
Zhiying Lu

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GitHub: <https://github.com/luzy05111036>

EDUCATION

- **2009-2015 Ph.D. Environmental Science** University of Chinese Academy of Science
- **2005-2009 B.Sc. Biotechnology** South-Central University for Nationalities
- **2020-2022(Expected) M.S. Computer science** University of Alabama at Birmingham

RESEARCH EXPERIENCE

- **Jan 2022-Present** Researcher IV University of Alabama at Birmingham
- **Jan 2020- Dec 2021** Postdoctoral Fellow University of Alabama at Birmingham
Adviser: [Jeffrey Morris](#)
Project: How elevated CO₂ affects the Black Queen Hypothesis evolution in ocean microbes
- **Oct 2017- Dec 2019** Postdoctoral Associate Duke University
Adviser: [Zackary Johnson](#)
Project: Develop economic and environmental-friendly algal cultivation and harvesting technologies for producing algal bioproducts-biofuel, food and feed
- **May 2015-Sep 2017** Postdoctoral Associate Institute of Hydrobiology at Chinese Academy of Sciences
Primary Advisor: Xuezhi Zhang; Co-advisor: Qiang Hu
Project: Characterize growth inhibitors in the reused algal culture media and develop effective technologies for algal media reuse.

CORE SKILLS

- Python, R, SQL, Java, Racket, C coding, SPSS statistics, cloud computing, Machine/Deep learning
- Next Gen sequencing technology, RNA-seq, and data analysis
- Linux/Unix. Ability to interpret, troubleshoot and report on complex data
- Design microalgal photobioreactor and harvesting system at scale
- Membrane filtration technology for algae and bio-molecules separation
- Operating equipment such as HPLC-MS, GC-MS and Flow cytometry.

AWARDS

- (1) [AI against Cancer, Data science Hackathon, 2021](#)-Natural Language Processing System for Retrieving Information about Cancer Phenotypes from Published Articles, 3rd prize.
- (2) [Duke Postdoctoral Professional Development Award](#), 2019 (Highly competitive, 5 winners per year and I am the only one who received the Ph.D. degree from outside of US).
- (3) **The Dory Postdoc Award 2021** from University of Alabama at Birmingham, Sep 2021.
- (4) Prize for oral presentation of **2021 UAB Postdoc Research Day**, 3RD place.
- (5) Excellent Oral Presentation in Young Researcher Session, Algae Biomass Summit, The 4th Asia-Oceania Algae Innovation Summit, Wuhan, China, 2016.

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- (6) Outstanding staff in the Center for Microalgal Biotechnology and Biofuels, Wuhan, China, 2016
 - (7) Outstanding student of University of Chinese Academy of Science, 2014
 - (8) Outstanding Volunteer Service for 13th World Lake Conference, Wuhan, China, 2009.

GRANTS

- (1) **Chinese postdoctoral science foundation**, ~\$ 8, 500. "Identification of growth inhibitors in the algal reused media and its removal", 2016/01-2017/09, Lead PI.
- (2) **International Postdoctoral Exchange Fellowship of China**, \$ 45, 000. "Develop economic and environmental-friendly algal cultivation and harvesting technologies for producing algal bioproducts-biofuel, food and feed", 2017/10-2019/12, Co-advisor: Zackary Johnson
- (3) **Natural Science Foundation of China**, \$ 85, 000. "Membrane fouling mechanisms caused by Algogenic Organic Matter (AOM) and its mitigation during microalgae harvesting process", 2017/01-2020/12, Major Investigator.
- (4) **US Department of Energy**, \$ 5, 200, 000. "[Combining biofuel and high-value bioproducts to meet the renewable fuel standard](#)", 2016/01-2019/12, Major Investigator.
- (5) **State Investigation and Development Corporation**, \$ 400, 000.00. "The key technologies in the algal harvesting and downstream process", 2015/02-2017/04, Major Investigator,
- (6) **Natural Science Foundation of China**, \$ 40, 000. Major Investigator, "Study on Cell Aggregation Mechanism and Dynamics in Microalgae Biomass Production", 2017/01-2019/12, Major Investigator.
- (7) **Natural Science Foundation of China**. \$ 40, 000.00. "Joint Effects of Four Alkaloids on Two Algae and Their Ecological Safety Assessment", 2012/01-2015/12, Major Investigator.

PROJECTS

- (1) Microbial Social Networking: Co-evolution of Bacteria and Algae in a Changing Ocean (NSF OCE-1851085) led by Jeffrey Morris. Based on the unique resource of our group- the "Long Term Phytoplankton Evolution" (LTPE) experiment (four phytoplankton types were evolved for 500 generations at either modern or year 2100 CO₂ concentrations), I used the omics, such as genomics/ transcriptomics/ proteomics approaches to quantify the evolutionary and ecological stability of the Black Queen interactions impacting the open ocean microbial carbon cycle.
- (2) MAGIC (Marine AlGae Industrialization Consortium)-Combining biofuel and high-value bioproducts to meet the renewable fuel standard (DOE Funded Project #DE-EE0007091, USA) led by Zackary Johnson. My roles in this project are to cultivate and harvest 8 strains of 40 kg dry algal biomass for biofuel and feed production; (2) to explore effective ways to reuse the water for algae cultivation.
- (3) Study the key technologies in the downstream processing of microalgae (State Development & Investment Company-funded project, China) led by Xuezhi Zhang. My role in this project is to characterize the growth inhibitors in the recycled algal culture media and develop effective technologies for media recycling (2015-2017).
- (4) CS663 Cloud computing-VPN. Using Amazon AWS cloud platform and Pritunl client, our team established a VPN with access for 20 users.
- (5) CS667 Machine learning - Using mask R-CNN to detect components of transmission towers photographed by drones. In this project, our team used Matterport's implementation of Mask R-

CNN, running on a TensorFlow and Keras backend. Additionally, Google Colab was used for training and inference due to GPU availability, which made the running time of training manageable.

- (6) CS665 Deep learning - Genre Recognition with VGG16. In the project, we established a method to classify music genres using audio spectrograms created from original soundtracks. The spectrograms were used as visual representation for feature extraction by using a deep learning model VGG-16 with the Adam optimizer. Our preliminary results from a total of 5000 samples indicated a promising performance of the model: an accuracy of > 80% for both training and testing, suggesting that the model is suitable for music genre classification.

PUBLICATIONS

- (1) Barreto Filho, M. M., **Lu, Z.**, Walker, M., & Morris, J. J. (2022). Community context and pCO₂ impact the transcriptome of the “helper” bacterium *Alteromonas* in co-culture with picocyanobacteria. *ISME Communications*, 2(1), 1-11.
- (2) **Lu, Z***, Beal, C., Johnson, Z. (2022). Comparative performance and technoeconomic analyses of two microalgae algae harvesting systems run at scale, *Algal research*, 64, 102667.
- (3) Morris, J.J., Rose, A.L., **Lu, Z.** (2022). Reactive oxygen species in the world ocean and their impacts on marine ecosystems, 102285. (Invited review from *Redox Biology*, IF: 11.8).
- (4) Li, X.Y., Pan, J.F., **Lu, Z.L***, Gao, Z.S., Yan, Z.G. (2021). Arsenate toxicity to the marine microalga *Chlorella vulgaris* increases under phosphorus-limited condition. *Environmental Science and Pollution Research* (*Corresponding author, IF: 4.2).
- (5) Sha, J., Xiong, H., Li, C., **Lu, Z.**, Zhang, J., Zhong, H., Zhang, W. and Yan, B., 2021. Harmful algal blooms and their eco-environmental indication. *Chemosphere*, p.129912 (IF: 7.08).
- (6) **Lu, Z.**, Loftus, S., Sha, J., Wang, W., Park, M., Zhang, X., Johnson, Z., Hu, Q. (2020). Water reuse for sustainable microalgae cultivation: Current knowledge and future directions. *Resources, Conservation and Recycling*, 161, 104975 (IF:10.2).
- (7) **Lu, Z***, Jun, S., Wang, W., Li, Y., Chen, Y., Zhang, X., Hu, Q. (2019). Identification of auto-inhibitors in the reused culture media of *Scenedesmus acuminatus*, *algal research*, 44: 101665(*Corresponding author, IF: 4.4).
- (8) Sha, J.[#], **Lu, Z.Y.**[#], Ye, J., Wang, G.H., Hu, Q., Chen., Y., Zhang, X. (2019). The Inhibition Effect of Recycled *Scenedesmus acuminatus* Culture Media: Influence of Growth Phase and Inhibitor Removal. *Algal research*, 42, 101612. (#, Equally contribute to the first author, IF: 4.4).
- (9) Shao, S., Shi, D., Li, Y., Liu, Y., **Lu, Z.Y.**, Fang, Z., & Liang, H. (2019). Effects of water temperature and light intensity on the performance of gravity-driven membrane system. *Chemosphere*, 216, 324-330 (IF: 7.08).
- (10) Wang, W., Sha, J., **Lu, Z.Y***, Shao, S., Sun, P., Hu, Q., & Zhang, X. (2018). Implementation of UV-based advanced oxidation processes in algal medium recycling. *Science of the Total Environment*, 634, 243-250 (*Corresponding author, IF: 7.96).
- (11) Chen, Z., Tian, Y., Zhu, C., Liu, B., Zhang, Y., **Lu, Z.Y.**, Zhou Q.H., & Wu, Z. (2018). Sensitive detection of oxidative DNA damage in cyanobacterial cells using supercoiling-sensitive quantitative PCR. *Chemosphere*, 211, 164-172 (IF: 7.08).
- (12) **Lu, Z.Y.**, Sha, J., Tian, Y., Zhang, X.Z., Liu, B.Y., & Wu, Z.B. (2017). Polyphenolic allelochemical pyrogallol acid induces caspase-3 (like)-dependent programmed cell death in the cyanobacterium *Microcystis aeruginosa*. *Algal Research*, 21, 148-155 (IF: 4.4).

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- (13) Gao, Y. N., Ge, F.J., Zhang, L.P., He, Y., **Lu, Z.Y.**, Liu, B. Y., Zhou, Q.H., & Wu, Z.B. (2017). Enhanced toxicity to Cyanobacteria *Microcystis aeruginosa* by Low-dosage Repeated to the Allelochemical N-phenyl-1-naphthylamine. *Chemosphere*, 173(IF: 7.08).
- (14) Zhang, X.Z[#], **Lu, Z.Y.**[#], Wang, Y.F., Wensel, P., Sommerfeld, M., & Hu, Q. (2016). Recycling *Nannochloropsis oceanica* culture media and growth inhibitors characterization. *Algal Research*, 20, 282-290 (#, **Equally contribute to the first author**).
- (15) **Lu, Z.Y.**, Zhang, Y., Gao, Y.N., Liu, B.Y., Sun, X., He, F., Zhou, Q.H., Wu, Z.B. (2016). Effects of pyrogallol acid on *Microcystis aeruginosa*: oxidative stress related toxicity. *Ecotoxicology and Environmental Safety*, 132, 413-41(**IF: 6.29**).
- (16) Gao, Y. N., Liu, B. Y., Ge, F. J., He, Y., **Lu, Z. Y.**, Zhou, Q. H., Wu, Z. B. (2015). Joint effects of allelochemical nonanoic acid, N-phenyl-1-naphthylamine and caffeic acid on the growth of *Microcystis aeruginosa*. *Allelopathy Journal*, 35(2).
- (17) Gao, Y. N., Ge, F.J., Liu, B. Y., **Lu, Z.Y.**, He, Y., Zhang, Y.Y., & Wu, Z.B. (2015). Comparative Study on Antialgal Effects of Allelochemicals from Aquatic Plants under Different Exposure Protocols. *Ecology and Environment Sciences (Chinese)*, 2015, 24(4): 554-560 (In Chinese with English abstract).
- (18) Sun, X. M., Liu, B.Y., Zhou, Q. H., Gao, Y.N., Ge, F.G., **Lu, Z. Y.**, & Wu, Z. B. Preliminary Study on Allelopathic Inhibition of Cyanobacteria: From the View of Low Dose-Repetitious Exposure of Pyrogallol Acid (2014). *Environmental Science & Technology (Chinese)* (1), 65-69 (In Chinese with English abstract).
- (19) Sun, X. M., **Lu, Z. Y.**, Liu, B. Y., Zhou, Q. H., Zhang, Y. Y., & Wu, Z. B. (2014). Allelopathic effects of pyrogallol acid secreted by submerged macrophytes on *Microcystis aeruginosa*: Role of ROS generation. *Allelopathy Journal*, 33(1), 121-124.
- (20) **Lu, Z.Y.**, Liu, B. Y., He, Y., Chen, Z. L., Zhou, Q. H., & Wu, Z. B. (2014). Effects of daily exposure of Cyanobacterium and Chlorophyte to low-doses of Pyrogallol. *Allelopathy Journal*, 34(2), 195-205.
- (21) **Lu, Z.Y.**, Sun, X., Zhang Y.Y, Wu Z.B. (2013). Review on inhibitory mechanisms of allelochemicals released by aquatic plants on phytoplankton. *Environmental Science & Technology (Chinese)*, 36(7): 64-69 (In Chinese with English abstract).
- (22) Sun X.M, Liu B.Y, **Lu Z.Y.**, Wu Z.B. (2013). Study on oxidative damage to *Microcystis aeruginosa* mediated by allelochemical pyrogallol acid from submerge macrophytes. *China Environmental Science(Chinese)*, 33(10): 1835-1841 (In Chinese with English abstract).
- (23) Ge F.G, Liu B.Y, **Lu Z.Y.**, Gao Y.N, Wu Z.B. (2012). Effects of different nitrogen and phosphorus levels on the growth and total phenolic contents of *Myriophyllum spicatum*[J]. *Acta Scientiae Circumstantiae (Chinese)*, 32(2): 472-479 (In Chinese with English abstract).
- (24) Ge F.G, Liu B.Y, **Lu Z.Y.**, Gao Y.N, Wu Z.B. (2012). Effects of light intensity on growth and phenolic contents of *Myriophyllum spicatum*. *Environmental Science & Technology (Chinese)*, 35(3): 30-33 (In Chinese with English abstract).

Book chapter

Lu Z.Y. & Chen Z.L. 2016. Chapter 4.3: Programmed cell death in phytoplankton induced by allelochemicals. pp.120-139. In Wu Z.B. *et al.* Allelopathic interaction between macrophyte and phytoplankton. Science press, Beijing, China.

Google scholar: https://scholar.google.com/citations?user=y3LiY_MAAAAJ&hl=zh-CN

PATENTS

(1) Wu Z.B, **Lu Z.Y.**, Guo W.J, Liu B.Y. The application of pyrogallol to inhibit the growth of algae.

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- Patent number, CN201310023374.0, Chinese patent, (Granted).
- (2) Wu Z.B, **Lu Z.Y.** and Liu. B.Y. A Method for Detecting DNA Damage in Microcystis Cell by Fluorescence Probe. Patent number: CN201610109195.2, Chinese patent (Supervisor is listed at the first place, (Granted).
- (3) Zhang X.Z., Sha J., **Lu Z.Y.**, and Hu Q. A High Throughput Detection Device for Microalgal Growth. Patent number, CN201620947536.9, Chinese patent. (Granted)
- (4) **Zhiying Lu, Zackary Johnson.** An integrated microalgae cultivation-harvesting-water reuse system, US patent, (in preparation).

ORAL & POSTER PRESENTATIONS

- (1) **Zhiying Lu***, Jeffrey Morris. Function of vesicles in the Black Queen Hypothesis. ProSynFest 2020, Palacio de Congresos de Córdoba, Spain, March 16-19, 2022. **Poster.**
- (2) **Zhiying Lu***, Jeffrey Morris. Vesicles deliver products of leaking function in the Black Queen Hypothesis. 18th Annual Postdoctoral Research Day, Birmingham, AL, USA, Sep 21, 2021, **Oral presentation.**
- (3) **Zhiying Lu***, Zackary Johnson. Comparative performance and technoeconomic analyses of two microalgae algae harvesting systems run at scale. *The 42st Annual Southeast Phycological Colloquy*, Birmingham, AL, USA, Nov 7, 2020, Online, **Oral presentation.**
- (4) **Zhiying Lu***, Jeffrey Morris. A growth ceiling exists when Prochlorococcus cultivates in artificial seawater media? The 74th annual Phycological Society of America Annual Meeting, July 29-30, 2020, Online, **Lightning talks.**
- (5) **Zhiying Lu***, Junsha Lu, Wenxuan Wang, Xuezhi Zhang. Identification of auto-inhibitors in the reused culture media of *Scenedesmus acuminatus*. *The 41st Annual Southeast Phycological Colloquy*, Birmingham, AL, USA, Oct 25-26, 2019, **Oral presentation.**
- (6) **Zhiying Lu***, Wenxuan Wang, Jun Sha, Peizhe Sun, Qiang Hu and Xuezhi Zhang. “Implementation of UV-based advanced oxidation processes in algal medium reuse”. *The 9th International Conference on Algal Biomass, Biofuels and Bioproducts*, Blouder, CO, USA, June 17-19, 2019, **Oral presentation.**
- (7) **Zhiying Lu***, Wenxuan Wang, Jun Sha, Peizhe Sun, Qiang Hu and Xuezhi Zhang. “Implementation of UV-based advanced oxidation processes in algal medium recycling”. *The 8th Annual NC State University Postdoctoral Research Symposium*, Raleigh, NC, USA, May 31, 2019, **Poster.**
- (8) **Zhiying Lu.** “Overview of algae cultivation and harvesting in a large scale” MMSIS, Duke marine lab, Beaufort, NC, March 22, 2019, **Oral presentation.**
- (9) **Zhiying Lu***, Jun Sha, Wenxuan Wang, Xuezhi Zhang, Qiang Hu, Zackary I. Johnson. “Fractionation and characterization of AOM responsible for growth inhibition in the recycled culture medium of *Scenedesmus spp*”. *The 8th International Conference on Algal Biomass, Biofuels and Bioproducts*”, Seattle, WA, USA, June 11-14, 2018, **Poster.**
- (10) **Zhiying Lu***, Yongsheng Chen, Xuezhi Zhang. “Culture Media Recycling for the Environmental and Sustainable Microalgal Biofuel Production”. *The 1st International Symposium on Bio-Energy and Environment*, Tianjin, China, Jul 9-12, 2017, **Oral presentation.**
- (11) **Zhiying Lu***, Xuezhi Zhang. “Fractionation of Algogenic Organic Matters Responsible for Growth Inhibition during Culture Media Recycling”. *The 4th Asia-Oceania Algae Innovation Summit*,

Wuhan, China, Sep 18-21. 2016, **Best Oral presentation award.**

- (12) **Zhiying Lu***, Lan Wang, Xuezhi Zhang. “The water footprint and reuse in the production of biofuel with microalgae” *The Chinese society of phycology 18th Symposium*, Xiamen, China, Nov 28-30, 2015, **Oral presentation.**
- (13) **Zhiying Lu***, Yongyuan Zhang, Zhenbin Wu. “Oxidative stress in cyanobacterium *Microcystis aeruginosa* induced by allelochemical pyrogallol”, *Chinese society of phycology 17th Symposium*, Wuhan, China, 17-20 Nov. 2013, **Poster.**

EDITORIAL WORKS, REVIEWERS FOR JOURNALS AND GRANTS

- Grant Reviewer for Poland National Science Center
- [Editorial Board Member](#) of MDPI Phycology.
- Editor for special issue: [Phycology: Economically and Environmentally Sustainable Algal Production, Harvesting and CO₂ Sequestration.](#)
- Independent Reviewer for Scholarly Journals: *The ISME Journal* (3), *Chemosphere*(2), *Algal research*(2), *Journal of Hazardous Materials*(2), *Environmental Chemistry Letters*(1), *Applied Microbiology and Biotechnology*(2); *Polish Journal of Environmental Studies*(2), *MDPI-Life*(1), *MDPI-Molecule*(2) *Environmental Technology & Innovation*(1), *Biomass Conversion and Biorefinery*(1), *Environmental science and pollution research*(3).

TEACHING

- **Graduate Teaching Assistant, University of Chinese Academy of Sciences**
Course: Biostatistics
Responsibilities: Teaching student how to use SPSS software to conduct statistics and data analysis.
Provide assistance and guidance in a weekly 2-hour computer-based SPSS Lab course
- **Graduate Teaching Assistant, University of Chinese Academy of Sciences**
Course: Hydrobiology laboratories
Responsibilities: Teach the algae session, including algae example collection, preservation, separation and identification.

STUDENTS MENTORED

- **Ms. Ting Gong**, Research associate at Centre for Biotechnology and Biofuel
Project: Establish fluorescence excitation-emission matrix combined with parallel factor analysis for dissolved organic matter quantification, Institute of Hydrobiology, 2015
- **Ms. Junette Yu**, undergraduate student from Duke University for summer independent study
Project: Harvesting algae at large-scale using NaOH-induced flocculation, Duke university marine lab, 2018.
- **Mr. Ian Bubb**, Masters student from Duke University for internship
Project: Large-scale algal harvesting using membrane filtration, Duke university marine lab, 2018.
- **Ms. Guerbine Fils-aime**, Masters student from Duke University for internship
Project: Optimize the backwash and chemical wash procedures for large-scale algal harvesting system, Duke University marine lab, 2019.

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- **Ms. Zane Forbus**, undergraduate student, University of Alabama at Birmingham for undergraduate research
Project: **Measuring the Reactive oxygen species in the evolved Prochlorococcus culture**, (2021/11-present).

SERVICE & LEADERSHIP

- (1) Algal Biofuel Project Representative at Duke Marine Lab Open House, July 13, 2019. (I was advertised on the local newspaper *THE NEWS-TIMES*, July 17, 2019)
- (2) Postdoctoral representative in the faculty meeting at Duke marine lab, May 2019.
- (3) Organize and coordinate the monthly postdoctoral professional development workshop at Duke marine lab, 2019.
- (4) Clean the glass debris on the beach for public safety, Radio Island, Morehead City, NC, March 2019
- (5) Beach cleanup after hurricane Florence, Atlantic Beach, NC, Oct 2018.
- (6) Committee member of Center of Biotechnology and Biofuel's hiring team, 2016.
- (7) Planning Committee, Cross-Strait Expert Forum on Constructed Wetland, Wuhan, China, 05-08 Dec 2012.
- (8) Interpreter for foreign specialists in the 3rd China Lake Forum, Wuhan, China, Oct 23-25, 2013.
- (9) Volunteer for the 13th World Lake Conference, Wuhan, China, Nov 01-05, 2009.

RECEIVED TRAININGS

- Waters HPLC Alliance Chemistry, Instrument and Software Training, 2015
- Agilent Cary Eclipse Fluorescence Spectrophotometer Operation Training, 2015