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Citizenship

U.S. Citizen

Education

Ph.D., Microbiology
University of Georgia

B.S., Biological Sciences & Genetic Biology, Honors Research Program
Purdue University

Summer Course in Microbial Diversity
Marine Biological Laboratory, Woods Hole, Massachusetts

Work Experience

Associate Research Professor
07/2014 – present Arizona State University Tempe, AZ
Biodesign Center for Applied Structural Discovery

Assistant Research Scientist
01/2012 – 06/2014 Arizona State University Tempe, AZ
Biodesign Center for Innovations in Medicine

Research Assistant Professor
01/2004 – 06/2009 Medical University of South Carolina Charleston, SC
Department of Biochemistry & Molecular Biology

Associate Research Scientist
08/2001 – 07/2003 Yale University New Haven, CT
Molecular Biophysics & Biochemistry

Post-doctoral Fellow
06/1997 – 07/2001 Yale University New Haven, CT
Molecular Biophysics & Biochemistry

Intellectual Property

Hansen D, Antonyrajah J & Fromme P (2025) Concentrated SDS-PAGE loading buffer: compositions, methods of preparation, and applications. WIPO international patent application WO 2025048289, filed September 26, 2025, Arizona Board of Regents on Behalf of Arizona State University.

Hansen D, Antonyrajah J, Fromme P (2024) Concentrated SDS-PAGE loading buffer: compositions, methods of preparation, and applications. USPTO U.S. Patent Application 63/700,242, filed September 27, 2024.

>300 unique **plasmid DNAs** and 2 unique *Escherichia coli* protein expression **strains** are available through the non-profit Addgene and DNASU repositories. Since 8/2020, these materials were **distributed to 77 unique institutions across 23 countries.**

Publications

http://www.ncbi.nlm.nih.gov/sites/myncbi/1NS_VusA66fkG/bibliography/43651356/public/?sort=date&direction=descending

Sonowal M, Ketawala G, Nagaratnam N, Logeswaran D, Basu S, de Sanctis D, Orlans J, Rose SL, Jernigan RJ, Hu H, Aguilar JDM, Ranaweera ME, Zacks MA, Chen JJ, **Hansen DT**, Schrag LG, Fromme R, Botha S, Fromme P (2025) Functional implications of hexameric dynamics in SARS-CoV-2 Nsp15. *Protein Sci* 34, e70115. PDB accession

numbers **9MRU 9MRY 9MRW**. http://dx.doi.org/10.1002/pro.70115

Botha S, Jernigan R, Logeswaran D, Doppler D, Nagaratnam N, Sonker M, Yang J-H, Ketawala G, Martin-Garcia JM, Shelby ML, Grant TD, Mariani V, Tolstikova A, Sheikh MZ, Yung MC, Coleman MA, Zaare S, Kaschner EK, Rabbani MT, Nazari R, Zacks MA, Hayes B, Sierra RG, Hunter MS, Lisova S, Batyuk A, Kupitz C, Boutet S, **Hansen DT**, Kirian RA, Schmidt M, Fromme R, Frank M, Ros A, Chen JJ & Fromme P (2023) Room temperature structural studies of SARS-CoV-2 protein, NendoU, with an X-ray free electron laser. *Acta Cryst* A79, C551. http://dx.doi.org/10.1107/S2053273323090654

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Antonyrajah J, Goode MR, Kaschner EK, **Hansen DT** & Fromme P (2023) Structure determination of outer surface protein BBA57 from the Lyme disease pathogen support the structure-based design of needed therapeutics. *Acta Cryst* A79: a380. http://dx.doi.org/10.1107/S2053273323096195

Jeyasothy K, Zhang S, Martin-Garcia JM, Aguilar DM, **Hansen DT**, Fromme P & Burnett JC, Jr. (2023) Structural studies of the human particulate guanylyl cyclase receptor A (pGC-A), to support therapeutics for cardiovascular diseases. *Acta Cryst* A79: a371. http://dx.doi.org/10.1107/S2053273323096286

Ranaweera E, Huseby CJ, **Hansen DT**, Chiu PL, Coleman P & Fromme P (2023) Cellular models for the investigation of the structural dynamics and activity of human tau protein aggregate formation. *Biophys J* 122: 41a-42a. http://dx.doi.org/10.1016/j.bpj.2022.11.436

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Kaschner EK, Olson TL, Craciunescu FM, **Hansen DT**, Liu J, Fromme P. (2021) Biophysical characterization and a roadmap towards the NMR solution structure of G0S2, a key enzyme in non-alcoholic fatty liver disease. *PLoS One* 16, e0249164. PMCID: PMC8279337. https://doi.org/10.1371/journal.pone.0249164

Echelmeier A, Villarreal JC … **Hansen DT** … Fromme P, Kirian RA, Ros A (2020) Segmented flow generator for serial crystallography at the European X-ray free electron laser. *Nat Commun* 11, 4511. PMCID: PMC7481229. https://doi.org/10.1038/s41467-020-18156-7

Zook JD, Shekhar M, **Hansen DT**, Conrad C, Grant TD, Gupta C, White T, Barty A, Basu S, Zhao Y, Zatsepin NA, Ishchenko A, Batyuk A, Gati C, Li C, Galli L, Coe J, Hunter M, Liang M, Weierstall U, Nelson G, James D, Stauch B, Craciunescu F, Thifault D, Liu W, Cherezov V, Singharoy A, Fromme P (2020) XFEL and NMR structures of *Francisella* lipoprotein reveal conformational space of drug target against tularemia. *Structure* 28, 540-547.e3. PDB accession number **6PNY**. https://doi.org/10.1016/j.str.2020.02.005

Robertson KE, Truong CD, Craciunescu FM, Yang JH, Chiu PL, Fromme P, **Hansen DT** (2019) Membrane directed expression in *Escherichia coli* of BBA57 and other virulence factors from the Lyme disease agent *Borrelia burgdorferi*. *Sci Rep* 9, 17606. PMCID: PMC6879480. https://doi.org/10.1038/s41598-019-53830-x

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Proposals Written as Lead PI

NIH NIAID R21 (new), Co-PIs Petra Fromme & Po-Lin Chiu. Submitted 10/13/2025.

Arizona Department of Health Services, Arizona Biomedical Research Centre, Investigator Grant. “Membrane-Translocation Provides a New View into Defeating Lyme Disease.” Collaborators Petra Fromme & Abhishek Singharoy. Pre-Proposal submitted 9/4/2025.

**** INVITED FULL PROPOSAL **** **Department of Defense**, Congressionally Directed Medical Research Programs, Tick-Borne Disease Research Program, Idea Award. “Membrane Translocation is a New Approach to Tick-Borne Disease Drug Development.” Co-PIs Petra Fromme & Abhishek Singharoy. Pre-Proposal submitted 6/26/2024; full proposal submitted 10/3/2024.

Department of Defense, Congressionally Directed Medical Research Programs, Tick-Borne Disease Research Program, Idea Award. “A New View for Tick-Borne Disease Drug Development: Imaging Membrane-Translocated Outer Surface Proteins.” Co-PIs Petra Fromme & Abhishek Singharoy. Pre-Proposal submitted 5/25/2023.

**** INVITED FULL PROPOSAL **** **Department of Defense,** Congressionally Directed Medical Research Programs, Tick-Borne Disease Research Program, Therapeutic/ Diagnostic Research Award. “A New View for Tick-Borne Disease Drug Development: Imaging Membrane-Translocated Outer Surface Proteins.” Co-PIs Petra Fromme & Abhishek Singharoy. Pre-Proposal submitted 5/23/2022; full proposal submitted 8/25/2022.

Bay Area Lyme Foundation, “A New View for Lyme Disease Drug Development: Imaging Membrane-Translocated Outer Surface Proteins.” Co-PI Petra Fromme. Submitted 6/30/2022.

**** FUNDED **** **ASU Women and Philanthropy,** “A New View for Drug Design Against Lyme Arthritis: Imaging Proteins at the Bacterial Outer Surface.” Co-PI Petra Fromme. Funded period 07/01/2022-12/31/2023. Pre-proposal & final proposal submitted 9/3/2021 & 2/23/2022.

**** SCORED **** **NIH NIAID R21 (new),** “A New View for Lyme Disease Drug Development: Imaging Membrane-translocated Outer Surface Proteins.” Co-PI Petra Fromme. Submitted 2/14/2022.

Bay Area Lyme Foundation, “A New View for Lyme Disease Drug Development: Imaging

Membrane-Translocated Outer Surface Proteins." Co-PI Petra Fromme. Submitted 9/30/2021.

Bay Area Lyme Foundation, "A New View for Lyme Disease Drug Development: Imaging Membrane-Translocated Outer Surface Proteins." Co-PI Petra Fromme. Submitted 1/31/2021.

Infectious Diseases Society of America, "The role of the Lyme neuroborreliosis outer surface lipoprotein VlsE in Alzheimer's disease." Co-PI Petra Fromme. Submitted 9/21/2021.

Bay Area Lyme Foundation, "A new view for the structure-based design of Lyme disease therapeutics: outer surface proteins oligomerize at the cell surface." Co-PI Petra Fromme. Submitted 6/30/2020.

Department of Defense, Congressionally Directed Medical Research Programs, Tick-Borne Disease Research Program, Idea Development Award. "Multimerization of outer surface proteins as a new paradigm for targeting the Lyme disease pathogen." Co-PI Petra Fromme. Pre-Proposal submitted 5/26/2020.

**** FUNDED *** **ASU/NASA Space Grant, Undergraduate Internship,** "Toward structure-based drug design against natively-folded P66, a key to Lyme disease infectivity & dissemination in heart & ear." Served as mentor for Christopher Ramirez. Fall 2020 – Spring 2021.

**** FUNDED *** **ASU Graduate and Professional Student Association JumpStart Research Grant,** "What the human immune system really sees during Lyme disease infection: purification of the Lyme disease vaccine component, outer surface protein A (OspA), toward the first described atomic-resolution images of its cell-membrane embedded form." Served as mentor for Emily Kaschner. Awarded 5/18/2020.

**** FUNDED *** **ASU Graduate and Professional Student Association JumpStart Research Grant,** "*Francisella* lipoprotein 3 has potential to be a drug target for the deadly disease tularemia." Served as mentor for Matthew Goode. Awarded 5/18/2020.

NIH NIAID R21 (new), "Structural analysis of a membrane-translocated form of lipoprotein BBA57, a multifactorial modulator of Lyme disease early infection." Co-PI Petra Fromme. Submitted 10/14/2019.

Steven & Alexandra Cohen Foundation, "Structural Studies of Membrane-Translocated BBA57, an Arthritogenic, Immune Modulating Lipoprotein." Co-PI Petra Fromme. Submitted 8/15/2019.

Global Lyme Alliance, "Structural Studies of a Membrane-Translocated Form of the Arthritogenic Lipoprotein BBA57." Co-PI Petra Fromme. Submitted 7/22/2019.

Department of Defense, Congressionally Directed Medical Research Programs, Tick-Borne Disease Research Program, Investigator-Initiated Research Award. "Mechanisms of Lyme Disease Pathogenesis Revealed by Structures of Membrane-Translocated Virulence Determinants." Co-PI Petra Fromme. Pre-Proposal submitted 5/22/2019.

**** SCORED *** **NIH NIAID R21 (resubmission),** "Structural analysis of a membrane-translocated form of lipoprotein BBA57, a multifactorial modulator of Lyme disease early infection." Co-PI Petra Fromme. Submitted 3/15/2019.

Bay Area Lyme Foundation, Emerging Leader Award, "Structures of membrane-translocated virulence determinants from the Lyme disease pathogen." Co-PI Petra Fromme. Submitted 3/1/2019.

NIH NIAID R21 (new), "Structural analysis of a membrane-translocated form of lipoprotein BBA57, a multifactorial modulator of Lyme disease early infection." Co-PI Petra Fromme.

Submitted 6/16/2018.

Global Lyme Alliance, "Developing Structure-based Treatments for Lyme Disease." Co-PIs Petra Fromme & Ying Zhang (Johns Hopkins Univ.). Submitted 9/15/2017.

**** FUNDED *** **ASU Biodesign Institute Seed Grant,** "Development of Genetic Immunization Approaches to Produce Novel Ligands for Membrane Protein Targets of Structural and Therapeutic Interest." Co-PI Stephen A. Johnston. 07/01/2015-06/30/2016.

**** FUNDED *** **Postdoctoral Fellowship,** NIH National Institute of General Medical Sciences, F32GM019278, "Novel Components in Archaeal Translation." Mentor, Dieter Söll. 12/1997-01/2000.

Manuscript Reviewer

Protein Science
PLoS ONE
Molecular Biology Reports
Applied Microbiology and Biotechnology
Virulence
Archives of Microbiology
Future Microbiology
Microbial Cell Factories

Teaching

MBB 493 – Honors Thesis

MBB 492 – Honors Directed Study

MBB 495, BIO 495 – Undergraduate Research

Service, Mentorship, & Outreach

Proposal Reviewer, Arizona Department of Health Services, 12/2025-.

Proposal Reviewer, ASU Limited Submissions panels, 04/2020-.

Mentor, ASU Barrett Honors undergraduate theses, 01/2014-05/2021; 05/2025-.

Member, Academic Professional Personnel Committee, ASU Office of Knowledge Enterprise Development, 01/2019-.

Lead, Lyme Disease table, ASU Open Door public outreach events, 2024, 2023, 2020.

Member, ASU Biodesign Faculty Chalk Talk committee, 08/2020-07/2023 (3 year term).

Proposal Reviewer, ASU Biodesign internal submissions, 2023.

Conference Chair, International SMALP Conference, 12/2022.

Mentor, ASU/NASA Space Grant, 07/2020-08/2021.

Conference Chair, Cambridge Healthtech Institute's Discovery on Target symposium, Antibodies Against Membrane Protein Targets, Boston, Massachusetts, 2016.

Scientific Meetings

Targeting the bacterial outer surface of tick-borne pathogens. Talk & poster. **Outstanding Poster Award**. 18th International Conference on the Crystallization of Biological Macromolecules, Tempe, Arizona, 2024.

Membrane translocation reveals that oligomerization is a recurring theme in the structures of outer membrane (lipo)proteins from pathogenic bacteria. Poster. Symposium: Aspects of Imaging, Diffraction, and Crystallography: Where John Spence's Legacy Takes Us, Tempe, Arizona, 2022.

Advances in the structural biology of the outer surface proteins from the Lyme disease pathogen support the structure-based design of needed therapeutics. Poster. 9th Annual BioXFEL International Conference, Tempe, Arizona, 2022.

The first images of a membrane-translocated virulence determinant from the Lyme disease pathogen. Invited seminar. ASU Biodesign Faculty Chalk Talks, Tempe, Arizona, 2020.

In vivo presentation to generate antibody-based structural ligands against membrane proteins. Talk & Poster. *Nature* Conference: Functional dynamics – visualizing molecules

in action, Tempe, Arizona, 2019.

Generation of high specificity antibodies against membrane proteins using DNA-gold micronanoplexes for gene gun immunization. Poster. Cambridge Healthtech Institute's Discovery on Target symposium Antibodies Against Membrane Protein Targets, Boston, Massachusetts, 2017.

Heterologous expression of bacterial inner and outer membrane proteins in *E. coli* for structural studies. Invited seminar. GTCbio's 4th Protein Expression, Purification & Characterization Conference, Boston, Massachusetts, 2016.

Efficiency of genetic immunization for the generation of antibodies against membrane proteins. Invited seminar. Cambridge Healthtech Institute's Discovery on Target symposium Antibodies Against Membrane Protein Targets, Boston, Massachusetts, 2016.

Expression strategies towards the structural determination of membrane proteins from *Francisella tularensis* SCHU S4. Poster. Cambridge Healthtech Institute's PepTalk: Membrane Proteins, A Valuable Resource and Target, San Diego, California, 2015.

Production and characterization of high-specificity polyclonal antibodies against membrane proteins from highly infectious agents in the absence of purified membrane protein. Poster. Cambridge Healthtech Institute's Discovery on Target symposium, Antibodies Against Membrane Protein Targets Parts 1 & 2, Boston, Massachusetts, 2014.

Reagents for membrane proteins from highly infectious agents: generation of target-specific mouse polyclonal antibodies in the absence of membrane protein. Poster. NIGMS Structural Biology Horizons Workshop, Bethesda, Maryland, 2013.

Production and characterization of polyclonal antibodies against membrane proteins from infectious microbes in the absence of soluble protein. Poster. PSI:Biology Technologies Workshop, Bethesda, Maryland, 2012.

hTR and hTERT assemble into active human telomerase in the absence of all other eukaryotic factors. Poster. Cold Spring Harbor Meeting on Telomeres and Telomerase, Cold Spring Harbor, New York, 2009.

Expression and assembly of active human telomerase in bacteria. Poster. Hollings Cancer Center Scientific Research Retreat, Charleston, South Carolina, 2008.

Large scale purification and crystallography of tipin, a cell cycle checkpoint protein. Poster. Symposium for Structural Biology, Medical University of South Carolina Center for Structural Biology, Charleston, South Carolina, 2008.

Structural studies of the assembly and function of human telomerase. Poster. Hollings Cancer Center Scientific Research Retreat, Charleston, South Carolina, 2005.

Naturally-occurring mischarging aminoacyl-tRNA synthetases. Poster. Gordon Research Conference, Nucleic Acids, Bristol, Rhode Island, 2002.

Indirect aminoacyl-tRNA synthesis in *Methanothermobacter thermautotrophicus*. Poster. Gordon Research Conference on Archaea, Andover, New Hampshire, 2001.

An archaeal-specific glutamyl-tRNA^{Gln} amidotransferase. Invited seminar. 18th tRNA Workshop, Cambridge, United Kingdom, 2000.

A genetics system for *Methanococcus maripaludis*. Invited seminar. Gordon Conference on Archaea: Ecology, Metabolism & Molecular Biology, Plymouth, New Hampshire, 1996.

Skills

Project design, management, and budgets.

Proposals, manuscripts, peer reviews, technical reports, standard operating procedures,

data analysis, and oral presentations.

Patent applications, intellectual property, technology development, and interdisciplinary collaborations.

Supervision, training, and mentoring of laboratory technicians and students (graduate, medical, undergraduate, and high school).

Management of the laboratory equipment, supplies, bacterial and archaeal strain collections, nucleic acid collections, chemicals, radiochemicals, biosafety (BSL1 and BSL2), chemical safety, and general laboratory safety.

Advanced recombinant DNA technology and plasmid design; PCR, DNA sequencing and transformation, transduction, and bioinformatics.

Membrane proteins, bacterial lipoproteins, RNA biochemistry, protein expression, protein purification, gel electrophoresis, and enzymatic assays.

Immunological methods: ELISAs, western immunoblots, and B cell isolation.

Antibody generation by DNA and protein immunization.

Mouse handling.

Development and management of IACUC animal protocols.

In vitro transcription and in vitro translation.

Peptide microarrays, protein microarrays, and array analyses.

Vaccine development against pathogens and cancer.

Identification and characterization of novel genes, enzymes, and biochemical pathways.

Genetics and gene knockouts in bacteria and archaea.

Chromatography (FPLC, HPLC, TLC, GC) and spectrophotometry.

Radiolabel and stable isotope methods (^{14}C, ^{13}C, ^{3}H, ^{32}P, ^{35}S).

Sterile microbiological technique.

Microbial growth in fermentors and on gaseous substrates.

Growth and culturing of diverse microbes, including strict anaerobes, thermophiles, photosynthetic bacteria, radioresistant microbes, and archaea.

Compressed gas handling systems and gas measurements (methane, CO_2, H_2, N_2, Ar).

Characterization of natural microbial populations and isolates.