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Microbiology Australia

AusME 2022 Melbourne conference

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This issue of Microbiology Australia contains contributions from AusME 2022 presenters who were invited by Guest Editors, Chris Greening, Zahra Islam, Christina Birnbaum and Steve Petrovski. The contributions showcase some of the opportunities in microbiology to enhance sustainable development. These articles span using microbiology to mitigate climate change, enhance agricultural production, degrade pollutants and protect vulnerable species.

Microbial ecologists across Australia rejoiced with the opportunity to meet, share latest science and catch up at the latest Australian Microbial Ecology Conference (AusME 2022). The conference was held from 7 to 9 November 2022 at Melbourne Connect (The University of Melbourne) – a beautiful new venue that seeks to support interdisciplinarity and innovation, as does AusME. The conference is supported by The Australian Society for Microbiology and was designed as a biannual meeting to bring the diverse microbial ecology community together. The first meeting was held in 2017 in Melbourne, followed by AusME 2019 in Perth. The pandemic impeded AusME from happening in 2021, and the community was eager to finally meet face-to-face after a long hiatus.

The exciting scientific program of AusME 2022 covered topics ranging from aquatic to terrestrial and host-associated ecosystems, presented through a diverse selection of plenary and invited speakers, oral presentations and posters. AusME 2022 also offered two workshops: 'Introduction to Metabarcoding using QIIME2', led by Ashley Dungan (The University of Melbourne), and 'Introduction to Galaxy', led by Simon Gladman (Australian BioCommons). The scientific program contained six sessions: Terrestrial Microbiology, Aquatic Microbiology, Human Microbiology, Industrial and Food Microbiology, Symbiosis, and the Microbial Toolbox. We were joined in person by 171 delegates, and the majority of presentations were given by students. There were six plenary speakers whose research topics ranged from how to define what a healthy microbiome is, feeding habits of gut microbes, signalling in the legume rhizosphere, communications and interactions in microbial communities and the use of targeted therapeutics to improve health. All plenaries were thought-provoking and shed a light on recent advances on microbial ecology in diverse contexts.

The first plenary speaker was Prof. Maureen O'Malley (University of Sydney), who challenged us to re-think healthy *v*. dysfunctional microbiomes. Following this very stimulating plenary, we proceeded with the presentations focussing on terrestrial microbiology. Dr Hang-wei Hu (The University of Melbourne) presented novel findings illustrating that soil protists are an important factor to the development of antibiotic resistance in bacterial communities. Archaeal ecology was discussed by multiple speakers, highlighting how little we know about archaeal diversity and functions despite their importance. Although we are still only uncovering the total terrestrial microbial diversity, some presentations showed how microbial communities can be utilised in ecological restoration. For example, Dr Náthali Machado de Lima (University of New South Wales and Loam Bio) showed that biocrust cyanobacteria can improve the performance of native plants in extreme environmental conditions.

Microbial ecology inherently deals with associations between organisms, and so it came as no surprise that many presentations at AusME 2022 focussed on symbiosis. Plenary speaker Prof. Scott Rice (CSIRO) discussed the emergent properties of multi-species biofilms, showing that they can be more resistant to stress than the ones formed by a single species. Cross-kingdom symbiotic interactions were addressed by several speakers in the symbiosis session. For example, Dr Adam Frew (Western Sydney University) discussed how mycorrhizal fungi affect plant defences against insect herbivory. Prof. Ulrike Mathesius (Australian National University) and Prof. Damien Maher (Southern Cross University) both discussed the ecology of nitrogen- bacteria, albeit in different environments. Prof. Mathesius presented on genetic modification of isoflavonoids synthesis and exudation in the model legume *Medicago truncatula*, which altered rhizobial interaction in legume roots improving symbiosis and reducing parasite infection. Prof. Maher opened our eyes to the weird and wonderful world of bark-dwelling bacterial communities, including nitrogen fixers, trace gas oxidisers and other microbes usually associated with soils rather than bark.

Several studies on symbiosis presented at AusME 2022 focussed on aquatic hosts, highlighting a treasure trove of discoveries in marine habitats. Assoc. Prof. Suhelen Egan (University of New South Wales), for example, delved deep into the ecological roles of *Roseobacter* spp. for their seaweed hosts. Prof. Elizabeth Dinsdale (Flinders University) indulged the audience in her plenary talk with a video showing how they have sampled the microbiome of sharks and rays. The brave efforts of Prof. Dinsdale's team allowed them to reconstruct Metagenome Assembled Genomes (MAGs) of the microbiome associated with cartilaginous fishes, and uncover patterns of host–microbiome co-evolution.

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This year's AusME featured multiple talks focussed on human microbiology. Plenary speaker Prof. Georgina Hold (University of New South Wales) reflected on the use of microbial therapeutics to improve health. In an effort to move the field towards a mechanistic understanding of the human gut microbiome, Prof. Hold's team developed an artificial gut system to perform carefully controlled experiments. Assoc. Prof. Sam Forster (Hudson Institute of Medical Research) discussed how advances in culturing anaerobic microbes is helping to make causal links between specific microbial strains and Inflammatory Bowel Disease. Dr Hajara Aslam (Deakin University) provided an overview of the links between the human gut microbiome, diet and mental health, and Dr Erin Shanahan (University of Sydney) discussed how the gut microbiome and diet can affect cancer immunotherapy.

The explosion of new insights in the microbial ecology field is largely due to recent technological advances, and AusME 2022 presenters highlighted the development and application of exciting new tools for microbiology. Plenary speaker Prof. Rob Edwards (Flinders University) is a pioneer in the development of bioinformatic tools to analyse microbiome data. His tools allowed the discovery of a massive diversity of phages from metagenome data, many years before they were cultivated. Dr Ben Woodcroft (Queensland University of Technology) presented a set of bioinformatic tools for high-throughput analyses of genomes and metagenomes, and their beautiful logos featuring Australian animals did not go unnoticed. Some AusME22 participants are leading the way in integrating multi-omics datasets to better understand the ecology of microbial systems. For example, Dr Cheong Xin Chan (University of Queensland) showed how an integrated multi-omics dataset is helping us understand the ecology and evolution of blooming behaviour in microalgae. Plenary speaker Prof. Phil Pope (Norwegian University of Life Sciences) discussed how the integration of multi-omics and phenotyping data is taking our understanding of microbial feeding habits to the next level. Prof. Pope also presented an innovative method to study the spatial arrangement of host-associated bacteria and their interactions in three dimensions. These and many other technological advances highlighted at AusME 2022 are certain to benefit agricultural, food and other industrial sectors. Dr Chris Rinke (University of Queensland), for example, presented how they are uncovering bacterial metabolic pathways related to polystyrene degradation, which they found in a worm that eats styrofoam. It is exciting to imagine where the next steps will take us.

Last but not least, congratulations to all the prize winners! Best oral People's Choice Presentation award went jointly to early career researchers (ECRs) Dr Rachael Lappan (Monash University), Dr Simon Law (CSIRO) and PhD student Talisa Doering (The University of Melbourne). Dr Laura Rood (Tasmanian Institute of Agriculture) and Dr Cami Plum (Monash University) jointly won the best ECR Poster Prize and Jiasui Li (University of New South Wales) and Calloway Thatcher (James Cook University) jointly won the Best Student Poster award. The Federation of European Microbiological Societies awarded the best People's Choice Poster award to Cecilie Gotze (The University of Melbourne).

Beyond the exciting science, AusME 2022 provided a great opportunity to reconnect, meet new colleagues and catch up with old ones. The informal evening function at the Inner North Brewery provided further opportunities to socialise while admiring the red moon outside. We hope that these connections will persist, and that AusME 2022 was a source of inspiration to continue the great microbial ecology work full steam ahead.

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