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Department of Chemical and Biomolecular Engineering
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EDUCATION/PROFESSIONAL EXPERIENCE

- 07/2023-present Assistant professor, Chemical and Biomolecular Engineering Department, Tulane University
- 07/2018 — 06/2023 Postdoctoral researcher at University of California, Berkeley
Department of Chemistry and QB3 Institute
Advisor: Prof. Judith P. Klinman
Project: Using biophysical probes of temperature dependent hydrogen deuterium exchange (TD-HDX) and Stokes shift fluorescence spectroscopy to investigate enzymatic thermal activation pathways and solvation dynamics for active site chemistry for a TIM barrel hydrolase adenosine deaminase. (Training in enzymology; protein dynamics; structural biology, and biocatalysis)
- 11/2016 — 03/2018 PhD student researcher at University of California, Berkeley
Department of Chemistry and QB3 Institute
Supervisor: Prof. Judith P. Klinman
Project: Tool development in TD-HDX to map activity-related protein motions in murine adenosine deaminase
- 09/2013 — 06/2018 Ph.D. in Chemical Engineering and Technology, Beijing University of Chemical Technology, College of Life Science and Technology
Supervisor: Prof. Guojun Zheng
Project: Identification, protein engineering and origin of enantioselectivity of a (+)- γ -lactamase from *Microbacterium hydrocarbonoxydans*. (Training in biocatalysis, protein engineering, structural biology, and enzyme discovery)
- 09/2009 — 06/2013 B.S. in Pharmaceutical Engineering, Beijing University of Chemical Technology
College of Life Science and Technology
Supervisor: Prof. Guojun Zheng
Project: Efficient synthesis of the intermediate of abacavir and carbovir using a novel lactamase as a catalyst. (Training in enzymology, pharmacology, and enzyme catalysis)

RESEARCH EXPERIENCE

Postdoctoral Fellow, University of California at Berkeley (PI: Judith P. Klinman)

- Protein and structural dynamics studies using temperature dependent hydrogen deuterium exchange couple to mass spectrometry (TDHDX-MS)
- Biophysical basis of enzymatic reaction cycle via TDHDX-MS with bound ground and transition state analogs
- Heat dissipation from solvent to enzyme active site studies using temperature dependent stokes shift fluorescence spectroscopy

PhD student, Beijing University of chemical Technology (PI: Guojun Zheng)

- Enzyme discovery by environmental screening and in silico genome mining methods
- High-throughput colorimetric screening method development for enzyme evolution and engineering
- Structural biology to investigate structural insight into the molecular mechanism of substrate recognition and origin of enantioselectivity
- Protein engineering in enhancing enantioselectivity and thermostability of enzymes by combined method of directed evolution and semi-rational design

AWARDS

2013—2018	Outstanding graduate award, Beijing University of Chemical Technology
2016—2017	Overseas study program fellowship, China Scholarship Council
2013—2014	2 nd place prize in bio-separation design award
2011—2012	National Endeavor Fellowship for undergraduates, China
2012—2013	1 st tier undergraduate scholarship, Beijing University of Chemical Technology
2011—2012	1 st tier undergraduate scholarship, Beijing University of Chemical Technology
2010—2011	1 st tier undergraduate scholarship, Beijing University of Chemical Technology
2009—2010	2 nd tier undergraduate scholarship, Beijing University of Chemical Technology

TEACHING EXPERIENCE

2017—present	Research mentor to 5 undergraduate students in Klinman lab, UC Berkeley
2018—2019	Teacher, Splash at Berkeley, Class: How enzymes achieve enormous rate accelerations and how to rationally engineer enzymes
2014—2018	Research mentor to 2 undergraduate and 3 graduate students, BUCT
2016	Teaching assistant, class of Molecular Biology
2015	Teaching assistant, class of Enzymology and Biocatalysis
2010—2013	Teacher in the teaching agency of Excel at Learning

PUBLICATIONS (*denotes corresponding author)

Google scholar link for: [my publications](#)

- (1) **Shuaihua Gao**, Xin Ting Wu, Wenju Zhang, Tyre Richardson, Samuel L. Barrow, Christian A. Thompson-Kucera, Anthony T. Iavarone, and Judith P. Klinman. Temporal Resolution of Activity-Related Nanosecond Solvation Dynamics in the TIM Barrel Enzyme Murine Adenosine Deaminase. *ACS Catalysis*, 2024, 14, 4554–4567.
- (2) **Gao, S** and Klinman, J. P., Functional roles of enzyme dynamics in accelerating active site chemistry: emerging techniques and changing concepts. *Current Opinion in Structural Biology*, 2022, 75, 102434. (**Invited Review paper**).
- (3) **Gao, S.;** Zhang, W.; Barrow, S. L.; Iavarone, A. T.; Klinman, J. P., Temperature-dependent hydrogen deuterium exchange shows impact of analog binding on adenosine deaminase flexibility but not embedded thermal networks. *Journal of Biological Chemistry*, 2022, 298(9), 102350.
- (4) **Gao, S.;** Thompson, E. J.; Barrow, S. L.; Zhang, W.; Iavarone, A. T.; Klinman, J. P., Hydrogen–Deuterium Exchange within adenosine deaminase, a TIM barrel hydrolase, identifies networks for thermal activation of catalysis. *Journal of the American Chemical Society* 2020, 142 (47), 19936-19949.
- (5) Zhang, J.; Balsbaugh, J. L.; **Gao, S.;** Ahn, N. G.; Klinman, J. P., Hydrogen deuterium exchange defines catalytically linked regions of protein flexibility in the catechol O-methyltransferase reaction. *Proceedings of the National Academy of Sciences* 2020, 117 (20), 10797-10805.
- (6) **Gao, S.;** Lu, Y.; Li, Y.; Huang, R.; Zheng, G., Enhancement in the catalytic activity of *Sulfolobus solfataricus* P2 (+)- γ -lactamase by semi-rational design with the aid of a newly established high-throughput screening method. *Applied microbiology and biotechnology* 2019, 103 (1), 251-263.
- (7) **Gao, S.;** Zhu, S.; Huang, R.; Li, H.; Wang, H.; Zheng, G., Engineering the Enantioselectivity and Thermostability of a (+)- γ -Lactamase from *Microbacterium hydrocarbonoxydans* for Kinetic Resolution of Vince Lactam (2-Azabicyclo [2.2. 1] hept-5-en-3-one). *Applied and environmental microbiology* 2018, 84 (1).
- (8) **Gao, S.;** Zhou, Y.; Zhang, W.; Wang, W.; Yu, Y.; Mu, Y.; Wang, H.; Gong, X.; Zheng, G.; Feng, Y., Structural insights into the γ -lactamase activity and substrate enantioselectivity of an isochorismatase-like hydrolase from *Microbacterium hydrocarbonoxydans*. *Scientific reports* 2017, 7, 44542.

- (9) **Gao, S.;** Huang, R.; Zhu, S.; Li, H.; Zheng, G., Identification and characterization of a novel (+)- γ -lactamase from *Microbacterium hydrocarbonoxydans*. Applied microbiology and biotechnology 2016, 100 (22), 9543-9553.
- (10) **Gao, S.;** Su, Y.; Zhao, L.; Li, G.; Zheng, G., Characterization of a (R)-selective amine transaminase from *Fusarium oxysporum*. Process Biochemistry 2017, 63, 130-136.
- (11) **Gao, S.;** Zhu, S.; Huang, R.; Lu, Y.; Zheng, G., Efficient synthesis of the intermediate of abacavir and carbovir using a novel (+)- γ -lactamase as a catalyst. Bioorganic & Medicinal Chemistry Letters 2015, 25 (18), 3878-3881.
- (12) Chen, Y.; Gao, F.; Zheng, G.; **Gao, S.,*** Enantioselective synthesis of a chiral intermediate of himbacine analogs by *Burkholderia cepacia* lipase A. Biotechnology Letters 2020, 42 (12), 2643-2651.
- (13) Chen, Y.; Zhang, X.; Zheng, G.; **Gao, S.,*** Preparation of the enantiomerically enriched precursor of lamivudine (3TC™) via asymmetric catalysis mediated by *Klebsiella oxytoca*. Process Biochemistry 2019, 81, 77-84.
- (14) Li, H.; **Gao, S.;** Qiu, Y.; Liang, C.; Zhu, S.; Zheng, G., Genome mining integrating semi-rational protein engineering and nanoreactor design: roadmap for a robust biocatalyst for industrial resolution of Vince lactam. Applied Microbiology and Biotechnology 2020, 104 (3), 1109-1123.
- (15) Shen, X.; Zhou, D.; Lin, Y.; Wang, J.; **Gao, S.;** Kandavelu, P.; Zhang, H.; Zhang, R.; Wang, B.-C.; Rose, J., Structural Insights into Catalytic Versatility of the Flavin-dependent Hydroxylase (HpaB) from *Escherichia coli*. Scientific reports 2019, 9 (1), 7087.
- (16) Su, Y.; **Gao, S.;** Li, H.; Zheng, G., Enantioselective resolution of γ -lactam utilizing a novel (+)- γ -lactamase from *Bacillus thuringiensis*. Process Biochemistry 2018, 72, 96-104.
- (17) Zhu, S.; Huang, R.; **Gao, S.;** Li, X.; Zheng, G., Discovery and characterization of a second extremely thermostable (+)- γ -lactamase from *Sulfolobus solfataricus* P2. Journal of bioscience and bioengineering 2016, 121 (5), 484-490.
- (18) Ren, L.; Zhu, S.; Shi, Y.; **Gao, S.;** Zheng, G., Enantioselective resolution of γ -lactam by a novel thermostable type II (+)- γ -lactamase from the hyperthermophilic archaeon *Aeropyrum pernix*. Applied biochemistry and biotechnology 2015, 176 (1), 170-184.
- (19) Zhu, S.; Gong, C.; Song, D.; **Gao, S.;** Zheng, G., Discovery of a novel (+)- γ -lactamase from *Bradyrhizobium japonicum* USDA 6 by rational genome mining. Applied and environmental microbiology 2012, 78 (20), 7492-7495.

PATENTS

Zheng, G., **Gao S.**, Huang, R., Zhu S., Li H., Applications of a *Microbacterium hydrocarbonoxydans* derived open reading frame in encoding (+)- γ -lactamase and the preparation of optically pure Vince-lactam. 201510051783.0, 2017, China.

ORAL PRESENTATIONS

1. “Biophysical tools for the detection of protein dynamics across a variety of time scales”, Mainland and Taiwan biotechnology symposium, 2016, Beijing.
2. “Mapping Activity-Related Protein Motions in Murine Adenosine Deaminase using Time-, Temperature-, and Mutation-Dependent Hydrogen-Deuterium Exchange Mass Spectrometry (HDX-MS)”, Gordon Research, Seminar, Proteins, Holderness, NH, US, June 16-21, 2019.
3. “Hydrogen–Deuterium Exchange within Adenosine Deaminase, a TIM Barrel Hydrolase, Identifies Networks for Thermal Activation of Catalysis”, ACS Fall 2020 Meeting & Expo, Biological Chemistry Division.
4. “Hydrogen–Deuterium Exchange within Adenosine Deaminase, a TIM Barrel Hydrolase, Identifies 5. Networks for Thermal Activation of Catalysis”, ChemistLive, 2020.
5. “Identification of Thermal Networks for Catalysis in murine adenosine deaminase”, Rutgers University symposium-Metalloproteins at the Crossroads of Design and Nature, January 27, 2021.
6. “Hydrogen deuterium exchange within adenosine deaminase provides long range protein networks and structural motifs for the thermal activation of active site chemistry”, ACS Spring 2021 Meeting & Expo, Biological Chemistry Division. April 5-30, 2021.

At Tulane:

7. "Identification, structural insights, and protein evolution of an enantioselective lactamase for antiviral drug synthesis", Tulane Center of Biomedical Informatics and Genomics, School of Medicine, Tulane University. Sep. 6, 2023.
8. "Protein engineering and structural insights into the lactamase activity and substrate enantioselectivity of a hydrolase from *Microbacterium hydrocarbonoxydans*", Department of Biochemistry and Molecular Biology, School of Medicine, Tulane University. Jan 22, 2024.
9. "Identification, structural insights, and protein evolution of an enantioselective lactamase for antiviral drug synthesis", ACS Spring 2024 Meeting, Biochemical Technology Division. March 17-21, 2024. New Orleans, Louisiana, USA.

POSTERS

1. "Mapping Activity-Related Protein Motions in Murine Adenosine Deaminase using Time-, Temperature-, and Mutation-Dependent Hydrogen-Deuterium Exchange Mass Spectrometry (HDX-MS)" Gordon Research Conference, Proteins, Holderness, NH, US, June 15-16, 2019.
2. "Identification, Characterization, Protein Engineering and Structural Insights into the gamma-Lactamase Activity and Substrate Enantioselectivity of a Hydrolase from *Microbacterium Hydrocarbonoxydans*", ACS Fall 2020 Meeting & Expo Biochemical Technology Division.
3. "Discovery and engineering of novel enzymes for the preparation of antiviral drugs abacavir and carbovir", ACS Spring 2021 Meeting & Expo, Division of Medicinal Chemistry. April 5-30, 2021.
4. "Temperature Dependent Hydrogen Deuterium Exchange Within Adenosine Deaminase in Complex with Substrate and Transition State Analogs: Ligands Alter Protein Flexibility but Not Embedded Thermal Networks" Gordon Research Conference, Biocatalysis, Southern New Hampshire University, NH, US, July 10-15, 2022.