Qing Tang, Ph.D.

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PROFILE

I am a microbiologist with expertise in microbiology, biochemistry, and innate immunology. I use multi-disciplinary approaches to investigate bacterial signal transduction mechanisms, bacterial stress responses, and bacterial pathogenesis. I have revealed unappreciated host-pathogen interaction mechanisms during *Listeria monocytogenes* and *Staphylococcus aureus* infections.

EDUCATION & RESEARCH

University of Washington (Seattle, WA) 02/2018-Present
Postdoctoral Fellow, Department of Microbiology
Project: C-di-AMP signaling in *S. aureus*
Advisor: Joshua J. Woodward, Ph.D.

Huazhong Agricultural University (Wuhan, China) 07/2011-06/2017
Ph.D., Microbiology
Dissertation: The regulatory mechanism of metabolism and infection by signal molecules in Gram-positive bacterial pathogens
Advisor: Jin He, Ph.D.

University of Washington (Seattle, WA) 10/2015-01/2017
Visiting graduate student, Department of Microbiology
Project: C-di-AMP signaling in *S. aureus*
Advisor: Joshua J. Woodward, Ph.D.

Hubei University of Technology (Wuhan, China) 09/2007-07/2011
B.S., Bioengineering
Advisor: Jianguo Lin, Ph.D.

RESEARCH EXPERIENCE

Bacterial signal transduction

Regulatory mechanisms of biotin metabolism in *Mycobacteria*: Biotin is essential for bacterial central metabolism and also critical for rapid phagosome escape of some pathogens. Bacteria have evolved diversified mechanisms to tightly control biotin metabolism. In this project, I identified a TetR family transcription factor BioQ in *M. smegmatis* which acted as a transcriptional repressor of biotin synthesis genes, thus defining a new mechanism for bacterial biotin metabolism. This work has been published in Molecular Microbiology (2014) and Biochimica et Biophysica Acta - General Subjects (2018).

Cyclic dinucleotide signaling in bacteria

C-di-GMP signaling in *Bacillus thuringiensis*: Cyclic diguanylate (c-di-GMP) is a ubiquitous second messenger that regulates diverse cellular processes in bacteria by binding to various protein or riboswitch effectors. In this project, I identified a c-di-GMP riboswitch and characterized its role in regulating the physiology and virulence of *B. thuringiensis.* This work is published in Scientific Reports (2016).

C-di-AMP signaling in *M. smegmatis*: Cyclic diadenylate (c-di-AMP) is a second messenger conserved in most gram-positive bacteria and some archaea. It is essential for many bacteria under standard growth conditions. Through binding to specific protein and riboswitch receptors, c-di-AMP regulates a wide variety of physiological functions. This project characterized the c-di-AMP metabolic pathway in *M. smegmatis* and elucidated the regulatory role of c-di-AMP in the cell wall synthesis. This work is published in International Journal of Biological Sciences (2015).

Cyclic dinucleotide signaling in host-pathogen interactions

C-di-AMP signaling in *S. aureus*: C-di-AMP is a conserved microbial signature for innate immune detection of several bacterial. During infection, c-di-AMP produced by bacterial pathogens elicits host immune response by binding and activating Stimulator of interferon genes (STING). This project characterized that anti-folate antibiotic treatment elicits a robust production of c-di-AMP of several Firmicutes. The elevated c-di-AMP induces an enhanced immune response by activating the STING signaling cascade and establishes a paradigm for respiratory exacerbations and reduced lung function caused by infection with *S. aureus* thymidine-dependent small colony variants in patients with pediatric cystic fibrosis (Part of this work is published in Cell Host Microbe, 2022). This work also focused on the regulatory mechanism of c-di-AMP in the central metabolism of *S. aureus* (Manuscript in preparation).

Kvβ2 and the host response to cyclic dinucleotides: Cyclic dinucleotides elicit host immune responses during infection. Several cytosolic pattern recognition receptors including STING, DDX41, and RECON that detect cyclic dinucleotides have been recently identified. This project identified a novel cyclic dinucleotide binding protein Kvβ2 (β subunit of voltage-dependent potassium channels). I am currently working on elucidating the role of Kvβ2 in recognizing bacterial cyclic dinucleotides and restricting bacterial infections. As the leader of this project, I wrote an R21 proposal with my PI which was funded in 2021.

SELECTED PUBLICATIONS

1. **Qing Tang**, Mimi R. Precit, Maureen K. Thomason, Fariha Ahmed-Qadri, Adelle P. McFarland, Daniel J. Wolter, Lucas R. Hoffman, Joshua J. Woodward. Thymidine starvation promotes c-di-AMP dependent inflammation during infection. Cell Host Microbe. 2022 Jul 13;30(7):961-974.e6.

2. Ling Yan*, **Qing Tang***, Zeyuan Guan, Ping Yin, Tingting Zou, Jin He. Structural insights into operator recognition by BioQ in biotin synthesis pathway. Biochim Biophys Acta Gen Subj. 2018 Sep;1862(9):1843-1851. (*co-first author)

3. **Qing Tang**, Kang Yin, Hongliang Qian, Youwen Zhao, Wen Wang, Shan-Ho Chou, Yang Fu, and Jin He. Cyclic di-GMP contributes to adaption and virulence of *Bacillus thuringiensis* through a riboswitch-regulated collagen adhesion protein. Sci Rep. 2016 Jul 6; 6:28807.

4. **Qing Tang**, Yuncao Luo, Chao Zheng, Kang Yin, Maria Kanwal, Xinfeng Li, Jin He. Functional Analysis of a c-di-AMP-specific Phosphodiesterase MsPDE from *Mycobacterium smegmatis*. Int J Biol Sci. 2015 May 30;11(7):813-24. eCollection 2015.

5. **Qing Tang**, Xinfeng Li, Tingting Zou, Huimin Zhang, Yingying Wang, Rongsui Gao, Zhencui Li, Jin He, Youjun Feng. *Mycobacterium smegmatis* BioQ defines a new regulatory network for biotin metabolism. Mol Microbiol. 2014 Oct 7. doi: 10.1111/mmi.12817.

ADDITIONAL PUBLICATIONS

1. WenYin, Li Zhu, Hui Xu, **Qing Tang**, Yingxin Ma, Shan-Ho Chou, Jin He. Bio-hybrid nanoarchitectonics of nanoflower-based ELISA method for the detection of *Staphylococcus aureus*. Sensors and Actuators B: Chemical. 1 September 2022, 132005.

2. Xinfeng Li, Fang Chen, Xiaoyu Liu, Jinfeng Xiao, Binda T. Andongma, **Qing Tang**, Xiaojian Cao, Shan-Ho Chou, Michael Y. Galperin, Jin He. *Mycobacterial* CarD defines a novel mechanism of response to starvation stress. eLife. 2022;11:e73347.

3. See-Yeun Ting, Esteban Martínez-García, Shuo Huang, Savannah K Bertolli, Katherine A Kelly, Kevin J Cutler, Elizabeth D Su, Hui Zhi, **Qing Tang**, Matthew C Radey, Manuela Raffatellu, S Brook Peterson, Víctor de Lorenzo, Joseph D Mougous. Targeted depletion of bacteria from mixed populations by programmable adhesion with antagonistic competitor cells. Cell Host Microbe. 2020 Aug 12;28(2):313-321.

4. Xinfeng Li, Han Mei, Fang Chen, **Qing Tang**, Zhaoqing Yu, Xiaojian Cao, Binda T Andongma, Shan-Ho Chou, Jin He. Transcriptome landscape of *Mycobacterium smegmatis*. Front Microbiol. 2017 Dec 18; 8:2505.

5. Maria Kanwal Ali, Xinfeng Li, **Qing Tang**, Xiaoyu Liu, Fang Chen, Jinfeng Xiao, Muhammad Ali, Shan-Ho Chou, Jin He. Regulation of inducible potassium transporter KdpFABC by KdpD/KdpE two-component system in *Mycobacterium smegmatis*. Front Microbiol. 2017 Apr 24; 8:570.

6. Hang Zhou, Cao Zheng, Jianmei Su, Bo Chen, Yang Fu, Yuqun Xie, **Qing Tang**, Shan-Ho Chou, Jin He. Characterization of a natural triple-tandem c-di-GMP riboswitch and application of the riboswitch-based dual-fluorescence reporter. Sci Rep. 2016 Feb 19; 6:20871.

7. Han Mei, **Qing Tang**, Yaxi Wang, Jieping Wang, Jin He. Insights into sRNA genes regulated by two-component systems in the *Bacillus cereus* group. Current Bioinformatics, 2015, 10(4): 56-468(13).

8. Shumeng Zhang, Jieping Wang, Yale Wei, **Qing Tang**, Maria Kanwal, Jin He. Heterologous expression of VHb can improve the yield and quality of biocontrol fungus *Paecilomyces lilacinus*, during submerged fermentation. J Biotechnol. 2014 Oct 10; 187:147-53.

9. Jieping Wang, Han Mei, Hongliang Qian, **Qing Tang**, Xiaocui Liu, Ziniu Yu, Jin He. Expression profile and regulation of spore and parasporal crystal formation-associated genes in *Bacillus thuringiensis*. J Proteome Res. 2013 Dec 6;12(12):5487-501.

FUNDING/FELLOWSHIP

Sponsor: Cystic Fibrosis Research Translation Center and Research Development Program (Seattle Children's Research Institute & University of Washington) 3/2018-3/2020
Title: Small molecule interactions between *Staphylococcus aureus* and *Pseudomonas aeruginosa* in cystic fibrosis lungs
Total Costs: $ 9,2000
Role: PI

AWARDS

Top Ten Outstanding Graduates of the Key Laboratory of Agricultural Microbiology 2015
The top ten outstanding women graduate students 2015
Excellent Lecture in the Annual Meeting in College of Life Science and Technology, Huazhong Agricultural University (second prize) 2014
National Scholarship for Graduates of China 2014
Outstanding Dissertation Award in Hubei University of Technology 2011
Undergraduate Study Scholarship in Hubei University of Technology 2010
Inventors Competition of Hubei University of Technology (second prize) 2009

SEMINARS AND CONFERENCE PRESENTATIONS (SELECTED)

International Conference on Gram-Positive Pathogens. Omaha, Nebraska, 2022
Poster: Thymidine starvation promotes c-di-AMP dependent inflammation during infection

Cystic fibrosis research seminar Series. Cystic Fibrosis Research and Translation Center and Research Development Program, University of Washington, 2021
Invited Speaker: Genotype specific hyper-inflammation of *Staphylococcus aureus* small-colony variants

Cystic fibrosis Foundation Research Conference, Stowe, Vermont, 2019
Poster: Lung neutrophil inflammation caused by *Staphylococcus aureus* TD SCVs

Cystic fibrosis research seminar Series. Cystic Fibrosis Research and Translation Center and Research Development Program, University of Washington, 2019
Invited Speaker: Lung neutrophil inflammation caused by *Staphylococcus aureus* TD-SCV

TEACHING AND MENTORING EXPERIENCE

Graduate/technician Mentor
Mentored Quentin Lowe, Woodward lab undergraduate 2022

Mentored Kayleen Lederman, Woodward lab rotation student	2022
Mentored Sophie Blanc, Woodward lab technician	2021
Mentored Aruna R Menon, Woodward lab technician	2020
Mentored Nana Lan, Woodward lab undergraduate	2019
Mentored Kang Yin, He lab graduate student	2016
Mentored Maria Kanwal Ali, He lab graduate student	2016
Mentored Xingfeng Li, He lab graduate student	2015

Teaching assistant

Microbial engineering, teaching assistant, Huazhong Agricultural University	2012
Microbial engineering, teaching assistant, Huazhong Agricultural University	2013

PROFESSIONAL MEMBERSHIP

1. Reviewer for Frontiers in Genetics
2. Reviewer for BioMed Research International
3. Member of Society of Chinese Bio-scientists in America