**Session Proposal**

# Session Title

Advancing Soil Microbial Insights via Single-Cell Technologies

# Session Organizers

Jian Xu, Qingdao Institute of Bioenergy and Bioprocess Technology, Chinese Academy of Sciences, xujian@qibebt.ac.cn

Yuting Liang, Institute of Soil Science, Chinese Academy of Sciences, ytliang@issas.ac.cn

Wei Huang, University of Oxford, wei.huang@eng.ox.ac.uk

Li Cui, Institute of Urban Environment, Chinese Academy of Sciences, lcui@iue.ac.cn

# Session Description

This session aims to explore cutting-edge advancements in single-cell technologies and their transformative role in soil microbial ecology. Soil harbors an immense diversity of uncultured microorganisms, often referred to as microbial "dark matter." Traditional bulk analysis methods fail to resolve individual microbial functions, but single-cell approaches—such as single-cell genomics, transcriptomics, Raman spectroscopy, and microfluidics—enable precise dissection of metabolic activities, interactions, and spatial organization at the single-cell level.

The session will address key challenges and opportunities, including:

1. Technological Innovations: Novel methods for isolating, sequencing, and analyzing single soil cells.

2. Functional Insights: Linking single-cell phenotypes to biogeochemical processes (e.g., carbon cycling, nitrogen fixation).

3. Applications: Leveraging single-cell data to optimize soil health, bioremediation, and agricultural productivity.

By bridging fundamental research and practical applications, this session will foster collaboration among microbiologists, ecologists, and biotechnologists. Early career researchers are particularly encouraged to participate, with dedicated networking opportunities to discuss interdisciplinary approaches.

# Format

Oral presentations (15 min each) followed by a panel discussion and interactive Q&A.

# Proposed Speakers

Speaker 1: **Jizhong Zhou**: Dr. Zhou is George Lynn Cross Research Professor and Presidential Professor in School of Biological Sciences, School of Civil Engineering and Environmental Sciences, and School of Computer Science, and Director of the Institute for Environmental Genomics, at University of Oklahoma. Dr. Zhou is an international leader in genomics-enabled microbial environmental sciences. He is engaged in development of macro-genomic technology and its application in environmental science and engineering. He is known for his pioneering advances in developing both cutting-edge experimental and computational metagenomic technologies to address frontier environmental, engineering, and ecological questions. He has achieved systematic innovations from basic theory to engineering application in the use of microorganisms to address environmental pollution, climate change and improve environmental health. He is an Editor-in-Chief for mLife, a former Senior Editor for The ISME Journal (a prime microbial ecology journal), for mBio, and formal Editor for Applied and Environmental Microbiology. In recognition of his achievements in research, he received several international awards, such as SURA, ISME-IWA and ASM. Dr. Zhou’s outstanding achievements are recognized as a top 0.1% global highly cited researcher by all three major complementary metrics based on Elservier’s Scopus, Web of Science, and Google Scholar.

Speaker 2: **Tanja Woyke**: Dr. Woyke is Deputy of User Programs, Microbial Program, and Head of Single Cell Research Group at Joint Genome Institute, Department of Energy at USA. In addition to her JGI appointment, she also holds an Adjunct Scientist appointment at the Bigelow Laboratory for Ocean Sciences since 2012 and an Adjunct Associate Professor at the University of California, Merced's School of Natural Sciences since 2015. Her major interest is microbial single-cell genomics, and has published pioneering studies in using single-cell genomics to tackle environmental cells that remain uncultivated yet play pivotal roles in ecological functions.

Speaker 3: **[Thulani Makhalanyane](http://www.sun.ac.za/english/faculty/science/microbiology/research/makhalanyane-lab%22%20%5Ct%20%22_blank)**. Dr Makhalanyane is professor in the Department of Microbiology and The School for Data Science and Computational Thinking at Stellenbosch University, Stellenbosch, South Africa. He is the leader of the African Microbiome Project (AMP), a multidisciplinary initiate to sequence environmental and host-associated samples such as geographically strategic terrestrial, marine, and freshwater from the African continent. His lab has dissected genetic, phylogenetic and functional mechanisms that shape microbiome diversity of polar and alpine soils. He also serves as the Editor in Chief for Reviews and Perspectives at the ISME journal.

Speaker 4: **Zhongjun Jia**. Dr. Jia is a CAS Distinguished Professor. He obtained PhD (2002) at the CAS Institute of Soil Science, followed by postdoctoral work at USDA/ARS, Nagoya University (Japan), and Max Planck Institute for Terrestrial Microbiology (Germany). Dr. Jia has been awarded CAS 100-Talent Program (2008); ‘Best-of-the-best of Awardees’ (2012); Distinguished Professor (2015). His research focuses on the ecophysiology of ammonia and methane oxidizers. Dr. Jia has expertise on stable-isotope probing of soil microbiome and omics techniques and organized the training workshop and seminar. He was awarded 11 national research grants, published A total of 260 papers including 189 papers in SCI-indexed journal in English and 71 in Chinese journals. (40% published in tier-1 SCI-indexed journals), and collaborated with colleagues from 23 countries.