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EDUCATION

- 2004 - 2009 Ph.D. in Biochemistry, University of Saskatchewan, Canada (Advised by Prof. Graham N. George)
Thesis title: "Structure-function relationships of molecules in cellular copper control."
- 2001 - 2002 Computer Science (for credits), University of Victoria, Canada
- 1998 - 2000 M.Sc. in Biochemistry, University of Victoria, Canada (Advised by Prof. Edward E. Ishiguro)
Thesis title: "The cloning, purification and preliminary functional studies on LytB in *E.coli*."
- 1993 - 1997 B.Sc. in Biochemistry, Jilin University, P.R. China

PROFESSIONAL EXPERIENCES

- 2015 – Present Assistant Professor, Department of Biochemistry and Redox Biology Center, University of Nebraska-Lincoln
Research Topic: Structural and functional investigations of enzymes in redox reaction and stress response
- 2009 – 2014 Postdoctoral Fellow (Natural Science and Engineering Council of Canada Postdoctoral Fellow [NSERC PDF] from 2009 – 2011) in Prof. Douglas C. Rees' group, California Institute of Technology
Research Topic: Structure- mechanism relationships of nitrogenase
- March–June 2009 Junior Consultant at the Canadian Light Source (contractor)
- 2004 – 2008 Assistant for commissioning at HXMA Beamline, Canadian Light Source (volunteer work)
- 2002 – 2003 Bioinformatics Database Administrator and Software Developer at Interomex Biopharmaceuticals Inc., Vancouver, Canada
- 2002 Bioinformatics Database Administrator and Software Developer at Perceptronix Medical Inc., Vancouver, Canada (internship)
- 2000 - 2001 Research Assistant, Department of Biochemistry and Microbiology, University of Victoria, Victoria, Canada (part-time)
- 1997 - 1998 Research Assistant, the Molecular Enzymology and Engineering Lab, Key Laboratory of China's Ministry of Education, Jilin University

RESEARCH EXPERTISE

- Protein crystallography
- X-ray absorption spectroscopy and site-specific X-ray absorption spectroscopy of metalloproteins and metallocomplexes
- High-resolution X-ray fluorescence imaging
- Redox biochemistry of metalloproteins

RESEARCH INTERESTS

- Structure-function relationships of metalloproteins and metallocomplexes in electron transfer, oxidative stress sensing and redox reactions
- Mechanisms of cellular transition metal homeostasis and detoxification
- Applications of microbes in bioenergy generation and bioremediation
- Development of synchrotron radiation-based techniques in inorganic and bioinorganic chemistry

TEACHING INTERESTS

- Teaching topics of undergraduate and graduate courses
 - Structural biology and biochemistry
 - Biological inorganic chemistry
 - Special topics:
 - Redox biology and biochemistry in bacterial pathogens
 - Application of Synchrotron radiation-based techniques in Redox Biology
- Topics for Outreach/High School Educations
 - Protein crystallization and crystallography
 - Redox biochemistry of metalloproteins
 - Identification of soil bacteria in the nitrogen cycle and bio-remediation
 - Antibiotic resistance

FELLOWSHIPS, AWARDS AND HONORS

- 2019–Current National Science Foundation (NSF) Faculty Early Career Development Award
- 2017-2019 New Project Leader of the Nebraska Center of Integrated Biomolecular Communication (CIBC)
- 2017 Royal Society of Chemistry Metallobiology Series Book prize award at the 18th International Conference of Biological Inorganic Chemistry
- 2015 – 2016 Research Development Fellow, the University of Nebraska-Lincoln
- 2013–2014 Center of Environmental Microbial Interactions (CEMI) Post-Doctoral Fellowship on the proposal “Site-specific X-ray absorption spectroscopic studies on nitrogen fixation,” co-proposed by L. Zhang, J. C. Peters, and D. C. Rees
- 2009– 2011 Natural Sciences and Engineering Research Council of Canada (NSERC) Postdoctoral Fellowship
- 1998– 2000 Fellowship at the University of Victoria

GRANTS AND GRANT PROPOSALS

Current Support

- National Science Foundation CAREER Award (Grant No 1846908), “Structure and Mechanism of an Iron-Sulfur Cluster-Based Nitric Oxide Sensor”, PI 07/01/2019 – 06/30/2024

Previous Support

- The New Project Leader award of the NIH-funded Nebraska Center for Integrated Biomolecular Communication ((P20GM113126), “A Unique Nitric Oxide Sensor and Regulator in Mycobacterium tuberculosis”, PI 08/01/2017 – 07/30/2019
- Nebraska Research Initiative - Equipment Purchase Grant, “*Application of MicroScale Thermophoresis in Characterization of Biomolecular Interactions*”, PI 05/01/2018 – 06/30/2018
- Revision Award, “Molecular mechanism for phenazine ring modifications during biosynthesis of the redox active antibiotics”, as a Co-PI with Dr. Liangcheng Du (UNL) 09/01/2017 – 08/31/2018
- RBC Pilot Grant, “Insights into a Unique Regulatory Network Controlling Multi-Antibiotic Resistance in Mycobacteria”, PI 07/01/2016 – 06/30/2017
- UNL Layman Award, " Mechanism of Multidrug Resistance Regulated by WhiB7 in *M. tuberculosis*", PI 06/01/2016 – 05/30/2017

SCIENTIFIC CONTRIBUTIONS

List of Publications

+these authors contribute equally, *corresponding authors, %undergraduate researchers

1. Wan, T. ⁺, Li, S. ⁺, Beltran, D. G. [%], Schacht, A. [%], Zhang, L., Becker, D. F., **Zhang, L-M.** “Structural basis of non-canonical transcriptional regulation by the σ^A -bound iron-sulfur protein WhiB1 in *M. tuberculosis*”, (2019) *Nucleic Acids Res.* (accepted with a “**breakthrough**” designation). <https://doi.org/10.1093/nar/gkz1133>
2. Gallenito, M. J., Irvine, G., **Zhang, L.**, Meloni, G. “Coordination plasticity guarantees metal substrate promiscuity in transmembrane primary-active Zn²⁺ pumps” (2019) *Chem. Comm.* 55:10844-10847
3. **Zhang, L-M.**, "X-ray absorption spectroscopy of metalloproteins", (2019), in Hu, Y. (ed.), “Metalloproteins: Methods and protocols, methods in molecular biology” (pp. 179-195), *Springer Science and Business Media, Humana Press*, New Jersey. (invited book chapter)
4. Jiang, J⁺. Beltran, D.G^{+,%}, Schacht, A. [%], **Zhang, L***, and Du, L*. “Functional and structural analysis of phenazine O-methyltransferase LaPhzM from *Lysobacter antibioticus* OH13 and one-pot enzymatic synthesis of the antibiotic myxin.” (2018) *ACS Chem. Biol.* 13: 1003-1012
5. Li, S., Wu, X., **Zhang, L.**, Shen, Y. and Du, L. “Activation of a cryptic gene cluster in *Lysobacter enzymogenes* reveals a module/domain portable mechanism of nonribosomal peptide synthetases in the biosynthesis of pyrrolopyrazines.” (2017) *Org. Lett.* 19: 5010-5013.

6. Spatzal, T., Schlesier, J., Burger, E. M., Sippel, D., **Zhang, L.**, Andrade, S. L. A., Rees, D. C., Einsle, O. "Nitrogenase FeMoco investigated by spatially resolved anomalous dispersion refinement." (2016) *Nat. Commun.* 7: 10902-10532.
7. Anderson, J., Cutsail III, G.E., Rittle, J., Connor, B. A., Gunderson, W. A., **Zhang, L.***, Hoffman, B. M.* and Peters, J. C.* "Characterization of an Fe≡N-NH₂ intermediate relevant to catalytic N₂ reduction to NH₃." (2015) *J Am. Chem. Soc.* 137: 7803-7809.
8. Mattle, D., **Zhang, L.**, Gourdon, P., Nissen, P., Rees, D. C. and Meloni, G. "A sulfur-based transport pathway for Cu⁺-ATPases." (2015) *EMBO J.* 16: 728-740.
9. Morrison, C., Hoy, J., **Zhang, L.**, Einsle, O. and Rees, D. C. "Substrate pathways in the nitrogenase MoFe protein by experimental identification of small molecule binding sites." (2015) *Biochemistry* 54: 2052-2060.
10. **Zhang, L.**, Morrison, C., Kaiser, J. T. and Rees, D. C. "Nitrogenase MoFe-protein from *Clostridium pasteurianum* at 1.08 Å Resolution: Comparison to the *Azotobacter vinelandii* MoFe-protein." (2015) *Acta Cryst D* 71: 274-282.
11. Meloni, G.*⁺, **Zhang, L.*⁺** and Rees, D. C.* "Transmembrane Type-2-like Cu²⁺ site in the P_{1B-3}-type ATPase CopB: implications for metal selectivity." (2014) *ACS Chem. Biol.* 9(1): 116-121.
12. **Zhang, L.**, Kaiser, J. T., Meloni, G., Yang, K. Y., Spatzal, T., Andrade, S. L. A., Einsle, O., Howard, J. B. and Rees, D. C. "The sixteenth iron in the nitrogenase MoFe-protein." (2013) *Angew. Chem. Int. Ed. Engl.* 52: 10529-10532.
13. Moret, M. E., **Zhang, L.** and Peters, J. C. "A polar copper-boron one-electron bond." (2013) *J. Am. Chem. Soc.* 135: 3792-3795.
14. Pushie, J.M., **Zhang, L.**, Pickering, I. J. and George, G. N. "The fictile coordination chemistry of cuprous-thiolate sites in copper chaperones." (2012) *BBA - Bioenergetics.* 1817: 938-947.
15. Spatzal, T., Aksoyoglu, M., **Zhang, L.** Andrade, S. L.A., Schleicher, E., Weber, S., Rees, D. C. and Einsle, O. "Direct evidence for interstitial carbon in nitrogenase FeMo cofactor." (2011) *Science.* 334:940-940.
16. Ma, Z., Cowart, D. M., Ward, B. P., Arnold, R. J., DiMarchi, R. D., **Zhang, L.**, George, G. N., Scott, R. A. and Giedroc, D. P. "Unnatural amino acid substitution as a probe of the allosteric coupling pathway in a mycobacterial Cu(I) sensor." (2009) *J. Am. Chem. Soc.* 131:18044-18045.
17. **Zhang, L.**, Lichtmanneger, J., Summer, K. H., Webb, S., Pickering, I. J. and George, G. N. "Tracing copper-thiomolybdate complexes in a prospective treatment for Wilson's disease." (2009) *Biochemistry* 48:891-897.
18. Bewer, B., Zhang, H., Zhu, Y., **Zhang, L.**, George, G.N., Pickering, I. J. and Chapman, D. "Development of a combined K-edge subtraction and fluorescence subtraction imaging system for small animals." (2008) *Rev. Sci. Instrum.* 79:085102-1-085102-3.
19. **Zhang, L.**, Pickering, I. J., Winge, D. R. and George, G. N. "X-ray absorption spectroscopy of cuprous-thiolate clusters in *Saccharomyces cerevisiae* metallothionein." (2008) *Chem. Biodivers.* 5:2042- 2049.
20. Zhang, H., Zhu, Y., Bewer, B., **Zhang, L.**, Korbas, M., Pickering, I. J., George, G. N., Gupta, M. and Chapman, D. "Comparison of iodine K-edge subtraction and fluorescence subtraction imaging in an animal system." (2008) *Nucl. Instrum. Methods Phys. Res. A.* 594: 283-291.

21. Chen, X., Hua, H., Balamurugan, K., Kong, X., **Zhang, L.**, George, G. N., Georgiev, O., Schaffner, W. and Giedroc, D. P. "Copper sensing function of *Drosophila* metal-responsive transcription factor-1 is mediated by a tetranuclear Cu(I) cluster." (2008) *Nucleic Acids Res.* 36 (9):3128-3138.
22. **Zhang, L.**, Nelson, K. J., Rajagopalan, K.V. and George, G. N. "Structure of molybdenum center in trimethylamine N-oxide reductase from *E. Coli*." (2008) *Inorg. Chem.* 47 (3): 1074-1078.
23. Rigby, K., **Zhang, L.**, Cobine, P. A., Tzagoloff, A., George, G. N. and Winge, D. R. "Characterization of the cytochrome *c* oxidase assembly factor Cox19 of *Saccharomyces cerevisiae*." (2007) *J. Biol. Chem.* 282 (14): 10233-10244.
24. Coyne, H. J., Ciofi-Baffoni, S., Banci, L., **Zhang, L.**, George, G. N. and Winge, D. R. "The characterization and role of zinc binding in yeast Cox4." (2007) *J. Biol. Chem.* 282 (12): 8926- 8934.
25. Liu, T., Ramesh, A., Ward, S. K., **Zhang, L.**, Ma, Z., George, G. N., Talaat, A. M., Sacchettini, J. C. and Giedroc, D. P. "CsoR is a novel *Mycobacterium tuberculosis* copper-sensing transcriptional regulator." (2007) *Nature Chem. Biol.* 3 (1): 60-68
26. Jiang, D.T., Chen, N., **Zhang, L.**, Malgorzata, K., Wright, G., Igarashi, R., Beauregard, D., Kirkham, M. and McKibben, M. "XAFS at Canadian Light Source." (2007) *AIP Proc. (XAFS13)* 882:893-895 (conference paper).
27. Doonan, C. J., **Zhang, L.**, Young, C. G., George, S. J., Deb, A., Bergmann, U., George G. N. and Cramer, S. P. "High-resolution X-ray emission spectroscopy of molybdenum compounds." (2005) *Inorg. Chem* 44 (8): 2579-2581.

Invited Talk and Conference Presentation

(Four talks have been scheduled in the Spring 2020)

1. "Shining Lights on the Metal Sites of Metalloproteins", Department of Chemistry, Colorado School of Mines, Golden, CO. October 18, 2019.
2. "Structural and Mechanistic Investigation on Iron-Sulfur Cluster-Bound Transcription Factors in *Mycobacterium tuberculosis*" The 19th International Conference on Biological Inorganic Chemistry (The 19th ICBIC), Interlaken, Switzerland. Aug. 11-Aug. 16, 2019.
3. "A Unique Family of Fe-S Cluster-Based Redox Sensors in Mycobacteria", The 2019 System Science Retreat – Drug Discovery Targeting Iron Metabolism, University of Nebraska Medical School, Omaha, NE. March 18, 2019.
4. "Application of X-ray Absorption-Based techniques to Metalloproteins in Redox Biology", Department of Biology, Southern University of Science and Technology, Shenzhen, China. January 7, 2019.
5. "Structural and Functional Studies on Metalloproteins in Redox Biology", College of Life Science, Fujian Normal University, Fuzhou, China. January 4, 2019.
6. "Application of X-ray Absorption-Based techniques to Metalloproteins", Department of Chemistry, University of Nebraska-Lincoln, Lincoln, NE, USA. March 28, 2018.
7. "The Ongoing Story of a Unique Family of Redox-Sensitive Regulators – Twists and Surprises", Redox Biology Center Symposium 2018, Lincoln NE, March 5, 2018.

8. “Shining Light on Metal in Biology and Medicine by XAS”, University of Nebraska-Kearney, Kearney, NE, USA. Oct. 27, 2017.
9. “Insights into the Structural Basis of Biological Nitrogen Fixation”, Huazhong-UNL Symposium, Lincoln NE, Sept. 8, 2017.
10. “Unique Family of Iron-Sulfur Regulators in Redox Stress Response in Mycobacteria” The 18th International Conference on Biological Inorganic Chemistry (The 18th ICBIC), Florianópolis, Brazil. July 31-Aug. 4th, 2017.
11. “Shining Lights on Metals in Diseases and Redox Reactions”, the Center of Virology, University of Nebraska –Lincoln, Lincoln, NE, USA. Jan. 6, 2017.
12. “Shining Light on the Metal Sites - Application of X-ray Absorption-Based techniques to Metalloproteins”, University of Texas at Dallas, Dallas, Texas, USA. Nov. 18, 2016.
13. “WhiB Proteins in the Stress Response and Antibiotic Resistance of *Mycobacterial tuberculosis*”, The 2016 Gordon Conference on Thiol-Based Redox Regulation and Signaling, Stowe VT, Aug. 11, 2016.
14. “WhiB Proteins in the Stress Response and Pathogenesis of *Mycobacterial tuberculosis*”, Redox Biology Center, Lincoln NE, March 28, 2016.
15. “Site-specific X-ray Absorption Spectroscopy Studies on Metalloproteins”, California State University, Long Beach, CA, USA. March 16, 2016.
16. “Structure-Mechanism Relationships of Nitrogenase MoFe-protein”, Canadian Light Source, Saskatoon, SK, Canada. March 6, 2016.
17. “A structural perspective of biological nitrogen fixation.” Missouri Valley and Missouri Branches of the American Society for Microbiology, Lincoln, NE, USA. March 26-27, 2015.
18. “Shining light on the metal binding sites of nitrogenase MoFe-protein.” 16th International Conference on Biological Inorganic Chemistry (The 16th ICBIC), Grenoble, France. July 22-26, 2013.
19. “Insights into structure-function relationships of nitrogenase MoFe-protein by X-ray crystallography.” 4th Georgian Bay International Conference on Bioinorganic Chemistry (CANBIC-4), Parry Sound, ON, Canada. May 21-25, 2013.
20. “Structure-function relationships of CsoR – a novel Cu-sensitive repressor from *M. tuberculosis*.” California Institute of Technology, Pasadena, CA, USA. 2009.
21. “A Potential treatment for Wilson’s disease using tetrathiomolybdate – insights from X-ray absorption spectroscopy.” Canadian Light Source, Saskatoon, SK, Canada. 2008.
22. “Shining light on the metal center of a novel copper-sensing repressor from *M. tuberculosis* – CsoR.” 13th International Conference on Biological Inorganic Chemistry (The 13th ICBIC), Vienna, Austria. July 15-20, 2007.

Posters

1. Wan, T. ⁺, Li, S. ⁺, Beltran, D. G., Schacht, A., **Zhang, L.** “A Unique Iron-Sulfur Cluster-Based Transcriptional Regulator in the Redox Stress Response of *Mycobacterium tuberculosis*”, Gordon Conference – Metal in Biology, Ventura, CA, Jan. 27 – Feb. 1, 2019

2. **L. Zhang**, D. C. Rees. "Site-specific X-ray Absorption Spectroscopy Study on Nitrogenase MoFe-protein." The 18th International Conference on Biological Inorganic Chemistry (The 18th ICBIC), Florianópolis, Brazil. July 31-Aug. 4th, 2017. (**Best Poster Book Prize**)
3. **L. Zhang**, K. H. Summer, and G. N. George. "A Potential Treatment for Wilson's Disease Using Tetrathiomolybdate: Insights from X-ray Absorption Spectroscopy." CLSI 11th Annual Users' Meeting and Workshops. Saskatoon, SK, Canada. June 2008.
4. **L. Zhang**, J. M. Pushie, D. P. Giedroc, and G. N. George. "Structure-function studies on the copper-sensing repressor - CsoR from *M. tuberculosis*." CLSI 11th Annual Users' Meeting and Workshops. Saskatoon, SK, Canada. 2008. (**First Prize at the poster competition**)
5. **L. Zhang**, J. M. Pushie, and G. N. George. "Copper(I)-Bound and Metal-free Forms of the CsoR Dimer Probed by Molecular Dynamics: Structural Response to Copper(I)-Binding." 91st Canadian Chemistry Society Conference, Edmonton, AB, Canada. 2008.
6. **L. Zhang**, K. Rogby, G. N. George and D. R. Winge. "Structure of the Metal Copper Centers in the Cu Chaperones of CcO Assembly." 12th International Conference on Biological Inorganic Chemistry (The 12th ICBIC). Ann Arbor, Michigan, USA. July 31-August 5, 2005.
7. **L. Zhang**, K. Rogby, G. N. George and D. R. Winge. "Structural Characterization of the Metal Copper Centers in the Cu Chaperones." CLSI 8th Annual Users' Meeting and Workshops. Saskatoon, SK, Canada. Nov 18-20, 2005.

TEACHING, MENTORING AND OUTREACH

Courses Taught

- Co-Instructor of BIOC433H "Inquiry-Based Biochemistry Laboratory – Structural and Mechanistic Studies on the Methyltransferase LaPhzM in Phenazine modification" at University of Nebraska-Lincoln, Lincoln, NE, USA, Aug. – Dec., 2018 - present.
- Instructor of BIOC/BIOS/CHEM 932 "Proteins: Structure and Functions" at University of Nebraska-Lincoln, Lincoln, NE, USA, 2015- current.
- Instructor of BIOC992K "Graduate Seminar" at University of Nebraska-Lincoln, Lincoln, NE, USA, 2017.
- Instructor of the Bi 23 course "Biology Tutorial - Special Topics on Synchrotron Light Techniques for Metals in Biology", at the California Institute of Technology, USA, 2013.

New Course Development

- Development of a new undergraduate course BIOC433H as a co-instructor with Dr. Jing Zhang

Guest Lectures

- Guest lecture in the RBC summer school course BIOC 983 "Redox Regulation, Oxidative Stress and Selenoproteins", titled "Iron-sulfur proteins in Redox Stress Response" at University of Nebraska-Lincoln, Lincoln, NE. June 10, 2019.
- Guest lecture in the REU summer research course, titled "Iron-sulfur proteins in Redox Reactions and Stress Response" at the Redox Biology Center, University of Nebraska-Lincoln, July 6, 2017.

- Guest lecture in the RBC summer school course BIOC 983 “Redox Regulation, Oxidative Stress and Selenoproteins”, titled “Iron-sulfur proteins in Redox Stress Response” at Karolinska Institutet, Stockholm, Sweden, May 16, 2017.
- Guest lecture in the NANO*1000 course “Introduction to Nanoscience”, titled “Structure-function of proteins: the finest nano molecule made by nature” at the University of Guelph, Guelph, ON, Oct 28, 2016.
- Guest lecture in the RBC summer school course BIOC 983 “Redox Regulation, Oxidative Stress and Selenoproteins”, titled “Iron-sulfur proteins and redox regulation” at the Redox Biology Center, Lincoln NE, June 11, 2016.
- Guest lecture in Bi 165 “Microbiology Research: Practice and Proposal”, titled “Biological nitrogen fixation”, at the California Institute of Technology, USA, Oct., 2014.
- Guest lecture in Ch 153b “Advanced Inorganic Chemistry (Applications of physical methods toward the characterization of inorganic and bioinorganic species)”, titled “Extended X-ray Absorption Fine Structure and X-ray Emission Spectroscopy”, at the California Institute of Technology, USA, May 2013.
- Guest lecture in Ch 153b “Advanced Inorganic Chemistry (Applications of physical methods toward the characterization of inorganic and bioinorganic species)”, titled “Introduction to Extended X-ray Absorption Fine Structure”, at the California Institute of Technology, USA, May 2011.

Workshop and Symposium

- Organizer of the System Science Retreat titled “Drug Discovery Targeting Iron Metabolism” at the California Institute of Technology, University of Nebraska Medical Center, Omaha, NE, USA, March 18, 2019.
- Organizer and co-instructor of the workshop titled “How X-ray Absorption Spectroscopy Can Help Your Research” at the California Institute of Technology, Pasadena, CA, USA, July 21, 2014.