Chen Liao, Ph.D.

Computational & Systems Biology Program
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EDUCATION

University of Illinois at Urbana-Champaign, Illinois, USA.   Aug. 2012 – May 2018
- Ph.D. in Bioengineering, College of Engineering

University of Science and Technology of China, Hefei, Anhui, China   Aug. 2006 – July 2010
- B.S. in Optics and Optical Engineering, School of Physical Sciences

WORK & RESEARCH EXPERIENCE

Incoming Assistant Professor   Starting at Jul. 2025
Department of Microbiology and Immunology, Dartmouth College

Postdoctoral Scholar/Associate (Advisor: Drs. Joao Xavier and Tobias Hohl)   Sept. 2018 – Present
Computational & Systems Biology Program, Memorial Sloan Kettering Cancer Center

Graduate Research Assistant (Advisor: Dr. Ting Lu)   Aug. 2012 – May 2018
Department of Bioengineering, University of Illinois at Urbana-Champaign (UIUC)

PUBLICATIONS

First/Co-first (#) Author Publications

1. **Liao, C.#**, Rolling, T.#, Djukovic, A.#, Fei, T., Mishra, V., Liu, H.B., Lindberg, C., Dai, L., Zhai, B., Peled, J.U., van den Brink, M.R.M., Hohl, T.M., Xavier, J.B. (2024) "Oral bacteria relative abundance in faeces increases due to gut microbiota depletion and is linked with patient outcomes". ***Nature Microbiology***. doi: 10.1038/s41564-024-01680-3.

2. Chen, C.#, **Liao, C.#**, Liu, Y.-Y. (2023) "Teasing out missing reactions in genome-scale metabolic networks through hypergraph learning". ***Nature Communications*** 14, 2375.

3. Santamaria, G.#, **Liao, C.#**, Wang, Z., Rhee, K., Pinto F., Yan, J., Xavier, J.B. (2022) "Evolution and regulation of microbial secondary metabolism". ***eLife*** 11: e76119.

4. Liu, H.#, **Liao, C.#**, Wu, L., Tang, J., Chen, J., Lei, C., Zheng, L., Zhang, C., Liu, Y.-Y., Xavier, J.B., Dai, L. (2022). "Ecological dynamics of the gut microbiome in response to dietary fiber". ***The ISME Journal*** 16(8):2040-2055.

5. **Liao, C.**, Taylor, B.P., Ceccarani, C., Fontana, E., Amoretti, L.A., Wright, R.J., Gomes, A.L.C., Peled, J.U., Taur, Y., Perales, M.-A., van den Brink, M.R.M., Littmann, E., Pamer, E.G., Schluter, J., Xavier, J.B. (2021). "Compilation of longitudinal microbiota data and hospitalome from hematopoietic cell transplantation patients". ***Scientific Data*** 8(1):71.

6. **Liao, C.**, Wang, T., Maslov, S., Xavier, J.B. (2020). "Modeling microbial cross-feeding at intermediate scale portrays community dynamics and species coexistence". ***PLoS Computational Biology*** 16(8): e1008135.

7. **Liao, C.**, Xavier, J.B., Zhu, Z. (2020). "Enhanced inference of ecological networks by parameterizing ensembles of population dynamics models constrained with prior knowledge". ***BMC Ecology*** 20(1):3.

8. **Liao, C.**, Blanchard, A.E., Lu, T. (2017) "An integrative circuit-host modelling framework for predicting synthetic gene network behaviours". *Nature Microbiology* 2(12):1658.

9. **Liao, C.**, Seo, S.O., Lu, T. (2016) "System-level modeling of acetone-butanol-ethanol fermentation". *FEMS Microbiology Letters* 393(9):fnw074.

10. **Liao, C.**, Seo, S.O., Celik, V., Liu, H., Kong, W., Wang, Y., Blaschek, H., Jin, Y.S., Lu, T. (2015) "An integrated, systems metabolic picture of the acetone-butanol-ethanol fermentation by *Clostridium acetobutylicum*". *PNAS* 112(27):8505-8510.

11. **Liao, C.**, Lu, T. (2013) "A minimal transcriptional controlling network of regulatory T cell development". *The Journal of Physical Chemistry B* 117(42):12995-13004.

12. **Liao, C.**, Cai, Y. (2014). "Towards Modeling Automation for Synthetic Biology", In A Systems Theoretic Approach to Systems and Synthetic Biology II: Analysis and Design of Cellular Systems (pp. 201-217). Springer Netherlands.

Collaborative Publications

13. Mathur D., **Liao, C.**, Lin, W., La Ferlita, A., Alaimo S., Taylor, S., Zhong, Y., Iacobuzio-Donahue, C., Ferro, A., Xavier, J.B. (2023) "The ratio of key metabolic transcripts is a predictive biomarker of breast cancer metastasis to the lung". *Cancer Research* 83(20):3478-3491.

14. Schluter, J., Djukovic, A., Taylor, B.P., Yan, J., Duan, C., Hussey, G.A., **Liao, C.**, Sharma, S., Fontana, E., Amoretti, L.A., Wright, R.J., Dai, A., Peled, J.U., Taur, Y., Perales, M.-A., Siranosian, B.A., Bhatt, A.S., van den Brink, M.R.M., Pamer, E.G., Xavier, J.B. (2023) "The TaxUMAP atlas: Efficient display of large clinical microbiome data reveals ecological competition in protection against bacteremia". *Cell Host & Microbe* 31(7):1126-1139.e6.

15. Nguyen, C., Markey, K., Miltiadous, O., Dai, A., Waters, N., Sadeghi K., Fei, T., Shouval, R., Taylor, B.P., **Liao, C.**, Slingerland, J.B., Slingerland`, A.E., Clurman, A.G., Maloy, M.A., Bohannon, L., Giardina, P.A., Brereton, D.G., Armijo, G.K., Fontana, E., Gradissimo, A., Guyrkcoza, B., Sung, A.D., Chao, N.J., Devlin, S.M., Taur, Y., Giralt, S.A., Perales, M.-A., Xavier, J.B., Pamer, E.G., Peled, J.U., Gomes, A.L.C., van den Brink, R.M. (2023) "High resolution analyses of associations between medications, microbiome and mortality in cancer patients". *Cell* 186(12):2705-2718.e17.

16. Li, L., Qiao, J., Yu, G., Wang, L., Li, H.-Y., **Liao, C.**, Zhu, Z. (2022). "Interpretable tree-based ensemble model for predicting beach water quality". *Water Research* 211:118078.

17. Xavier, J.B., Monk, J.M., Poudel, S., Norsigian, C.J., Sastry, A.V., **Liao, C.**, Bento, J., Suchard, M.A., Arrieta-Ortiz, M.L., Peterson, E.J., Baliga, N.S. (2022). "Mathematical models to study the biology of pathogens and the infectious diseases they cause". *iScience* 25(4):104079.

18. Yan, J., **Liao, C.**, Taylor, B.P., Fontana, E., Amoretti, L.A., Wright, R.J., Dai, A., Waters N., Peled, J.U., Taur, Y., Perales, M.-A., Siranosian B.A., Bhatt A.S., van den Brink, M.R.M., Pamer, E.G., Schluter, J., Xavier, J.B. (2022). "A compilation of fecal microbiome shotgun metagenomics from hospitalized patients undergoing hematopoietic cell transplantation". *Scientific Data* 9(1):219.

19. Wang, L., Zhu, Z., Sassoubre, L., Yu, G., **Liao, C.**, Hu, Q., Wang, Y. (2021). "Improving the Robustness of Beach Water Quality Modeling using an Ensemble Machine Learning Approach". *Science of The Total Environment* 765:142760.

20. Yan, J., Estanbouli, H., **Liao, C.**, Kim, W., Monk, J.M., Rahman, R., Kamboj, M., Palsson, B.O., Qiu, W., Xavier, J.B. (2019). "Systems-level analysis of NalD mutation, a recurrent driver of rapid drug resistance in acute *Pseudomonas aeruginosa* infection". ***PLoS Computational Biology*** 15(12):e1007562.

21. Pan, J., Ma, J., Wu, H., Chen, B., He, M., **Liao, C.**, Wei, C. (2018). "Application of metabolic division of labor in simultaneous removal of nitrogen and thiocyanate from wastewater". ***Water Research*** 150:216-224.

22. Blanchard, A.E., **Liao, C.**, Lu, T. (2018) "Circuit-host coupling induces multifaceted behavioral modulations of a gene switch". ***Biophysical Journal*** 114(3):737-746.

23. Kong, W., Blanchard, A.E., **Liao, C.**, Lu, T. (2017) "Engineering robust and tunable spatial structures with synthetic gene circuits". ***Nucleic Acids Research*** 45(2):1005-1014.

24. Blanchard, A.E., **Liao, C.**, Lu, T. (2016) "An ecological understanding of quorum sensing-controlled bacteriocin synthesis". ***Cellular and Molecular Bioengineering*** 9(3):443-454.

25. Kong, W., Celik, V., **Liao, C.**, Hua, Q., Lu, T. (2014) "Programming the group behaviors of bacterial communities with synthetic cellular communications". ***Bioresources and Bioprocessing*** 1(1):24.

Submitted/Under Revision Publications

26. Zhai, B.#, **Liao, C.#**, Jaggavarapu, S.#, Tang, Y.#, Rolling, T., Ning, Y., Sun, T., Bergin, S.A., Gjonbalaj M., Miranda, E., Babady, N.E., Bader, O., Taur, Y., Butler, G., Zhang, L., Xavier, J.B., Weiss, D.S., Hohl T.M. (2024) "Echinocandin heteroresistance causes prophylaxis failure and facilitates breakthrough *Candida parapsilosis* infection". Under revision in ***Nature Medicine***. doi: 10.1101/2022.05.29.22275734. Available at https://www.medrxiv.org/content/10.1101/2022.05.29.22275734v2

GRANT SUPPORT

1. NIH-NIAID K99/R00 (PI: Chen Liao, Amount: $745,661)   05/2024-04/2028
   Project title: Unraveling the ecology of intestinal fungal expansion in immunocompromised patients through computational modeling and machine learning

PRESENTATIONS

Seminar Talks

1. Unintended Consequences: Antimicrobial Collateral Damage in the Human Gut Microbiome. Department of Biological Sciences, Purdue University, West Lafayette, IN., USA., June 5, 2023.

2. Learning microbiome ecology from perturbations. Department of Microbial Infection and Immunity, The Ohio State University, Columbus, OH., USA., Mar. 30, 2023.

3. Learning microbiome ecology from perturbations. Department of Microbiology and Immunology, Dartmouth College, Hanover, NH., USA., Feb. 13, 2023.

4. Oral bacteria in feces reflect the loss of intestinal bacteria. *Channing Microbiome Seminar (Virtual)*, Channing Division of Network Medicine, Department of Medicine, Brigham and Women's Hospital, Boston, MA., USA., Nov. 19, 2021.

5. An integrative circuit-host modeling framework for synthetic biology. *Graduate Student Speaker Exchange Program*, University of Wisconsin-Madison, Madison, WI., USA., May 1, 2017.

6. Integrative modeling of acetone-butanol-ethanol (ABE) fermentation. *Bioengineering Graduate Student Seminar Series*, University of Illinois at Urbana-Champaign, Champaign, IL., USA., Oct. 12, 2015.

7. Understanding microbial metabolism through integrative modeling. Institute of Microbiology, Chinese Academy of Sciences, Beijing, China, Jun. 30, 2015.

Conference Talks

8. Making sense of gut microbiome dysbiosis. *Rust Belt Microbiome Conference 2022*, Nov. 3-4, 2022. **Invited talk**.

9. Machine learning-based diagnosis of antimicrobial drug heteroresistance. *SMBEeverywhere GS5 (Virtual).* Oct. 20, 2022.

10. Modeling microbial cross-feeding at intermediate scale portrays community dynamics and species coexistence. *Microbial Ecology & Evolution (MEEvirtual)*, Aug. 12-14, 2020.

11. An integrative circuit-host modeling framework for predicting synthetic gene network behaviors. *The 4th Synthetic Biology Young Scholar Forum*, Shenzhen, China, Jul. 7, 2018.

12. An integrative circuit-host modeling framework for predicting synthetic gene networks. *Spring 2018 CPLC/CBQB Graduate Student and Postdoc Symposium*, University of Illinois at Urbana-Champaign, Champaign, IL., USA., Apr. 24, 2018.

13. An integrative circuit-host modeling framework for synthetic biology. *Bioengineering Graduate Student Symposium*, University of Illinois at Urbana-Champaign, Champaign, IL., USA., Apr. 29, 2017.

14. Rule-based modeling approach for synthetic biology. *Six-Academy Synthetic Biology Symposium*, Shanghai, China, Oct. 12-14, 2011. **Invited talk**.

TEACHING EXPERIENCE

- Teaching Assistant, BioE201 Conservation Principles in Bioengineering, UIUC, 2017
- Teaching Assistant, BioE310 Computational Tools for Biological Data, UIUC, 2016
- Teaching Assistant, BioE598 Introduction to Synthetic Biology, UIUC, 2013-2017
- Teaching Assistant, BioE507 Advanced Bioinstrumentation, UIUC, 2014-2016
- Instructor of USTC-Software Team for International Genetically Engineered Machine (iGEM) Competition, 2011

HONORS & AWARDS

- The Anthony C. Brown Society Scholar, MSKCC, 2020-2024
- Chinese Government Award for Outstanding Self-financed Students Abroad, Chinese Scholarship Council, 2017
- Yee Memorial Fund Fellowship, UIUC, 2015
- Gold Medal & Best Software Tool (team leader on behalf of USTC), International Genetically Engineered Machine (iGEM) Competition, 2010
- Meritorious Winner, the Mathematical Contest in Modeling (MCM), 2010
- Outstanding Student Scholarship, USTC, 2009
- Outstanding Student Scholarship, USTC, 2008

- Second Prize Winner of Physics Research Experiment Contest, USTC, 2008
- Outstanding Freshman Scholarship, USTC, 2006