cells as part of a the adaptive immune response. They are also involved in white blood cell recognition, cell growth, differentiation, cell-cell interactions and protein folding. Glycoproteins are also indicators for various cancers. A large number of important glycoproteins are integral membrane proteins. They can be found in the lipid bilayers that make up the plasma membrane and the membranes of organelles. Two of the proteins that my lab is specifically interested in are Sarcoglycan, involved in maintaining the integrity of muscle cells, and whose malfunction can lead to Muscular Dystrophy, and Syndecan, a protein used as a marker for several cancers including breast and prostate. Nuclear Magnetic Resonance Spectroscopy has been shown recently to be the ideal method for studying large membrane proteins in a native-like lipid environment. In my lab a combination of solution and solid-state NMR is employed to study the effects of glycosylation on structure, dynamics and the interactions of these important proteins. Understanding these properties is an incredibly important component to the development of treatments of human disease involving glycoproteins.

AWARDS AND MEMBERSHIPS

Oklahoma State University College of Arts & Sciences Award for Excellence in General Education Teaching
American Chemical Society Member (2014 – current)
Biophysical Society Member (2003 – current)
Protein Society Member (2010 – current)
2004 Kansas State University Biochemistry Graduate Student Teacher Assistant of the Year
2005 Kansas State University Biochemistry Graduate Student Researcher of the Year

TEACHING EXPERIENCE

CHEM 1314 – General Chemistry I – Fall 2015, 2016, 2017, Spring & Fall 2018, Spring & Fall 2019, Spring, Summer & Fall 2020, Fall 2021, Fall 2022

CHEM 1515H – General Chemistry II for Honors – Spring 2015

CHEM 1314H – General Chemistry I for Honors – Fall 2015

CHEM 2980 – Everyday Chemistry for Honors – Fall 2017, Spring & Fall 2018, Spring & Fall 2019

CHEM 2890 – Everyday Chemistry for Honors – Spring & Fall 2020, Spring & Fall 2021, Spring 2021, Fall 2022

CHEM 4990 – Special Problems – Spring & Fall 2015, Spring & Fall 2016, Spring & Fall 2017, Spring & Fall 2018

CHEM 5011 – Seminar Course

CHEM 6650 – Chemistry Perspectives on Protein Biophysics (graduate class) – Spring 2017

CHEM 4123/6650 – The Chemical and Physical Basis of Macromolecular Function – Spring 2019

CHEM 4123/6650 – Biomolecular Chemistry and Function – Spring 2021

SELECTED PRESENTATIONS

Ogunleye, T. *, Cook, G.A. (2022) Recombinant Expression and Purification of TMPRSS2 from E. coli Cells, *Oklahoma Center for Respiratory and Infectious Diseases*, Oklahoma State University, Stillwater, OK, USA (Poster)

Ogunleye, T. *, Cook, G.A. (2022) Recombinant Expression and Purification of membrane proteins, TCR α and TMPRSS2, *National Organization for the Professional Advancement of Black Chemists and Chemical Engineers*, Orlando, FL, USA (Poster)

Cook, G.A.* (2022) Monitoring novel *in vitro* glycosylation of membrane proteins, *National American Chemical Society Meeting*, Chicago, IL, USA (Oral)

Anderson, A.R. *, Cook, G.A. (2022) Studying the effects of glycosylation on structure and dynamics of membrane glycoproteins, *Oklahoma Center of Biomedical Research Excellence in Structural Biology Meeting*, University of Oklahoma, Norman, OK, USA (Poster)

Cook, G.A.* (2022) *in vitro* glycosylation of membrane proteins involved in human disease, *National American Chemical Society Meeting*, San Diego, CA, USA (Oral)

Cook, G.A.* (2021) *in vitro* Glycosylation of Membrane Proteins and Quantitative Analysis. Murray State University, Murray, KY, USA (Invited Seminar Presentation)

Cook, G.A.* (2021) *Southeast Regional ACS Meeting (SERMACS)*, Confirmed and quantified *in vitro* glycosylation of membrane proteins, Birmingham, AL, USA (Oral)

Cook, G.A.* (2021) *in vitro* Glycosylation of Membrane Proteins. North Carolina State University, Raleigh, NC, USA (Invited Seminar Presentation)

Cook, G.A.* (2021) *Southwest Regional Meeting (SWRM) ACS*, *in vitro* glycosylation of membrane proteins and quantitative analysis, Austin, TX, USA (Oral)

Cook, G.A.* (2021) Studying post-translational modification of membrane proteins using *in vitro* glycosylation, *Midwest Regional Meeting (MWRM) ACS*, Springfield, IL, USA (Oral)

Anderson, A. *, Cook, G.A. (2021) Expression, Purification, and Characterization of Ectodomains from the Membrane Protein Syndecan-1, *Midwest Regional Meeting (MWRM) ACS*, Springfield, IL, USA (Oral)

Harris, M.S.* Cook, G.A. (2021) Oral Presentation: *In vitro* Glycosylation of Membrane Protein γ -Sarcoglycan, *Midwest Regional Meeting (MWRM) ACS*, Springfield, IL, USA (Oral)

Bryce, J.R.* Cook, G.A. (2021) A focused look at the transmembrane domain of the glycoprotein γ -sarcoglycan, *Midwest Regional Meeting (MWRM) ACS*, Springfield, IL, USA (Poster)

Ogunleye, T. *, Cook, G.A. (2021) Poster Presentation: Recombinant Expression and Characterization of TCR α from the T-Cell Receptor Complex, *Midwest Regional Meeting (MWRM) ACS*, Springfield, IL, USA (Poster)

Cook, G.A.* (2021) Structural Characterization of Glycomembrane Proteins Involved in Human Disease, *National American Chemical Society Meeting*, Atlanta, GA, USA (Oral)

- Cook, G.A. * (2020) Structural characterization of glycomembrane proteins involved in human disease. Northeastern State University, Tahlequah, OK, USA (Invited Seminar Presentation)
- Cook, G.A. * (2020) Studying post-translational modification of membrane proteins using in vitro glycosylation, *Midwest Regional ACS Meeting (MWRM)*, Springfield, MO, USA (Oral)
- Ogunleye, T. *, Cook, G.A. (2020), Expression and purification of the TCR α protein, *Midwest Regional ACS Meeting (MWRM)*, Springfield, MO, USA (Poster)
- Anderson, A. *, Cook, G.A. (2020), expression, purification, and NMR characterization of the SDC-1 ectodomain cleavage fragments, *Midwest Regional ACS Meeting (MWRM)*, Springfield, MO, USA (Poster)
- Harris, M.H. *, Adelaide, L., Cook, G.A. * (2020) Glycosylation of γ -Sarcoglycan, *Midwest Regional ACS Meeting (MWRM)*, Springfield, MO, USA (Poster)
- Bryce, J., Harris, M.H., Cook, G.A. * (2020) Expressing, purifying and determining the structure of truncated sarcoglycan, *Midwest Regional ACS Meeting (MWRM)*, Springfield, MO, USA (Poster)
- Bryce, J., Harris, M.H., Cook, G.A. * (2020) Expressing, purifying and determining the structure of truncated sarcoglycan, *Midwest Regional ACS Meeting (MWRM)*, Springfield, MO, USA (Poster)
- Cook, G.A. * (2019) Structural characterization of glycomembrane proteins involved in human disease. East Central University, Ada, OK, USA (Invited Seminar Presentation)
- Cook, G.A. * (2019) *in vitro* Glycosylation of Membrane Glycoproteins *National ACS Meeting*, Orlando, FL, USA (Oral Presentation)
- Adelaide, L., Cook, G.A. * (2019) Using NMR to monitor in vitro post-translational modification, *Experimental NMR Conference (ENC)*, Pacific Grove, CA, USA (Poster)
- Anderson, A. *, Cook, G.A. (2019) Detection of Shed Syndecan-1. *ACS Pentasectional Meeting* Norman, OK, USA (Poster)
- Harris, M. *, Jamaledine, M., Cook, G.A. (2019) Characterization of γ -Sarcoglycan by NMR. *ACS Pentasectional Meeting* Tulsa, OK, USA (Poster)
- Harris, M. *, Jamaledine, M., Cook, G.A. (2019) Characterization of γ -Sarcoglycan by NMR. *ACS Pentasectional Meeting* Tulsa, OK, USA (Oral Presentation)
- Cook, G.A. * (2019) Structural characterization of glycomembrane proteins involved in human disease *Southeast Regional Meeting of ACS (SERMACS)*, Savannah, GA, USA (Oral Presentation)
- Cook, G.A. * (2019) Structural characterization of glycomembrane proteins involved in human disease. *Midwest Regional ACS Meeting (MWRM)*, Wichita, KS, USA (Oral Presentation)
- Adelaide, L., Jamaledine, A.M., Cook, G.A. * (2018) *in vitro* Glycosylation of Membrane Glycoproteins. *Southwest Regional ACS Meeting (SWRM)*, Little Rock, AR, USA (Invited Talk)
- Adelaide, L. *, Cook, G.A. (2018) *in vitro* Glycosylation of the membrane proteins gamma-Sarcoglycan. *ACS Pentasectional Meeting* Tulsa, OK, USA (Oral Presentation)
- Adelaide, L., Cook, G.A. * (2018) Using NMR to monitor post-translational modification *Great Plains Regional Symposium on Protein and Biomolecular NMR (GRASP)*, Lawrence, KS, USA (Invited talk)
- Adelaide, L., Cook, G.A. * (2018) *in vitro* Glycosylation of Membrane Glycoproteins. *Midwest Regional ACS Meeting (MWRM)*, Ames, IA, USA (Poster)
- Adelaide, L., Cook, G.A. * (2017) Studying the Effects of Glycosylation on Membrane Proteins. *Southwest Regional ACS Meeting (SWRM)*, Lubbock, TX, USA (Invited Talk)
- Adelaide, L., Cook, G.A. * (2017) Using NMR to study biologically relevant samples of membrane proteins. P41 Grant Review Committee Meeting, La Jolla, CA, USA (Invited Talk)
- Adelaide, L., Cook, G.A. * (2017) Using NMR Spectroscopy to Measure Membrane Protein Structure, Dynamics, Interactions and Modifications. *OSU Biochemistry and Molecular Biology Graduate Student Association Seminar Series*, Stillwater, OK, USA (Invited Talk)

- Adelaide, L., Cook, G.A.* (2017) NMR as a tool to monitor post-translational modification. *Great Plains Regional Annual Symposium on Protein and Biomolecular NMR*. Lawrence, KS, USA (Poster Presentation)
- Jamaledine, A.M., Adelaide, L., Cook, G.A.* (2017) Expression, Purification and Structural Characterization of Membrane Glycoprotein γ -Sarcoglycan. *Biophysical Society Meeting*, New Orleans, LA, USA (Poster Presentation)
- Adelaide, L., Cook, G.A.* (2017) NMR as a tool to monitor post-translational modification. *Experimental Nuclear Magnetic Resonance Conference*, Pacific Grove, CA, USA (Poster Presentation)
- Cook, G.A.* (2016) Using NMR to study biologically relevant samples of membrane proteins. University of California Riverside, Riverside, CA, USA (Invited Seminar Presentation)
- Cook, G.A.* (2016) Using solution and solid-state NMR to study biologically relevant membrane proteins. Wichita State University, Wichita, KS, USA (Invited Seminar Presentation)
- Adelaide, L., Blair, E. and Cook, G.A.* (2016) *in vitro* Glycosylation of Membrane Proteins. *Biophysical Society Meeting*, Los Angeles, CA, USA (Poster Presentation)
- Cook, G.A.* (2016) Using NMR to study biologically relevant samples of membrane proteins. Missouri State University, Springfield, MO, USA (Invited Seminar Presentation)
- Adelaide, L.* and Cook, G.A. (2016) Using NMR to Monitor *in vitro* Glycosylation of Membrane Proteins. University of Oklahoma *COBRE Symposium*. Norman, OK, USA (Poster Presentation)
- Adelaide, L. and Cook, G.A.* (2016) Using NMR to Monitor *in vitro* Glycosylation of Membrane Proteins. *Experimental Nuclear Magnetic Resonance Conference*, Pittsburgh, PA, USA (Poster Presentation)
- Adelaide, L.* and Cook, G.A. (2016) *in vitro* Glycosylation of Membrane Proteins. *American Chemical Society Pentasectional Regional Meeting*, Oklahoma Wesleyan University, Bartlesville, OK, USA (Poster Presentation)
- Morgan, P.* and Cook, G.A. (2016) Studies of the Structure, Function and Dynamics of Cancer Protein Syndecan-1. *American Chemical Society Pentasectional Regional Meeting*, Oklahoma Wesleyan University, Bartlesville, OK, USA
- Cook, G.A.* (2015) The application of solution and solid-state NMR in characterizing biologically relevant membrane proteins. Kansas State University, Manhattan, KS, USA (Invited Seminar Presentation)
- Cook, G.A.* (2015) Using solution and solid-state NMR to determine the structure, dynamics and interactions of biologically relevant membrane proteins. *American Chemical Society Pentasectional Regional Meeting*, Pittsburg State University, Pittsburg, KS, USA (Oral Presentation)
- Cook, G.A.* (2015) Structure and Interaction Studies of Membrane Glycoproteins by NMR. *Gordon Research Conference: Glycobiology*, Lucca, Italy (Poster Presentation)
- Cook, G.A.*, Dawson, L., Das, B., Tian, Y., Opella S.J. (2014) Closing in on the target: using NMR to study the Hepatitis C viral membrane protein p7, *GRASP Meeting*, University of Kansas, Lawrence, KS, USA (Oral Presentation)

*Presenting Author

PUBLICATIONS

- Reed, D.R., Nehmzow, K., Essandoh, M.A., Ebqa' ai, M.A., Nelson, T.L., Lutter, E.I., **Cook, G.A.**, Champlin, F.R., Contribution of cell surface ultrastructure to the antibacterial properties of a novel hydrophobic melanin-inspired derivative. *Submitted*
- Anderson, A.R., **Cook, G.A.** (2022) Recombinant expression, purification, and structural analysis of two ectodomains of Syndecan-1. *Protein Expression and Purification* **201**: 106170
- Kayastha, B.B., Kubo, A., Burch-Konda, J., Rogers, R.R., Dohmen, R.L., Bever, J., Peng, S., Chaudhary, B., Mohanty, S. Barbier, M., **Cook, G.A.**, Deng, J., Patrauchan, M.A. (2022) EF-hand protein, EfhP, specifically binds Ca²⁺ and mediates Ca²⁺ regulation of virulence in a human pathogen *Pseudomonas aeruginosa*. *Scientific Reports* **12**: 8791-8805
- Liyanage, L., Harris, M.S., **Cook, G.A.** (2021) *In vitro* glycosylation of membrane proteins using N-Glycosyltransferase. *ACS Omega* **6**: 12133-12142
- Jamaledine, M., Harris, M.S., Liyanage, L., **Cook, G.A.** (2019) Expression, purification, and structural analysis of the full-length human integral membrane protein γ -sarcoglycan. *Protein Expression and Purification* **167**: 105525

- Cook, G.A.**, Dawson, L., Tian, Y., Opella, S.J. (2013) The three-dimensional structure and drug interaction studies of HCV p7 in DHPC by solution NMR. *Biochemistry* **52**: 5295-5303
- Bukovnik, U., Gao, J., **Cook, G.A.**, Shank, L.P., Seabra, M.B., Schultz, B.D., Iwamoto, T., Chen, J., **Tomich, J.M.** (2012) Structural and biophysical properties of a synthetic channel-forming peptide: designing a clinically relevant anion selective pore. *Biochim. Biophys. Acta* **1818**: 1039-48
- Song, W.S., Park, S.H., Nothnagel, H.J., Lu, G.J., Wang, Y., Zhang, H., **Cook, G.A.**, Howell, S.C., Opella, S.J. (2012) 'qtitation' of long-chain and short-chain lipids differentiates between structured and mobile residues of membrane proteins studied in bicelles by solution NMR spectroscopy. *J. Magn. Reson.* **214**:111-118.
- Cook, G.A.** and Opella, S.J. (2011) Secondary structure, dynamics, and architecture of the p7 membrane protein from hepatitis C virus by NMR spectroscopy. *Biochim Biophys Acta.* **1808**: 1448-53
- Cook, G.A.**, Zhang, H., Park, S.H., Wang, Y., Opella, S.J. (2011) Comparative NMR studies demonstrate profound differences between two viroporins: p7 of HCV and Vpu of HIV-1. *Biochim Biophys Acta.* **1808**: 554-60 (peer reviewed, invited review)
- Park, S.H., Berkamp, S., **Cook, G.A.**, Chan, M.K., Viadiu, H., Opella, S.J. (2011) Nanodiscs versus Macrodiscs for NMR of Membrane Protein. *Biochemistry* **50**:8983-5
- Cook, G.A.**, Stefer, S., Opella, S.J. (2010) Expression and purification of the membrane protein p7 from HCV. *Peptide Science* **96**: 32-40
- Cook, G.A.** and Opella, S.J. (2010) NMR studies of membrane proteins, in *Membrane Transporters in Drug Discovery and Development*, Methods in Molecular Biology (Yan, Q., Ed), Springer, New York, pp. 263-275 (invited book chapter)
- Herrera, A.I., Al-Rawi, A., **Cook, G.A.**, Gao, J., Iwamoto, T., Prakash, O., Tomich, J.M., Chen, J. (2010) Structural characterization of two pore-forming peptides: Consequences of introducing a C-terminal tryptophan. *Proteins* **78**:2238-50.
- Cook, G.A.** and Opella, S.J. (2009) NMR studies of p7 protein from hepatitis C virus. *Eur. Biophys J.* **39**:1097-104 (peer reviewed, invited review)
- Wu, C.H., Grant, C.V., **Cook, G.A.**, Park S.H., Opella S.J. (2009) A strip-shield improves the efficiency of a solenoid coil in probes for high-field solid-state NMR of lossy biological samples. *J. Magn. Reson.* **200**:74-80
- Cook, G.A.**, Pajewski, R., Aburi, M., Smith, P.E., Prakash, O., Tomich, J.M., Gokel, G. (2006) NMR structure and dynamics studies of an anion binding channel-forming heptapeptide. *J. Am. Chem. Soc.* **128**: 1633-1638.
- Johnston, J.M., **Cook, G.A.**, Samson, M.S., Tomich, J.M. (2006) Conformation and environment of channel-forming peptides: A Simulation Study. *Biophys. J.* **90**: 1855-1864
- Shank, L.P., Broughman, J.R., Takeguchi, W., **Cook, G.A.**, Robbins, A.S., Hahn, L., Radke, G., Iwamoto, T., Schultz, B.D. and Tomich, J.M. (2006) Redesigning channel-forming peptides: Amino acid substitutions that enhance rates of supramolecular self-assembly and raise ion transport activity. *Biophys. J.* **90**:2138-2150
- Cook, G.A.**, Prakash, O., Zhang, K., Shank, L.P., Takeguchi, W.A., Robbins, A., Gong, Y.X., Iwamoto, T., Schultz, B.D., Tomich, J.M. (2004) Activity and structural comparisons of solution associating and monomeric channel-forming peptides derived from the glycine receptor M2 segment. *Biophys. J.* **74**:1424-1435