Zemin Zhou, Ph.D.

15 North Medical Drive East, Salt Lake City, UT 84112
Department of Pathology, University of Utah
Phone: 1 (801) 289-6345
Email: zemin.zhou@path.utah.edu

Education

1995-1999	B.S.	Agronomy, Huazhong Agricultural University, Wuhan, China
1999-2006	Ph.D.	Biochemistry and Molecular Biology, Huazhong Agricultural University, Wuhan, China
2010-2016	Ph.D.	Microbiology and Immunology, University of Utah, Salt Lake City, USA

Postdoctoral Training Experience

2006-2009	Postdoctoral Fellow, Department of Pathology, University of Utah, Salt Lake City, USA
2009-2010	Lab Specialist, Department of Pathology, University of Utah, Salt Lake City, USA
2016.4	Intern in Clinical Immunology, ARUP Laboratories, Salt Lake City, USA
2016-	Research Associate, Department of Pathology, University of Utah, Salt Lake City, USA

Research Interests

- Antigen processing and presentation;
- Autoreactive T cell development;
- Diabetes mellitus;
- Autoimmune diseases;
- Tumor immunology;
- Redox biochemistry;
- Translational immunology;
- Novel techniques in immunology

Publications

Peer-reviewed Articles

1. **Zemin Zhou**, Eduardo Reyes-Vargas, Hernando Escobar, Kuan Y. Chang, Alan L. Rockwood, Julio C. Delgado, Xiao He, Peter E. Jensen (2016) Peptidomic analysis of type 1 diabetes associated HLA-DQ molecules and the impact of HLA-DM on peptide repertoire editing. Eur J Immunol, doi: 10.1002/eji. 201646656

2. **Zemin Zhou**, Eduardo Reyes-Vargas, Hernando Escobar, Brant Rudd, Alan L. Rockwood, Julio C. Delgado, Xiao He, Peter E. Jensen (2016) Type 1 diabetes associated HLA-DQ2 and DQ8 molecules are relatively resistant to HLA-DM mediated release of invariant chain-derived CLIP peptides. Eur J Immunol, 46(4): 834-845

3. **Zemin Zhou**, Xiao He, Peter E. Jensen (2014) Molecular identification of an MHC class Ib (H2-Q9) restricted T cell receptor specific for a mouse polyomavirus peptide VP2.139. Austin J Clin Immunol, 1(3): 8-15

4. **Zemin Zhou**, Peter E. Jensen (2013) Structural characteristics of HLA-DQ that may impact DM editing and susceptibility to type 1 diabetes. Front Immunol, 4:262

5. **Zemin Zhou**, Kari A. Callaway, Dominique A. Weber, Peter E. Jensen (2009) Cutting-edge: HLA-DM functions through a mechanism that does not require specific conserved hydrogen bonds in class II MHC-peptide complexes. J Immunol, 183: 4187–4191

6. Lihua Hu, Huiming Wu, **Zemin Zhou**, Yongjun Lin (2007) Introduction of citrate synthase gene into an elite indica rice restorer line Minghui 86 by Agrobacterium mediated method. Mol Plant Breeding, 4(2): 160-166

Working Papers

1. **Zemin Zhou**, Sonia Liu, Xiaomin Wang, Xiao He, Peter E. Jensen. N-Glycosylation is essential for the maturation and localization of gamma-interferon-inducible lysosomal thiol reductase.

2. **Zemin Zhou**, Xiaomin Wang, Hu Dai, Xiao He, Peter E. Jensen. Catalytic mechanism of gamma-interferon-inducible lysosomal thiol reductase mediated insulin epitope processing.

3. Hemant Raj Joshi, **Zemin Zhou**, Harry Hill, Karl Voelkerding, Attila Kumanovics. CXXC5 is an epigenetic regulator of hematopoiesis.

4. Eduardo Reyes-Vargas, Adam P. Barker, **Zemin Zhou**, Xiao He, Peter E. Jensen. HLA-DM senses peptide-MHC Class II interactions throughout the peptide-binding groove.

5. Eduardo Reyes-Vargas, Adam P. Barker, **Zemin Zhou**, Xiao He, Peter E. Jensen. MHCII with full peptide occupancy is a substrate for HLA-DM catalyzed peptide exchange.

Patents

1. Qifa Zhang, **Zemin Zhou**, Yongjun Lin, Liyuan He and Caiguo Xu (2002) A way to breed the rice with high affinity of phosphorus acquisition. China patent accession number: 02149378.2

2. Qifa Zhang, **Zemin Zhou**, Yongjun Lin (2003) A citrate synthase gene and its application. China patent accession number: 200310121124.7

Conference Abstracts

1. Eduardo Reyes-Vargas, Adam P. Barker, **Zemin Zhou**, Xiao He, Peter E. Jensen (2017) HLA–DM Senses Peptide-MHC Class II Interactions Throughout the Peptide Binding Groove (606.7). ASBMB Experimental Biology, Chicago, IL, USA

2. Eduardo Reyes-Vargas, Adam P. Barker, **Zemin Zhou**, Xiao He, Peter E. Jensen (2016) MHCII with full peptide occupancy is a substrate for HLA-DM catalyzed peptide exchange (A-769-

0004-00198). International Congress of Immunology, Melbourne, Australia

3. Eduardo Reyes-Vargas, Adam P. Barker, **Zemin Zhou**, Xiao He, Peter E. Jensen (2016) MHCII with full peptide occupancy is a substrate for HLA-DM catalyzed peptide exchange. J Immunol, 196:46.9

4. **Zemin Zhou**, Eduardo Reyes-Vargas, Hernando Escobar, Kuan Y. Chang, Alan L. Rockwood, Julio C. Delgado, Xiao He, Peter E. Jensen (2015) Peptidomic analysis of type 1 diabetes associated HLA-DQ molecules and impact of HLA-DM editing. J Immunol, 194:183.10

5. Eduardo Reyes-Vargas, Adam P. Barker, **Zemin Zhou**, Xiao He, Peter E. Jensen (2015) Peptide sequence determinants in HLA-DM susceptibility. J Immunol, 194:183.7

6. **Zemin Zhou**, Eduardo Reyes-Vargas, Hernando Escobar, Brant Rudd, Alan L. Rockwood, Julio C. Delgado, Xiao He, Peter E. Jensen (2014) Relative resistance to HLA-DM editing is a distinguishing characteristic of type 1 diabetes associated HLA-DQ molecules. J Immunol, 192:43.1

7. **Zemin Zhou**, Eduardo Reyes-Vargas, Hernando Escobar, Brant Rudd, Alan L. Rockwood, Julio C. Delgado, Xiao He, Peter E. Jensen (2013) Type 1 diabetes associated HLA-DQ molecules are relatively resistant to HLA-DM catalytic function. Immunopathology of Type 1 Diabetes (Z1), Keystone Symposia, Whistler, British Columbia, Canada

8. **Zemin Zhou**, Xiao He, Xinjian Chen, Peter E. Jensen (2007) The double mutation of DRBW61A/N82A changed the MHC II-peptide complex stability and DM catalytic activity. J Immunol, 178: 93.24

9. **Zemin Zhou**, Yongjun Lin, Liyuan He, Caiguo Xu, Qifa Zhang (2004) Effects of overexpression of citrate synthase gene from *pseudomonas* on improving nutrient use efficiency of rice. Conference of Plant Genomics in China V, Wuhan, China

10. **Zemin Zhou**, Yongjun Lin, Liyuan He, Caiguo Xu, Qifa Zhang (2003) Improved tolerance to phosphorus and nitrogen deficiency by overexpression of a bacterial citrate synthase gene in rice. China's genetics: Genetics Society of China Seventh Congress and Symposium Abstracts, S511.22: 13

11. **Zemin Zhou**, Yongjun Lin, Liyuan He, Caiguo Xu, Qifa Zhang (2002) Overexpression of a bacterial citrate synthase gene in *Japonica* rice cultivar, Hejiang 19 improved the growth on phosphorus deficiency soil. First International Symposium on Crop Genomics and Genetic Improvement, Wuhan, China

12. **Zemin Zhou**, Yongjun Lin, Liyuan He, Caiguo Xu, Qifa Zhang (2002) Overexpression of a bacterial citrate synthase gene in *Japonica* rice cultivar, Hejiang 19 improved the growth on phosphorus deficiency soil. Conference of Plant genomics in China III, Beijing, China

Invited Presentations

1. Peptidomic analysis of type 1 diabetes associated HLA-DQ molecules and impact of HLA-DM editing. 102th Annual Meeting of the American Association of Immunologists, New Orleans, Louisiana, USA, 2015

2. Relative resistance to HLA-DM editing is a distinguishing characteristic of type 1 diabetes associated HLA-DQ molecules. 101th Annual Meeting of the American Association of Immunologists, Pittsburgh, Pennsylvania, USA, 2014

3. Antigen presentation function of type 1 diabetes associated HLA-DQ molecules. Annual Convention of the Chinese Association for Science and Technology at Utah, Salt Lake City, Utah, USA, 2014

4. Invited speaker. The function of Major Histocompatibility Complex class II in type 1 diabetes. Biological Science Division, Pacific Northwest National Laboratory, Richland, Washington, USA, 2013

5. The mutation of key residues in HLA-DR beta chain changed the MHC II-peptide complex stability and DM catalytic activity. 94th Annual Meeting of the American Association of Immunologists, Miami, Florida, USA, 2007

Research Experience

Biochemical and structural function of gamma-interferon induced lysosomal thiol reductase
Department of Pathology, University of Utah, Salt Lake City, UT, USA
Research Associate, June 2015 - Present

- Initiated the study of GILT post-translational modification, N-glycosylation, and its function in GILT maturation and subcellular localization;
- Designed the strategies and generated the mature and immature forms of GILT proteins in 293T cell lines and optimized the purification methods;
- Confirmed the results of GILT-dependent and -independent reduction of insulin by in vitro reduction of insulin with purified GILT, and synthesized disulfide bond-containing peptides in HPLC analysis
- Optimized the biochemical methods to measure the activity of GILT in thiol reduction, started the identification of in vivo cofactor(s) involved in GILT activation and GILT-dependent epitope processing by substrate-trapping mutation;
- Predicted the GILT structure model and initiated the structure-function study

Properties of type 1 diabetes associated HLA-DQ molecules and DM editing function
Department of Pathology, University of Utah, Salt Lake City, UT, USA
Graduate Research Assistant, July 2010 - Present

- Cloned all of the DQa and DQb genes from different EBV-immortalized B cell lines and generated each of the DQ 293T cell lentiviral-mediated transductants expressing full length or soluble DQ (sDQ) proteins;
- Applied the immunopeptidomic analysis of each DQ molecules in the absence or presence of invariant chain and/or HLA-DM;
- Optimized the sDQ proteins purification methods and measured the properties of each DQ proteins with fluorescence-labeled peptides;
- Helped the experiment design and wrote the manuscripts for publishing

Co-crystal structure of DM-DO and DM-DR
Department of Pathology, University of Utah, Salt Lake City, UT, USA
Graduate Research Assistant, June 2009 - March 2011

- Confirmed the interaction of DM-DO by co-immunoprecipitation;

- Designed the experiments, including the constructs of soluble DM-DO and soluble DM-DR for insect cell S2 over-expression;
- Purified the soluble proteins in large-scale and confirmed their function

Mutational structure-function analysis of Qa1b, a non-classical MHC class I molecule
Department of Pathology, University of Utah, Salt Lake City, UT, USA
Lab Specialist, June 2008 - July 2010

- Continuing Dr. Lisa M. Reed-Loisel's project, generated more Qa1b multiple site mutations and expressed each in E.coli;
- Purified the inclusion bodies for each mutants and refolded with B2m and Qdm peptides;
- Measured the stability of each refolded Qa1b monomers by Eu-assay

Structure characteristic of DM P4' pocket
Department of Pathology, University of Utah, Salt Lake City, UT, USA
Postdoctoral Fellow, June 2006 - Present

- Continuing Dr. Oskar Laur's project, verified new DM mutants and confirmed previous results with T2 cell lines;
- Generated mouse DM mutants and investigated its function in retrogenic mice by bone marrow reconstitution;
- Functional analysis of double and triple mutants of DM around the P4' pocket;
- Organized the new results and updated the manuscript

Identification of MHC class Ib (H2-Q9) restricted mouse polyoma virus specific T cell receptor (TCR) and its function in retrogenic mice
Department of Pathology, University of Utah, Salt Lake City, UT, USA
Postdoctoral Fellow, May 2007 - November 2009

- Cloned the genes of TCR from two different T cell clones and hybridomas;
- Expressed and identified the function of cloned TCR genes in cell lines and retrogenic mice by bone marrow reconstitution;
- Generated soluble Q9 protein and refolded Q9/VP2.139 tetramer for T cell staining;
- Organized the data and wrote the manuscript for publishing

Molecular mechanism of HLA-DM editing in antigen presentation
Department of Pathology, University of Utah, Salt Lake City, UT, USA
Postdoctoral Fellow, June 2006 - September 2009

- Collaborating with Dr. Kari A. Callaway, generated and analyzed the effects of hydrogen bonds in DRa and DRb mutants;
- Helped the establishing of Fluorescence Polarization methods with soluble proteins and investigated the off-rate and other properties of DR wild type and mutants;
- Organized the data and prepared the manuscript for publishing

Generation and characterization of transgenic rice overexpressing bacterial citrate synthase with improved yield in phosphorus deficient condition
College of Life Science and Technology, Huazhong Agricultural University, Wuhan, China
Graduate Research Assistant, May 2000 - May 2006

- Cloned and overexpressed bacterial citrate synthase gene in rice with increased yield in phosphorus deficient condition;
- Established and optimized the HPLC method to analyze the rice root secreted organic acids;
- Investigated the metabolism of organic acids, nitrogen and phosphorus in rice;
- Analyzed the transcriptome that involved in organic acid synthesis and regulation

Investigation of the agroecosystem on brown red soil wetland of south Hubei Province
Department of Agronomy, Huazhong Agricultural University, Wuhan, China
Undergraduate Research Assistant, September 1998 - May 1999

- Investigated the weed population on brown red soil wetland;
- Analyzed the concentration of boron in brown red soil;
- Participated the data collection and statistic analysis

Other Training Experience

2003.11 HPLC analysis of rice root secreted organic acids, College of Resource and Environment, China Agricultural University, Beijing, China

2013.8 Advanced Course in Immunology, The American Association of Immunologists, Seaport World Trade Center, Boston, MA, USA

2013.10 Immune Epitope Database (IEDB) User Workshop, La Jolla Institure for Allergy and Immunology, La Jolla, CA, USA

Teaching Experience

Teaching assistance, Genetics Laboratory (2003). Huazhong Agricultural University

- Lead laboratory sections, and graded laboratory reports for undergraduates

Teaching assistance, Basic Immunology (2011). University of Utah

- Lead weekly discussion sections, helped design tests, and graded papers

Research Mentor (2014-2016), University of Utah
Provided mentoring and guidance of research to undergraduate and graduate students

- Pratima Chapagain (2014), Graduate student, University of Utah
- Victor Chen (2014), Undergraduate student, University of Utah, Summer Undergraduate Research Program
- Sonia Liu (2014-2016), Undergraduate student, University of Utah, Summer Undergraduate Research Program

Honors and Awards

2014, 2015 AAI Trainee Abstract Award, American Association of Immunologists
2014, 2015 Graduate Student Travel Assistance Award, University of Utah
2014 Outstanding Research Award, Chinese Association for Science and Technology at Utah
2013 IEDB Travel Fellowship, La Jolla Institute for Allergy and Immunology

Professional Membership

2007 - American Association of Immunologists
2014 - Chinese Association for Science and Technology at Utah

Major Contributions to Science

1. Clarification of the molecular and structural mechanism of HLA-DM in antigen presentation and its role in Type 1 diabetes:

    - Zemin Zhou, Kari A. Callaway, Dominique A. Weber, Peter E. Jensen (2009) Cutting-edge: HLA-DM functions through a mechanism that does not require specific conserved hydrogen bonds in class II MHC-peptide complexes. J Immunol, 183: 4187–4191 **(Discovery of none of specific hydrogen bonds dominates the catalytic mechanism of DM editing in antigen presentation)**

    - Zemin Zhou, Eduardo Reyes-Vargas, Hernando Escobar, Brant Rudd, Alan L. Rockwood, Julio C. Delgado, Xiao He, Peter E. Jensen (2016) Type 1 diabetes associated HLA-DQ2 and DQ8 molecules are relatively resistant to HLA-DM mediated release of invariant chain-derived CLIP peptides. Eur J Immunol, 46(4): 834-845 **(Discovery of the DM editing resistance for Ii-derived CLIP peptides in T1D associated DQ molecules)**

    - Zemin Zhou, Eduardo Reyes-Vargas, Hernando Escobar, Kuan Y. Chang, Alan L. Rockwood, Julio C. Delgado, Xiao He, Peter E. Jensen (2016) Peptidomic analysis of type 1 diabetes associated HLA-DQ molecules and the impact of HLA-DM on peptide repertoire editing. Eur J Immunol, doi: 10.1002/eji. 201646656 **(Discovery of the global impact of DM editing resistance in T1D associated DQ molecules and the candidate parameters in predicting the sensitivity of T cell epitopes to DM editing)**

2. Identification of an MHC class Ib (H2-Q9) restricted TCR with epitope specificity for mouse polyomavirus VP2 protein derived VP2.139 peptide;

3. Investigation of biochemical and structural function of gamma-interferon induced lysosomal thiol reductase (GILT) in antigen processing and its role in diabetes:

    - Glycosylation of GILT and its role in GILT maturation and subcellular localization;

    - Cofactor(s) of GILT in processing of diabetes associated auto-antigens, insulin and amylin;

    - Structural and mechanical studies of GILT in disulfide bond reduction

4. Generation and characterization of a transgenic rice line overexpressing bacterial citrate synthase with improved yield in phosphorus deficient condition