

Joshua James Ziarek
Assistant Professor of Molecular and Cellular Biochemistry
Indiana University

Google Scholar Index: <https://scholar.google.com/citations?user=GbueUdgAAAAJ&hl=en>
ORCID ID: <http://orcid.org/0000-0002-3740-9999>

TRAINING

- 2012-2017 Postdoctoral Fellow, Harvard Medical School
Mentor: Prof. Gerhard Wagner
- 2011-2012 Postdoctoral Fellow, Medical College of Wisconsin
Mentor: Prof. Sam T. Hwang and Prof. Brian F. Volkman
- 2007-2011 PhD, Biochemistry, Medical College of Wisconsin
Dissertation: Biophysical analysis of CXCL12/CXCR4 interactions and structure-guided inhibitor discovery
Mentor: Prof. Brian F. Volkman
- 2003-2007 BS, Biology and Chemistry, University of Wisconsin – Milwaukee
Mentor: Prof. J. Rudi Strickler

APPOINTMENTS

- 2017- Assistant Professor, Department of Molecular and Cellular Biochemistry, Indiana University
- 2015-2016 Visiting Researcher with Prof. Masatsune Kainosho, Nagoya University, Japan
- 2011-2012 Postdoctoral Fellow with Prof. Sam T. Hwang and Prof. Brian F. Volkman, Medical College of Wisconsin, USA
- 2007-2011 Graduate Research Assistant with Prof. Brian F. Volkman, Medical College of Wisconsin, USA
- 2004-2007 Undergraduate Research Assistant with Prof. J. Rudi Strickler, University of Wisconsin-Milwaukee, USA

FELLOWSHIPS AND AWARDS

Fellowships

- 2015 Pathway to Independence Award (K99/R00), National Institutes of Health
- 2014 Postdoctoral Fellowship (Short-term), Japan Society for the Promotion of Science (*Declined*)
- 2012 Individual Ruth L. Kirschstein National Research Service Award (NRSA), National Institutes of Health
- 2011 Postdoctoral Fellowship in Cancer Research, Cancer Center of the Medical College of Wisconsin
- 2006 Research Experience for Undergraduates (REU) Fellowship, National Science Foundation

Awards and Honors

- 2016 Young Investigator Award, International Conference on Magnetic Resonance in Biological Systems
- 2012 Outstanding Doctoral Dissertation Award, Medical College of Wisconsin
- 2011 Friends of MCW Graduate Student Travel Award, Medical College of Wisconsin
- 2010 1st Prize in American Chemical Society Poster Session – Milwaukee Chapter
- 2010 Student Travel Award, American Chemical Society – Milwaukee Chapter
(Declined)

PUBLICATIONS

33 articles, 1594 citations, H-index = 21 (Google Scholar)

‡ = peer reviewed, † = at Indiana University

PRIMARY RESEARCH PUBLICATIONS

- 27.^{‡†} Bumbak, F., Pons, M., Inoue, A., Paniagua, J.C., Yan, F., Wu, H., Robson, S.A., Bathgate, R.A.D., Scott, D.J., Gooley, P.R. & Ziarek, J.J. Ligands tune the local and global motions of neurotensin receptor 1 (NTS1): a DFT-guided solution NMR analysis. **Cell Reports**, *in press*. <https://doi.org/10.1101/2022.08.09.503369>.
- 26.^{‡†} Dixon, A.D., Robson, S.A., Trinidad, J.C. & Ziarek, J.J. 2022. A method for Selective ¹⁹F-Labeling Absent of Probe Sequestration (SLAPS). **Protein Science**, 31(11):e4454.
- 25.^{‡†} Dixon, A.D., Inoue, A., Robson, S.A., Culhane, K.J., Trinidad, J.C., Sivaramakrishnan, S., Bumbak, F. & Ziarek, J.J. 2022. Effect of ligands and transducers on the Neurotensin Receptor 1 (NTS1) conformational ensemble. **Journal of the American Chemical Society**, 144(23):10241-10250.
- 24.^{‡†} Melland, H., Bumbak, F., Kolesnik-Taylor, A., Ng-Cordell, E., John, A., Constantinou, P., Joss, S., Larsen, M., Fagerberg, C., Thies, J., Emslie, F., Willemsen, M., Kleefstra, T., Pfundt, R., Barrick, R., Chang, R., Loong, L., Alfadhel, M., van der Smagt, J., Nizon, M., Kurian, M., Scott, D.J., Ziarek, J.J., Gordon, S. & K. Baker. 2021. Expanding the genotype and phenotype spectrum of SYT1-associated neurodevelopmental disorder. **Genetics in Medicine**, 24(4):880-893.
- 23.^{‡†} Chamness, L.M., Zelt, N.B., Kuntz, C.P., Bender, B.J., Penn, W.D., Ziarek, J.J., Meiler, J. & Schleich, J.P. 2021. Molecular basis for the evolved instability of a human G-protein coupled receptor. **Cell Reports**, 37(8):110046.
- 22.^{‡†} Robson, S.A., Dağ, Ç., Wu, H. & Ziarek, J.J. 2021. TRACT revisited: an algebraic solution for determining overall rotational correlation times from cross-correlated relaxation rates. **Journal Biomolecular NMR**, 75(8):293-302.
- 21.^{‡†} Hitchinson, B., Eby, J., Gao, X., Guite-Vinet, F., Ziarek, J.J., Abdelkarim, H., Lee, Y., Okamoto, Y., Shikano, S., Majetschak, M., Heveker, N., Volkman, B.F., Tarasova, N.I. & V. Gaponenko. 2018. Biased antagonism of CXCR4 avoids antagonist tolerance. **Science Signaling**, 11:eaat2214.
- 20.^{‡†} Gruenhagen, T.C., Ziarek, J.J. & J.P. Schleich. 2018. Bicelle size modulates the rate of bacteriorhodopsin folding. **Protein Science**, 27(6):1109-1112.
- 19.[‡] Chhabra, S., Fischer, P., Takeuchi, K., Dubey, A., Ziarek, J.J., Boeszoermyeni, A., Mathieu, D., Bermel, W., Davey, N.E., Wagner, G. & Arthanari, H. A. 2018. ¹⁵N Detection Harnesses the Slow Relaxation Property of Nitrogen: Delivering enhanced resolution for

- intrinsically disordered proteins. **Proceedings of the National Academy of Sciences of the United States of America**, 115(8):E1710-1719.
- 18.‡ Ziarek, J.J., Kleist, A.B., London, N., Raveh, B., Montpas, N., Bonnetterre, J., St-Onge, G., DiCosmo-Ponticello, C.J., Koplinski, C.A., Roy, I., Stephens, B., Thelen, S., Veldkamp, C.T., Coffman, F.D., Cohen, M.C., Dwinell, M.B., Thelen, M., Peterson, F.C., Heveker, N. & Volkman, B.F. 2017. Structural basis for chemokine recognition of a G protein-coupled receptor and implications for receptor activation. **Science Signaling**, 10:eaah5756.
- 17.‡ Nihongi, A., Ziarek, J.J., Uttieri, M., Sandulli, R., Zambianchi, E. & Strickler, J.R. 2016. Behavioral interseasonal adaptations in *Daphnia pulex* (Crustacea: Cladocera) as induced by predation infochemicals. **Aquatic Ecology**, doi:10.1007/s10452-016-9585-0.
- 16.‡ Smith, E., Liu, Y., Getschman, A.E., Peterson, F.C., Ziarek, J.J., Li, R., Volkman, B.F. & Chen, Y. 2014. Structural analysis of a novel small molecule ligand bound to the CXCL12 chemokine. **Journal of Medicinal Chemistry**, 57(22):9693-9699.
- 15.‡ Wommack, A.J., Ziarek, J.J., Tomaras, J., Chileveru, H.R., Zhang, Y., Wagner, G. & Nolan, E.M. 2014. Discovery and characterization of a disulfide-locked C2-symmetric defensin peptide. **Journal of the American Chemical Society**, 136(39):13494-13497.
- 14.‡ Verkaar, F., van Offenbeek, J., van der Lee, M.M.C., van Lith, L.H.C.J., Watts, A.O., Rops, A.L.W.M.M., Aguilar, D.C., Ziarek, J.J., van der Vlag, J., Handel, T.M., Volkman, B.F., Proudfoot, A.E.I., Vischer, H.F., Zaman, G.J.R., & Smit, M.J. 2014. Chemokine cooperativity is caused by competitive glycosaminoglycan binding. **Journal of Immunology**, 192(8):3908-3914.
- 13.‡ Ziarek, J.J.★, Getschman, A.E.★, Butler, S.J., Taleski, D., Stephens, B., Kufareva, I., Handel, T.M., Payne, R.J. & Volkman, B.F. 2013. Sulfopeptide probes of the CXCR4/CXCL12 interface reveal oligomer-specific contacts and chemokine allostery. **ACS Chemical Biology**, 8:1955-1963. ★*Equal contributors*.
- 12.‡ Ziarek, J.J., Veldkamp, C.T., Zhang, F. Murray, N.J., Kartz, G.A., Liang, X., Su, J., Baker, J.E., Lindhardt, R.J. & Volkman, B.F. 2013. Heparin Oligosaccharides Inhibit Chemokine (CXC Motif) Ligand 12 (CXCL12) Cardioprotection by Binding Orthogonal to the Dimerization Interface, Promoting Oligomerization, and Competing with the Chemokine (CXC Motif) Receptor 4 (CXCR4) N Terminus. **Journal of Biological Chemistry**, 288:737-746.
- 11.‡ Ziarek, J.J.★, Liu, Y.★, Smith, E., Chen, J., Peterson, F.C., Zhang, G., Yu, Y., Chen, Y., Volkman, B.F. & Li, R. 2012. Fragment-based optimization of small molecule CXCL12 inhibitors for antagonizing the CXCL12/CXCR4 interaction. **Current Topics in Medicinal Chemistry**, 12:2727-2740. ★*Equal contributors*.
- 10.‡ Takekoshi, T., Ziarek, J.J., Volkman, B.F. & Hwang, S.T. 2012. A locked, dimeric CXCL12 variant effectively inhibits pulmonary metastasis of CXCR4-expressing melanoma cells due to enhanced serum stability. **Molecular Cancer Therapeutics**, 11:2516-2525.
- 9.‡ Mysinger, M.M.★, Weiss, D.R.★, Ziarek, J.J.★, Gravel, S., Doak, A.K., Karpiak, J., Heveker, N., Shoichet, B.K. & Volkman, B.F. 2012. Structure-based ligand discovery for chemokine receptor CXCR4. **Proceedings of the National Academy of Sciences of the United States of America**, 109: 5517-5522. ★*Equal contributors*.

- 8.‡ Love, M., Sandberg, J.L., Ziarek, J.J., Rode, R.R., Gerarden, K.P., Jensen, D.R., McCastlin, D., Peterson, F.C. & Veldkamp, C.T. 2012. Solution structure of CCL21 and identification of a putative CCR7 binding site. **Biochemistry**, 51(3): 733-735.
- 7.‡ Drury, L.D.★, Ziarek, J.J.★, Gravel, S., Veldkamp, C.T., Takekoshi, T., Hwang, S.T., Heveker, N., Volkman, B.F. & Dwinell, M.B. 2011. Monomeric and dimeric CXCL12 inhibit metastasis through distinct CXCR4 interactions and signaling pathways. **Proceedings of the National Academy of Sciences of the United States of America**, 108: 17655-17660. ★*Equal contributors*.
- 6.‡ Saini, V., Staren, D.M., Ziarek, J.J., Nashaat, Z.N., Campbell, E.M., Volkman, B.F., Marchese, A. & Majetschak, M. 2011. The CXC chemokine receptor 4 ligands ubiquitin and stromal-cell derived factor-1 α function through distinct receptor interactions. **Journal of Biological Chemistry**, 286: 33466-33477.
- 5.‡ Ziarek, J.J., Heroux, M.S., Veldkamp, C.T., Peterson, F.C. & Volkman, B.F. 2011. Sulfotyrosine recognition as marker for druggable sites in the extracellular space. **International Journal of Molecular Sciences**, 12(6), 3740-3756.
- 4.‡ Ziarek, J.J., Nihongi, A., Nagai, T., Uttieri, M., Zambianchi, E., & Stricker, J.R. 2011. Seasonal adaptations of *Daphnia pulex* swimming behaviour: the effect of water temperature. **Hydrobiologia**, 661: 317-327.
- 3.‡ Nihongi, A., Ziarek, J.J., Nagai, T., Uttieri, M., Zambianchi, E. & Strickler, J.R. 2011. *Daphnia pulex* hijacked by *Vibrio cholera*: Altered swimming behaviour and predation risk Implications. In: **Zooplankton and Phytoplankton**. Ed: Katell, G. Nova Science Publishers.
- 2.‡ Veldkamp, C.T., Ziarek, J.J., Peterson, F.C., Chen, Y. & Volkman, B.F. 2010. Targeting SDF-1/CXCL12 with a ligand that prevents activation of CXCR4 through structure based drug design. **Journal of the American Chemical Society**, 132: 7242-7243.
- 1.‡ Veldkamp, C.T., Ziarek, J.J., Su, J., Basnet, H., Lennertz, R., Weiner, J.J., Peterson, F.C., Baker, J.E. & Volkman, B.F. 2009. Monomeric structure of the cardioprotective chemokine SDF-1/CXCL12. **Protein Science**, 18:1359-1369.

REVIEWS AND BOOK CHAPTERS

- 6.‡ Ziarek, J.J., Baptista, D. & Wagner, G. 2018. Recent developments in solution NMR-based molecular biology. **Journal of Molecular Medicine**, 96:1-8.
- 5.‡ Kleist, A.B., Getschman, A.E., Ziarek, J.J., Nevins, A.M., Gauthier, P-A., Chevigne, A., Szpakowska, M. & Volkman, B.F. 2016. New paradigms in chemokine receptor signal transduction: moving beyond the two-site model. **Biochemical Pharmacology**, 114:53-68.
- 4.‡ Luna, R.E.★, Akabayov, S.R.★, Ziarek, J.J.★ & Wagner, G. 2013. Examining weak protein-protein interactions in start codon recognition via nuclear magnetic resonance spectroscopy. **FEBS Journal**, 281(8):1965-1973. ★*Equal contributors*.
- 3.‡ Ziarek, J.J. & Volkman, B.F. 2012. NMR in the analysis of functional chemokine interactions and drug discovery. **Drug Discovery Today: Technologies**, 9:e293-e299.
- 2.‡ Ziarek, J.J., Peterson, F.C., Lytle, B.L. & Volkman, B.F. 2011. Chapter ten: Binding site identification and structure determination of protein-ligand complexes by NMR. **Methods in Enzymology**, 493:241-275.

- 1.[‡] Strickler, J.R., Udvardia, A.J., Marino, J., Radabaugh, N., Ziarek, J.J., & Nihongi, A. 2005. Visibility as a factor in the copepod – planktivorous fish relationship. **Scientia Marina**, 69(Suppl. 1):111-124.

MANUSCRIPTS IN PEER-REVIEW

- 1.^{††} Bumbak, F., Inoue, A., Paniagua, J.C., Pons, M., Yan, F., Wu, H., Robson, S.A., Bathgate, R.A.D., Scott, D.J., Gooley, P.R. & Ziarek, J.J. The dynamic nature of neurotensin receptor 1 (NTS₁) allostery and signaling bias. *In revisions*.
<https://doi.org/10.1101/2022.11.25.517797>.

GRANTS

Pending

Title: Acquisition of an 800 MHz hybrid solution-/solid-state NMR spectrometer
 Source: NIH High-End Instrumentation (HEI) S10 OD032431-A1
 Role: PI
 Dates: 02/01/2023-01/31/2024
 Direct funds: \$2,000,000

Ongoing

Title: The role of dynamics in GPCR and arrestin allostery
 Source: NIH Maximizing Investigators' Research Award (MIRA-ESI) R35 GM138262
 Role: PI
 Dates: 07/2021-07/2026
 Direct funds: \$1,250,000

Title: Restoring Ocr11 function in Lowe Syndrome and Dent-2 disease
 Source: NIH R01 DK131049
 Role: Co-investigator (PI = Ruben C. Aguilar, Purdue University)
 Subcontract Dates: 04/2022-03/2023
 Total funds: \$115,555 (Subcontract)

Title: Molecular mechanisms of arrestin activation
 Source: Indiana CTSI Core Facility Pilot Funding
 Role: PI
 Dates: 08/2020-08/2022 (No Cost Extension until 08/2023)
 Direct funds: \$10,000

Completed

Title: Deciphering GPCR signal transduction through NMR structure and dynamics studies
 Source: NIH Pathway to Independence Award R00 GM115814
 Role: PI
 Dates: 09/2017-08/2020

Title: Deciphering GPCR signal transduction through NMR structure and dynamics studies

Source: NIH Pathway to Independence Award K99 GM115814

Role: PI (Mentor: Gerhard Wagner, PhD)

Dates: 09/2015-08/2017

Title: Structural basis for SCAP/SREBP interaction

Source: NIH Individual NRSA Fellowship F32 GM103005

Role: PI (Mentor: Gerhard Wagner, PhD)

Dates: 09/2012-08/2015

Title: Inhibiting melanoma metastasis with an engineered chemokine

Source: Medical College of Wisconsin Cancer Center

Role: PI (Mentors: Samuel T. Hwang, MD, PhD and Brian F. Volkman, PhD)

Dates: 09/2011-08/2012

PATENTS

4. Provisional patent application no. 61/695,027. Volkman, B., Ziarek, J., Peterson, F. Li, R., Chen. Y. Small Molecule CXCL12 Inhibitors.
3. Patent No. 11,369,662. Methods of treating inflammation with monomeric CXCL12 peptide. Volkman, B., Ziarek, J., Veldkamp, C., and Peterson, F. Issued on 6/28/2022. Expiration on 6/11/2035.
2. Patent No. 10,537,613. Monomeric CXCL12₁ peptide and methods of treating autoimmune diseases. Volkman, B., Ziarek, J., Veldkamp, C., and Peterson, F. Issued on 1/21/2020. Expiration on 8/15/2035.
1. Patent No. 9,908,923. Volkman, B., Ziarek, J., Veldkamp, C., and Peterson, F. A Monomeric CXCL12 peptide and methods of use thereof. Issued on 3/6/2018. Expiration on 7/21/2035.

STUDENTS AND POSTDOCS TRAINED

Previous Postdoctoral Trainees

Cagdas Dag, PhD, 2017-2018

Fabian Bumbak, PhD, 2018-2021

Previous Graduate Students

Mingzhe Pan (MS student), 2018-2021

Austin Dixon (PhD student) 2017-2022

Current Graduate Students

James Bower (PhD student), 2018-present

Thomas Shriver, III (PhD student), 2021-present

Skylar Zemmer (PhD student), 2021-present

Current Postdoctoral Trainees

Scott Robson, PhD, 2019-present

PhD Thesis Committee Member

Tanmaya Rasal (IU Biology; Mentor: Prof Julia van Kessel), 2021-present

Kait Taylor (IU Biochemistry; Mentor: Prof Matthew Bochmann), 2022-present

Austin Tedman (IU Biochemistry; Mentor: Prof Jonathan Schleich), 2022-present
 Jacklyn Gallagher (IU Chemistry; Mentor: Prof Jonathan Schleich), 2022-present
 Jiayan Cui (IU Biochemistry; Mentor: Prof Jesper Pallesen), 2022-present

UNDERGRADUATE RESEARCH MENTORED

Laboratory Volunteers

Alexis Lindahl, IU, 2021-present
 Ryan Cook, IU, 2019-2020
 Yunping Wang, IUPUI, 2018-2020
 Andrew Metzman, IU, 2018-2020
 Quinn Kaurich, IU, 2018-2020
 Seyda Balkan, Middle East Technical University, Turkey, Summer 2018

IU Minority Serving Institutes (MSI) STEM Initiative

GianCarlo Montiel, University of California-Merced, Summer 2019

CLASSROOM TEACHING

<u>Courses taught:</u>	<u>Enrollment</u>	<u>Semester</u>	<u>Year</u>
MLS440 – Membranes and Signal Transduction	10	Spring	2020
MLS440 – Membranes and Signal Transduction	11	Spring	2021
MLS440 – Membranes and Signal Transduction	10	Spring	2022

UNIVERSITY AND DEPARTMENTAL SERVICE

<u>University Service</u>	<u>Year</u>
Member, Structural Biology Search Committee, IU School of Medicine	2018

<u>Departmental Service</u>	<u>Year</u>
Faculty mentor, Biochemistry Graduate Program Social Committee	2019-present
Co-organizer, MolBioPhys working group	2018-present
Member, Biochemistry Graduate Program Admissions Committee	2017-present

ON CAMPUS PRESENTATIONS

2018	Deciphering GPCR signal transduction through solution NMR, Biology GCDB
2018	Cell-free protein synthesis, StruBIO Working Group
2017	Deciphering GPCR signal transduction through solution NMR, MCB BMB

INVITED SYMPOSIA AND CONFERENCE TALKS

2022	International Conference on Magnetic Resonance in Biology. Boston, MA. USA
2022	Great Lakes Regional GPCR Retreat. Toronto. Canada
2022	Biophysical Society Annual Meeting. San Francisco, CA. USA
2020	Gateway Regional NMR Meeting. Nashville, TN. USA (<i>COVID – virtual</i>)
2019	Gateway Regional NMR meeting. Ann Arbor, MI. USA
2019	Gordon Research Conference: Molecular Pharmacology. Ventura, CA. USA
2017	Gordon Research Seminar: Molecular Pharmacology. Tuscany. Italy
2015	Kyoto University RRR Workshop. Kyoto. Japan
2015	Annual Meeting of the NMR Society of Japan. Tokyo. Japan
2015	International Workshop: High Resolution Cell Biology. Nagoya. Japan

- 2010 Great Plains Regional Annual Symposium on Protein and Biomolecular NMR.
Lawrence, KS. USA
- 2007 American Society of Limnology and Oceanography: Aquatic Sciences Meeting.
Santa Fe, NM. USA
- 2005 University of Wisconsin Symposium for Undergraduate Research. Oshkosh, WI.
USA

INVITED SEMINARS

- 2022 Northwestern University Feinberg School of Medicine, USA, Department of
Pharmacology
- 2022 University of Florida, USA, Department of Chemistry (*COVID – virtual*)
- 2021 Indiana University School of Medicine, USA, Department of Biochemistry
(*COVID - virtual*)
- 2021 Indiana University School of Medicine, USA, Drug Discovery and Development
Working Group (*COVID – virtual*)
- 2019 Dortmund University, Germany, Faculty of Chemistry and Chemical Biology
- 2017 Tohoku University, Japan, Graduate School of Pharmaceutical Sciences
- 2017 Tokyo Metropolitan University, Japan, Department of Chemistry
- 2015 University of Hawaii, USA, Department of Chemistry
- 2013 Kyoto University, Japan, Biomolecular Function Chemistry Laboratory

PROFESSIONAL SERVICE

<u>Editorial Board</u>	<u>Year</u>
FEBS Letters	2019-present

<u>Grant review</u>	<u>Year</u>
NIH Special Emphasis Panel ZGM1-TWD-U-KR (K99/R00)	2022
Indiana CTSI	2021
NIH Special Emphasis Panel ZRG1-MDCN-R(04)	2020
Indiana CTSI	2020

Peer Review

Nature Structural and Molecular Biology

Trends in Pharmacological Sciences

Journal of Protein Expression and Purification

FEBS

Nature Communications

Society Memberships

American Chemical Society

Biophysical Society

Protein Society