

Curriculum Vitae

Asst Prof An-Ni Zhang

Contact Details

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Webpage	https://genomiverse.net/ https://dr.ntu.edu.sg/cris/rp/rp02473
Video CV	Postdoc work & future research https://youtu.be/VsgphgSG9qQ PhD work https://youtu.be/4RQBEILzm-4
Github	https://github.com/caozhichongchong
Researchgate	https://www.researchgate.net/profile/An_Ni_Zhang

Tertiary Education

Research Associate of Alm Lab, Biology Engineering, MIT	2023-2024
Senior post-doc of Alm Lab, Biology Engineering, MIT	2022-2023
Post-doc of Alm Lab, Biology Engineering, MIT	2018-2022
Doctor of Philosophy (PhD) (Environmental Engineering), PAOs in phosphorus removal reactors and ARGs in environmental microbiomes: new insights from bioinformatics, University of Hong Kong.	2018
Bachelor of Science (Environmental Biology), Nanjing University.	2014

Research Experiences

Over my PhD, I built a novel framework of **developing bioinformatic tools** and applied **big data analysis** to the field of environment microbiology. I investigated a million genome data and a thousand metagenome data to mine new knowledge and potential applications. This framework was demonstrated by three critical conventional and emerging pollutants (phosphorus, mobile DNA elements and antibiotic resistance genes). The achievements of my PhD thesis provide novel guidance to better **interpret the microbial community and better remove these pollutants in the environments**. This framework can insight the linkages between knowledge and applications in other fields.

During my postdoc, I applied my whole package to this brand-new field of human microbiome. I was captivated by the idea of creating a new kind of drug using live rationally designed ‘living therapeutics’, the bacteria living in and on our human bodies. The idea of “**bugs as drugs**” really fascinates me, especially its potential to treat inflammatory bowel disease, diabetes, obesity, even depression, and autism. I built an **integrated bioinformatics and experimental pipeline to combine genomes, meta-omics, and bacterial isolates** to mine new knowledge in the evolution and adaptation of human gut microbiome within us. My research focuses on the **colonization and survival of gut microbiome within healthy individuals** by studying **host-microbe interactions, microbe-microbe interactions, and microbe-virus interactions**.

My group currently focuses on developing AI models to understand microbial mechanisms with clinical implications. My long-term aim is to advance bacteria-based therapies by creating **smart and adaptive microbial doctors** —that can evolve to combat dynamic diseases such as cancer. For instance, some bacteria have a natural tendency to accumulate in tumor environments characterized by low oxygen and nutrients. By engineering bacteria to specifically target tumor cells, we aim to develop a safe and effective alternative treatment. This approach involves **designing genetic circuits** that can recognize tumor environments and then activate anticancer drug production and/or immune response only within tumor environments. However, existing methods are not efficient at predicting microbial **gene regulation and environmental sensing**, which ultimately relies on predicting **DNA-protein binding and protein-ligand binding**.

Publication List (Google Drive link)

Publications in Refereed Journals: Impact factors (IF) from Web of Science

An-Ni Zhang, Jeffrey Gaston, ..., and Eric Alm. “[CRISPR spacer acquisition is a rare event in human gut microbiome.](#)” Under Review

Jeffrey Gaston, Eric Alm and **An-Ni Zhang**. “[Mapper: fast and accurate sequence alignment via x-mers.](#)” Under Review

Jeffrey Gaston, Eric Alm and An-Ni Zhang . " Fast and Accurate Variant Identification Tool for Sequencing-Based Studies ." <i>BMC Biology</i> 22, no. 1 (2024): 90.	IF 7.4 (Citation 0)
An-Ni Zhang , Jeffrey Gaston, Chengzhen L. Dai, Shijie Zhao, Mathilde Poyet, Mathieu Groussin, Xiaole Yin et al. "An omics-based framework for assessing the health risk of antimicrobial resistance genes." <i>Nature communications</i> 12, no. 1 (2021): 1-11.	IF 14.919 (Citation 262)
An-Ni Zhang , Chen-Ju Hou, Mishty Negi, Li-Guan Li, and Tong Zhang. "Online searching platform for the antibiotic resistome in bacterial tree of life and global habitats." <i>FEMS Microbiology Ecology</i> 96, no. 7 (2020): f1aa107. (Editor's Choice article)	IF 4.098 (Citation 21)
An-Ni Zhang , Yanping Mao, Yubo Wang, and Tong Zhang. "Mining traits for the enrichment and isolation of not-yet-cultured populations." <i>Microbiome</i> 7, no. 1 (2019): 1-13.	IF 10.465 (Citation 9)
An-Ni Zhang , Li-Guan Li, Liping Ma, Michael R. Gillings, James M. Tiedje, and Tong Zhang. "Conserved phylogenetic distribution and limited antibiotic resistance of class 1 integrons revealed by assessing the bacterial genome and plasmid collection." <i>Microbiome</i> 6, no. 1 (2018): 1-14.	IF 10.465 (Citation 87)
An-Ni Zhang , Yanping Mao, and Tong Zhang. "Development of quantitative real-time PCR assays for different clades of "Candidatus Accumulibacter"." <i>Scientific reports</i> 6, no. 1 (2016): 1-7.	IF 4.525 (Citation 38)
Liu Tang, An-Ni Zhang , Jiawen Wang, Shufeng Liu, Xiaotao Jiang, Chenyuan Dang, Tao Ma et al. "Integrated biogeography of planktonic and sedimentary bacterial communities in the Yangtze River." <i>Microbiome</i> 6, no. 1 (2018): 1-14. (Co-first author)	IF 10.465 (Citation 217)
An-Dong Li, Jacob W Metch, Yulin Wang, Emily Garner, An Ni Zhang , ... "Effects of sample preservation and DNA extraction on enumeration of antibiotic resistance genes in wastewater." <i>FEMS microbiology ecology</i> 94.2 (2018): fix189.	IF 4.2 (Citation 43)
Xiaoqiong Gu, Jean XY Sim, Wei Lin Lee, Liang Cui, Yvonne FZ Chan, Ega Danu Chang, Yii Ean Teh, An-Ni Zhang , ... "Gut Ruminococcaceae levels at baseline correlate with risk of antibiotic-associated diarrhea." <i>Iscience</i> 25.1 (2022).	IF 5.08 (Citation 22)
Yang Yu, An-Ni Zhang , You Che, Lei Liu, Yu Deng, and Tong Zhang. "Underrepresented high diversity of class 1 integrons in the environment uncovered by PacBio sequencing using a new primer." <i>Science of The Total Environment</i> 787 (2021): 147611.	IF 7.963 (Citation 14)
Yu Deng, Yulin Wang, Yu Xia, An-Ni Zhang , ... "Genomic resolution of bacterial populations in saccharin and cyclamate degradation." <i>Science of the Total Environment</i> 658 (2019): 357-366.	IF 10.7 (Citation 11)

Yulin Wang, Wei Qin, Xiaotao Jiang, Feng Ju, Yanping Mao, An-Ni Zhang , ... "Seasonal prevalence of ammonia-oxidizing archaea in a full-scale municipal wastewater treatment plant treating saline wastewater revealed by a 6-year time-series analysis." <i>Environmental Science & Technology</i> 55.4 (2021): 2662-2673.	IF 11.4 (Citation 10)
Xiaole Yin, Xiawan Zheng, Liguan Li, An-Ni Zhang , ... "ARGs-OAP v3. 0: Antibiotic-resistance gene database curation and analysis pipeline optimization." <i>Engineering</i> (2022).	IF 12.8 (Citation 8)
Y Yang, X Jiang, B Chai, L Ma, B Li, An-Ni Zhang , ... "ARGs-OAP: online analysis pipeline for antibiotic resistance genes detection from metagenomic data using an integrated structured ARG-database." <i>Bioinformatics</i> 32 (15), 2346-2351 (2016).	IF 5.8 (Citation 257)
An-Ni Zhang , Shijie Zhao, ..., and Eric Alm. " Widespread within-person adaptation in the human gut microbiome. "	In Preparation

Conference Talk/Abstracts

Title	Presentation
An-Ni Zhang. Leveraging Computation to Understand Microbial Mechanisms. 2024 NTU SBS Faculty Internal Seminar.	Invited Oral
An-Ni Zhang. Leveraging Computation to Understand Microbial Mechanisms. 2024 NTU LKCMedicine Seminar.	Invited Oral
An-Ni Zhang. Leveraging Computation to Understand Microbial Mechanisms. 2024 MIT Microbiome Club Seminar.	Invited Oral
An-Ni Zhang, Jeffry Gaston, and Eric Alm (2023) CRISPR spacer acquisition is a rare event in human gut microbiome. 2023 Applied and Environmental Microbiology GRC	Selected Talk
An-Ni Zhang, Jeffry Gaston, and Eric Alm (2023) CRISPR spacer acquisition is a rare event in human gut microbiome. 2023 Microbial population biology GRS	Invited Oral
An-Ni Zhang (2023) Gut microbiome from eco-evo to therapeutics. Nanjing University Conference.	Invited Oral
An-Ni Zhang, Jeffry Gaston, and Eric Alm (2022) CRISPR spacer acquisition is a rare event in human gut microbiome. 2022 Lake Arrowhead Microbial Genomics (LAMG)	Selected Oral
An-Ni Zhang, Jeffry Gaston, and Eric Alm (2022) CRISPR spacer acquisition is a rare event in human gut microbiome. 2022 AMR SMART R&T session	Invited Oral
An-Ni Zhang, Jeffry Gaston, and Eric Alm (2022) Mapper: a fast and accurate sequence alignment tool. 2022 MIT BE Retreat	Selected Oral
An-Ni Zhang, Jeffry Gaston, and Eric Alm (2021) Widespread adaptive evolution of human gut microbiome. Microbiome Virtual International Forum n.4	Selected Oral

An-Ni Zhang, Jeffry Gaston, and Eric Alm (2021) Widespread adaptive evolution of human gut microbiome. 2021 MIT Center for Microbiome Informatics & Therapeutics Working In Progress CMIT WIP	Invited Oral
An-Ni Zhang, Jeffry Gaston, and Eric Alm (2021) Mapper: a fast and accurate sequence alignment tool. 2021 MIT Center for Microbiome Informatics & Therapeutics Working In Progress CMIT WIP	Invited Oral
An-Ni Zhang and Eric Alm(2021) Meta_decoder: a reference-based metagenomics workflow in KBase. 2021 KBase/ENIGMA SFA Webinar	Invited Oral
An-Ni Zhang, Kazakov A., and Eric Alm(2021) Demonstration of Meta_decoder and Fame on ENIGMA data: strain dynamics and nitrogen cycle. 2021 DOE ENIGMA Review	Invited Poster Talk
An-Ni Zhang and Eric Alm (2020) Population genomics of the human gut microbiome. 2020 MIT Center for Microbiome Informatics & Therapeutics Working In Progress CMIT WIP	Invited Oral
An-Ni Zhang (2020). Online searching platform for antibiotic resistome in bacterial tree of life and global habitats. FEMS Microbiology Ecology Editor's Choice article	Invited Oral
An-Ni Zhang and Eric Alm (2020) Strain dynamics and functional diversity of 22 high-quality single cell genomes from ENIGMA ground water. 2020 Genomic Sciences Program (GSP) Annual Principal Investigator (PI) Meeting	Poster
An-Ni Zhang, ..., Eric Alm, and Tong Zhang. (2019) Choosing your Battles: Which Resistance Genes Warrant Global Action?. The Parsons Lab Microbial Systems Seminar Series @MIT	Invited Oral
An-Ni Zhang and Eric Alm (2019) Building a reference-based metagenomics workflow in KBase. 2019 ENIGMA Retreat	Invited Oral
An-Ni Zhang, Yu, X.Q., Albores, D.A., and Eric Alm (2019) Environmental selection drive functional convergence but not population convergence in the human gut. 2019 Applied and Environmental Microbiology Gordon Research Conference (GRC)	Invited Oral
An-Ni Zhang, ..., Eric Alm, and Tong Zhang. (2019) Whom to Fight: Top Risk Antibiotic Resistances for Global Action. 5th International Symposium on the Environmental Dimension of Antibiotic Resistance (EDAR5)	Invited Oral
An-Ni Zhang, Yu, X.Q. and Eric Alm (2019) Buty_phyl: inferring butyrate producing bacteria by 16S. 2019 The Harvard Infectious Diseases Consortium (IDC) Retreat	Selected Oral
An-Ni Zhang, Yu, X.Q. and Eric Alm (2019) Environmental Selection of Butyrate Producers Drives Genetic But Not Species Convergence. 2019 Microbial Engineering and Sciences Seminar of MIT	Invited Oral

An-Ni Zhang and Eric Alm (2019) Building a reference-based metagenomics workflow in KBase. 2019 Genomic Sciences Program Annual Principal Investigator (PI) Meeting	Invited Oral
An-Ni Zhang and Eric Alm (2019) Environmental Selection of Butyrate Producers Drives Genetic But Not Species Convergence. Third Workshop on Statistical and Algorithmic Challenges in Microbiome Data Analysis 2019	Selected Oral
An-Ni Zhang and Eric Alm (2019) Environmental Selection of Butyrate Producers Drives Genetic But Not Species Convergence. 4th Annual MIT-Harvard Microbiome Symposium 2019	Poster
An-Ni Zhang, Yang, Y., and Tong Zhang. (2018) Recovering Whole Sequence of Class 1 Integrons in Environments by Constructing a Comprehensible Class 1 Integrase Database. ASM Microbe 2018.	Selected Oral
An-Ni Zhang, Yang, Y., and Tong Zhang. (2018) Recovering Whole Sequence of Class 1 Integrons in Environments by Designing New PCR Primers. 2018 Environmental Sciences: Water. and 2018 Environmental Sciences: Water (GRS).	Poster
An-Ni Zhang and Tong Zhang. (2018) Introduction to Whole Genome Analysis International Symposium on Antimicrobial Resistance in the Environment (ISARE 2017).	Invited Oral
An-Ni Zhang, Li, L.G., Ma, L., and Tong Zhang. (2017) Conserved Phylogenetic Distribution of Integrons Revealed by Analysis of the Collection of Whole Genomes. 4th International Symposium on the Environmental Dimension of Antibiotic Resistance (EDAR 4).	Selected Oral
An-Ni Zhang, Jiang, X.T., Mao, Y., and Tong Zhang. (2016) Variations of Polyphosphate Accumulation Organisms (PAOs) Dynamics and Their Time-Dependent Associations to Operational Parameters. IWA Microbial Ecology in Water Engineering & Biofilms Joint Specialist Conference (MEWE) 2016.	Poster
An-Ni Zhang, Mao, Y., and Tong Zhang. (2015) Revealing Human Pathogens in Livestock Faeces by Metagenomes Based on High-Throughput Sequencing. ASM Conference on 2015 Rapid NGS Bioinformatic Pipelines for Enhanced Molecular Epidemiologic Investigation of Pathogens.	Poster
An-Ni Zhang, Mao, Y., and Tong Zhang. (2014) Geographical Distribution and Seasonal Dynamics of Polyphosphate Accumulating Organisms and Glycogen Accumulating Organisms in Sewage Treatment Plants. DSD International Conference 2014.	Invited Oral
An-Ni Zhang (2013) Potential Sources to Food Contamination and Its Effect to Human Health During The Life Cycle of Domestic Livestocks. International Student Conference on Environment and Sustainability UNEP.	Poster

Leadership & Service

Judge for Youth Science Conference - providing expertise in microbiology	2024
Supervising two master students for AY24/25 MSc Biomedical Data Science Immersion Scheme (BDMSIS)	2024
Providing chalk talk feedback for faculty position candidate Alexandra Dallaire	2024

External Consultancy

Company	Year
OpenBiome: developing 16S analysis pipeline	2023

Invited Talks/Speeches

School of Biological Sciences (Nanyang Technological University)
Department of Chemistry and Molecular Biology (Gothenburg University)
Prof. Eric Alm (MIT)
Prof. Michael Gilmore (Harvard Medical School)
Dr. Bill Hanage (Harvard Medical School)
Prof. James Tiedje (Michigan State University, former president of ASM)
Prof. Rob Knight (UCSD)
Prof. Martin Blaser (New York University)
Prof. Ian Paulsen (Macquarie University)
Prof. Michael Gillings (Macquarie University)
Prof. Phil Hugenholtz (University of Queensland)
Prof. Emad El-Omar (University of New South Wales)
Prof. Marko Virta (University of Helsinki)
Prof. Barth Smets (Technical University of Denmark)
Prof. Karina Gin (National University of Singapore)
Dr. Kostas Konstantinidis (Georgia Tech University)
Dr. Bonnie Hurwit (University of Arizona)

Scientific Paper Review

1 <i>Bioinformatics Advances</i>	2024
1 <i>ISME</i>	2023

1 <i>Cell Host & Microbe</i>	2023
1 <i>The Lancet Planetary Health</i>	2023
1 <i>Environmental Science & Technology</i>	2023
1 <i>BMC Biology</i>	2022
2 <i>Environmental Science & Technology</i>	2022
1 <i>Environmental Science & Technology</i>	2021
1 <i>Cell Host & Microbe</i>	2021
1 <i>Med Cell Press</i>	2021
1 <i>PLOS Computational Biology</i>	2020
1 <i>Briefings in Bioinformatics</i>	2020
1 <i>Water Research</i>	2019
1 <i>eLife</i>	2019
1 <i>PNAS</i> (Assistance Review)	2014-2018
1 <i>ISME</i> (Assistance Review)	2014-2018
1 <i>Water Research</i> (Assistance Review)	2014-2018

Awards/Achievements

Chair of Applied and Environmental Microbiology Conference Gordon Research Seminar (GRS) .	2023
Panelist for "Computational Microbiology" Breakout Session at Boston Bacterial Meeting	2023
Poster Judge for MIT Microbiome Symposium	2023
Boston Bacterial Meeting (BBM) Organizing Committee Member: Organizer and Host for Breakout Session Microbiome and Microbial Communities and Breakout Session Bioinformatics	2021
MIT Microbiome Club Organizing Committee Member (Microbiome Symposium)	2021
4th Workshop on Statistical and Algorithmic Challenges in Microbiome Data Analysis (SACMDA4) Organizing Committee Member	2020
Boston Bacterial Meeting (BBM) Organizing Committee Member (Abstract book & Website)	2020
Outstanding Research Postgraduate Student 2018 of The University of Hong Kong (10 awards per year)	2019
Norman W.M. Ko Ph.D. Prize 2018 of The University of Hong Kong (5,000 HKD)	2019

Elected as Chair of 2023 Applied and Environmental Microbiology Conference Gordon Research Seminar (GRS)	2019
Nomination by the University of Hong Kong for Schmidt Science Fellows	2019
Offer of Post-doc position, Prof. Eric Alm (MIT)	2018
Offer of Post-doc Position, Prof. Rob Knight (UCSD)	2018
Offer of Post-doc Position, Prof Michael Gilmore (Harvard Medical School)	2018
Outstanding PhD Thesis Award, The University of Hong Kong	2018
Outstanding Teaching Assistant Award, The University of Hong Kong	2018
ASM Student Travel Grants	2015
Hong Kong PhD Scholarship and Fellowship	2014-2018
Y S and Christabel Lung Postgraduate Scholarship, The University of Hong Kong	2014-2018
Outstanding NOC assistant, Nanjing Summer Youth Olympic Games	2014
Outstanding Undergraduate Student of Nanjing University (1 per department)	2014
Top Undergraduate Student (Rank 1/66), Department of Environmental Science, The Nanjing University	2014
The National Scholarship, China	2013
Klaus Toepfer Environmental Scholarship, UNEP	2013

Teaching & Mentoring

MIT Kaufman Teaching Certificate	2023
MIT micro teaching: “You can move, but you can’t hide. Identifying horizontal gene transfer (HGT) in microbes.”	2023
Teaching Course 20.265 “Genetics for Biological Engineering” of MIT (two guest lectures)	2022
Teaching assistant of common core course “CCCH9036 Environmental Pollution in Mainland China”, The University of Hong Kong	2014-2018

I have mentored postgraduate students and research assistants on both dry-lab and wet-lab experiments.

Xinyu Lv, exchange student, NTU	2024
Victoria Chen, PhD student, MIT	2023
Rashi Rajesh Jeeda, PhD student, MIT	2023

Emanuel F Burgos, PhD student, MIT	2022
Alexa Felice Sachs Gomberg, PhD student, MIT	2022
Yifeng Yuan, Postdoc, MIT	2019-2020
Qi Zhang, PhD student, The University of Hong Kong	2018-cont.
Yu Yang, PhD student, The University of Hong Kong	2017-cont.
Qi Huang, PhD student, The University of Hong Kong	2017-2018
Chen-Ju Hou, research assistant, The University of Hing Kong	2017-2018
Yangyang Chu, undergraduate student, Nanjing University	2016-2017
Leading teaching assistant and course coordinator for CCCH9036 “Environmental Pollution in China”of University of Hong Kong. I won the Outstanding Teaching Assistant Award in 2018.	2014-2018
