Baoli Zhu

Molecular Ecology Group
Institute of Groundwater Ecology, Helmholtz Zentrum Muenchen
German Research Center for Environmental Health
85740 Neuherberg, Munich, Germany
baoli.zhu@helmholtz-muenchen.de
Tel +49-89-31872960 (Office)

Research interest

Microorganisms are essential in maintaining all other life forms on Earth. Currently, great part of the microbial diversity has not been explored and is 'uncultivable'. This 'uncultured majority' or 'microbial dark matter' harbors microorganisms that could provide innovative solutions for severe environmental challenges we are facing today, such as global warming and environmental pollutions. My research aims to **uncover novel ecologically-important microorganisms** that degrade pollutants and mediate biogeochemical elements cycling in natural and man-made environments, and unravel their ecology and ecophysiology, and exploit their application potential in the environment for waste management and bioremediation.

Specifically, my future research will focus on microbial nitrogen (N) and carbon (C) cycles, with emphasis on hydrocarbon and nitrogen-species degrading processes and microbes. Two examples are: **1)** anaerobic methane oxidation by microorganisms has been sought for over a century, but extraordinary microbes were only recently discovered (**including my contribution**) that can use nitrate, nitrite or oxidized metals as electron acceptors to remove methane. The versatile metabolisms of these microbes and their environmental prevalence suggest their ecological significance, which has not been well addressed. **2)** Nitric oxide (NO) directly split into N_2 and O_2 (NO dismutation) is a novel intriguing process, which enables microbes to produce their own oxygen in anoxic environments. Molecular evidence suggests that NO dismutation is widespread in diverse microorganisms and environment (**Zhu et al., 2017**). This indicates the importance of microbes with NO dismutation capability, but currently little is known about the process.

Multi-disciplinary and multi-scaled approaches/ techniques will be employed to address these research questions. From single cell characterization to microbiome analysis, from microcosms to large scale *in situ* environments, the mechanisms and ecological significance of novel microbes will be pinned down.

Education and experience

Since 2014 **Fellow of excellent postdoctoral project program** at Helmholtz-Zentrum Muenchen, German research center for environmental health, Munich, Germany

https://www.helmholtz-muenchen.de/fellows/index.html

Brief introduction: my project focuses on the ecology and ecophysiology of novel pollutant-degrading microorganisms that are able to form their oxygen from nitric oxide in anoxic environments. This exciting physiology of environmental microorganisms offers innovative and environmental-friendly approaches for waste treatment and bioremediation. My research revealed for the first time that NO dismutation is a widespread microbial process in the environment (Zhu, et al., 2017). The molecular mechanism and ecological role of the process is being investigated.

2009-2013 **Ph.D** in Environmental Microbiology at *Department of Microbiology, Radboud University Nijmegen, the Netherlands*

Supervisors: Prof. Dr. Mike Jetten and Dr. Katharina F. Ettwig

Brief introduction: I mainly investigated the ecology and ecophysiology of recently discovered anaerobic methanotrophic NC10 bacteria. One of my projects revealed important ecological role of *M. oxyfera*-like bacteria that mediate nitrite-dependent anaerobic oxidation of methane, which is a recently described anaerobic process via a novel oxygenic pathway. In another research project, I enriched and identified novel bacteria and archaea that perform anaerobic oxidation of methane coupled to the reduction of nitrate, iron and manganese. These processes were known to exist, but responsible microbes have not been identified for decades. Thus my research closed the knowledge gap and opened up new research fields in microbial ecology.

2006-2009 **Master of Science** in Molecular Microbiology at *State Key Laboratory of Microbial Resources, Institute of Microbiology, CAS*, *Beijing China*

Supervisors: Prof. Dr. Xiuzhu Dong and Dr. Huichun Tong

2002-2006 **Bachelor of Science** in Biology at *College of Life Sciences, Peking University, Beijing China*

Manuscripts and publications

Google Scholar profile:
https://scholar.google.de/citations?user=TqP1Xs4AAAAJ&hl=en

H-index: 8
Total citations: 568

Zhu, B., et al., Using nitric oxide dismutase (*nod*) gene to probe the diversity and phylogeny of oxygenic methanotrophic bacteria. (in preparation for **Frontiers in Microbiology**)

Zhu, B., et al., Novel oxygenic methanotroph and their genomic characteristics in massive hypoxic cave biofilms. (in preparation for **ISME J**)

Bradford, L., Vestergaard, G., Táncsics, A., **Zhu**, **B.**, Schloter, M., Lueders, T., (2018) Transcriptome-stable isotope probing of a hypoxic pollutant-degrading aquifer microbiota, *Frontiers in Microbiology (accepted)*

Y Hu, Y Xia, Q Sun, K Liu, X Chen, T Ge, **Zhu, B.**, Z Zhu, Z Zhang, Y Su, (2018), Effects of long-term fertilization on phoD-harboring bacterial community in Karst soils. *The Science of the total environment 628, 53-63*

Zhu, B.[#], Bradford L., Huang, S., Szalay A., Tancsics A., Drewes J.E., Lueders T.[#] (2017) Unexpected diversity and high abundance of putative nitric oxide dismutase (*nod*) genes in contaminated aquifers and wastewater treatment systems. *Applied and Environmental Microbiology*. ([#]Corresponding author)

Ettwig, K.F.*, **Zhu, B.***, Speth D.R., Keltjens J.T., Jetten M.S.M., Kartal B. (2016) Archaea catalyze iron-dependent anaerobic oxidation of methane. *Proceedings of the National Academy of Sciences of the United States of America*. (*Co-first author)

Zhu, B., Microbial and environmental aspects of anaerobic oxidation of methane, (2014), *Radboud University Nijmegen, the Netherlands, Thesis.*

Zhu, B., van Dijk, G., Fritz, C., Smolders, A.J.P., Pol, A., Jetten, M.S.M., and Ettwig, K.F. (2012) Anaerobic Oxidization of Methane in a Minerotrophic Peatland: Enrichment of Nitrite-Dependent Methane-Oxidizing Bacteria. *Applied and Environmental Microbiology* 78: 8657-8665.

Kool, D.M., **Zhu, B.**, Rijpstra, W.I.C., Jetten, M.S.M., Ettwig, K.F., and Sinninghe Damsté, J.S. (2012) Rare Branched Fatty Acids Characterize the Lipid Composition of the Intra-

Aerobic Methane Oxidizer "*Candidatus* Methylomirabilis oxyfera". *Applied and Environmental Microbiology* 78: 8650-8656.

Zhu, B., Sanchez, J., van Alen, T.A., Sanabria, J., Jetten, M.S., Ettwig, K.F., and Kartal, B. (2011) Combined anaerobic ammonium and methane oxidation for nitrogen and methane removal. *Biochemical Society Transactions* 39: 1822-1825.

Luesken, F.A.*, **Zhu, B.***, van Alen, T.A.*, Butler, M.K., Diaz, M.R., Song, B. et al. (2011) *pmoA* primers for detection of anaerobic methanotrophs. *Applied and Environmental Microbiology* 77: 3877-3880. (*Co-first author)

Wang, Y., Zhu, G., Harhangi, H.R., **Zhu, B.**, Jetten, M.S.M., Yin, C., and Op den Camp, H.J.M. (2012) Co-occurrence and distribution of nitrite-dependent anaerobic ammonium and methane-oxidizing bacteria in a paddy soil. *FEMS Microbiology Letters* 336: 79-88.

Tong, H.C., **Zhu, B.**, Chen, W., Qi, F.X., Shi, W.Y., and Dong, X.Z. (2006) Establishing a genetic system for ecological studies of *Streptococcus oligofermentans*. *FEMS Microbiology Letters* 264: 213-219.

Professional activities

Served as reviewer for *Applied and Environmental Microbiology*, *Applied Microbiology and Biotechnology*, *Environmental Science and Pollution Research, FEMS Microbiology Ecology* and *FEMS Microbiology Letters, Science of the total environment*

Supervised projects

Since 2015	Lauren Bradford (Helmholtz Zentrum Muenchen); Ph.D student project 'Intra-aerobic hydrocarbon degradation in anoxic contaminated aquifers'.
2015-2016	Sichao Huang (Technical University of Denmark); Master thesis project 'The occurrence, diversity and abundance of nitric oxide dismutase (*nod*) gene-carrying microbes in urban water treatment systems'.
2012	Alexandra Plessa (Radboud University Nijmegen); Master internship project 'Characterization of anammox bacteria enriched from an acidic peatland'.

Conference and invited presentations

Sep. 2017	Institute of Subtropical Agriculture (Changsha) and Institute of Microbiology (Beijing), Chinese Academy of Sciences
August 2016	16th International Symposium on Microbial Ecology, Montreal, Canada
March 2016	Association for General and Applied Microbiology (VAAM), Jena, Germany
Oct. 2015	ThemeTag, Helmholtz-Zentrum Muenchen, Munich, Germany
Feb. 2014	Center for Microbial Ecology and Technology, University of Ghent, Belgium
Nov. 2013	National University of Ireland, Galway, Ireland
Dec. 2012	Royal Dutch Society for Microbiology (KNVM) - Microbial Ecology section fall meeting, Wageningen, the Netherlands
April 2011	Annual meeting of the Dutch Society for Microbiology (NVVM), Arnhem, the Netherlands