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Biofilm research highlights networked globally

Asia-Pacific Biofilms 2022 was held as a hybrid event with a virtual meeting for international speakers, and a venue for domestic speakers on October 18-23, 2022 in South China University of Technology in Guangzhou, China. A total of 112 speakers (63 international and 49 local), 24 presenters in "early career researchers and students" session, as well as approximately 300 scientists conducting microbial biofilm-related research around the world participated in the conference. They represented 20 countries in Asia, Oceania, North America and Europe. Perhaps, this is the biggest biofilm conference participated by both antibiofilm and pro-biofilm researchers. Importantly, Asia-Pacific Biofilms 2022 supported gender equality and had successfully obtained gender balance among the presenters with 75 female and 75 male speakers.

The organizing committee included nine international and seven local scientists. Dr. Zhenbo Xu (South China University of Technology, with adjunct positions in the National Institute of Fundamental Studies in Sri Lanka and University of Maryland in College Park, Co-Chair of the conference) was the main organizer of the conference. Dr. Mark Shirtliff (Honorary Chair of the conference, a leading biofilm scientist worked at the University of Maryland, Baltimore, who passed away in 2018) and Dr. Zhenbo Xu founded this series of conferences in 2017. Firstly, known as China Biofilms, the organizing committee had held China Biofilms 2017; China Biofilms 2019 as in-person conferences in Guangzhou (www.chinabiofilms.org), as well as Asia-Pacific Biofilms 2021 as virtual conference (www.asiapacificbiofilms.org/2021). This conference is one of the three leading series of conferences in the biofilm field, along with Euro-Biofilms (organized by ESCMID) in Europe, and ASM Biofilms (organized by ASM) in North America.

In the workshop on October 19th, Dr. Kendra Rumbaugh (Texas Tech University, Lubbock) and Dr. Janette Harro (University of Maryland, Baltimore) delivered the first workshop on modeling biofilm-associated wound infections, and animal models of orthopedic infection, respectively, under the theme of animal models in biofilm research. In the second workshop, Dr. Paul Stoodley (Ohio State University, Columbus, who had associated previously with J. William Costerton (1934–2012), the biofilm pioneer) explained the need for standard methods in controlling strategies for bacterial biofilms. Dr. Kelli Buckingham-Meyer (Montana State University, Bozeman) described the standardized biofilm methods, while Dr. Albert Parker (Montana State University, Bozeman) talked about statistical considerations in image analysis.

Opening the conference on October 20th by Dr. Birthe Kjellerup (University of Maryland, College Park, Chair of the conference), the first day of the conference was dedicated for medical microbiology. The first talk was delivered by Dr. Paul Stoodley, where he talked about the freefloating biofilm-like aggregates that is currently expanding the understanding of the biofilm conceptual model. He highlighted the importance of aggregates and posed a new conceptual model composed of a surface cycle and an expanded cycle. Dr. Kendra Rumbaugh discussed biofilm-associated wound infections with focus on investigating how different bacterial species in wounds work together to build more cohesive biofilms and thereby create biofilm infections that are more difficult to treat. Dr. Daniel Wozniak (Ohio State University, Columbus, Fellow of the American Academy for Microbiology and American Association of the Advancement of Science) delivered a comprehensive talk on Pseudomonas aeruginosa-Staphylococcus aureus interactions that enhance the resistance to host defenses. In his recent work, S. aureus staphyloxanthin production was found to be induced by specific strains of P. aeruginosa that promoted resistance of S. aureus to killing mediated by Reactive Oxygen Species (ROS) and neutrophils. Dr. Matthew Parsek (University of Washington, Seattle, Kavli Fellow of the National Academy of Sciences) provided new insights into the biofilm matrix of P. aeruginosa, focusing on c-di-GMP and cell envelop stress in surface sensing and the Wsp-system. In the afternoon session, Dr. Tom Coenve (Ghent University, Ghent, Former Chair of ESGB) shared his understanding on where we are and where we should be going concerning reduced antimicrobial susceptibility in microbial biofilms. Gordon Ramage (University of Glasgow, Glasgow, Chair of ESGB) highlighted the clinical importance of interkingdom biofilms in the oral cavity and beyond. Dr. Ute Römling (Karolinska Institute, Stockholm) discussed the regulation of biofilm formation by cyclic di-GMP signaling. The final topic of the sessions during the first day of medical biofilms was pathogenesis of polymicrobial biofilm-associated infections that was discussed by Dr. Kimberly Kline (University of Geneva, Geneva).

A highlight of the conference was the "Biofilms in Australia" sessions held on October 21st. This novel session type was introduced at APB 2022 to highlight biofilm research taking place in a geographic part covered by the conference series APB. Organized by Dr. Yue Qu (Monash University and Alfred Health, Melbourne), 14 Australia-based leading scientists presented their cutting-edge biofilm research in four sessions, focusing on microorganism-biomaterial interface, biofilm biology, device-related biofilm infections, and other biofilm-associated chronic infections, respectively. In the morning sessions, Dr. Peter Kingshott (Swinburne University of Technology, Melbourne, Deputy Director of Australian Research Council Industrial Transformation Training Centre in Surface Engineering for Advanced Materials) and Dr. Helmut Thissen (Commonwealth Scientific and Industrial Research Organisation (CSIRO), Clayton) dissected chemico-biological interactions occurring at the microorganism-biomaterial interface. Then, Dr. Scott Rice (CSIRO, Canberra) led an in-depth discussion on microbial factors influencing biofilm formation, with Dr. Heema Vyas (The University of Sydney, Sydney) and Dr. Taghrid Istvan (Royal Melbourne Institute of

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Technology, Melbourne). The afternoon sessions focused on medical biofilms, covering various biofilm-related infections including ventricular assist device driveline infection, contact lens-related infections, oral infections, chronic wounds and recurrent vulvovaginal candidiasis. Dr. Mark Wilcox (The University of New South Wales, Sydney, Former President of the International Society for Contact Lens Research), Dr. Anton Peleg (Monash University and Alfred Health, Melbourne, Fellow of the Australian Academy of Health and Medical Sciences), Dr. Jim Monas (The University of Sydney, Sydney), Dr. Stuart Dashper (The University of Melbourne, Melbourne) and Dr. Zlatko Kopecki (University of South Australia, Adelaide), Dr. Yue Qu, and Dr. Ruth Thornton (The University of Western Australia, Perth) shared their understandings on the role played by microbial biofilms in the pathogenesis of medical device-related infections and other incurable chronic infections. At the conclusion of the meeting, Dr. David McGiffin A world-renowned surgeon at Alfred Health, Melbourne), Dr. Anton Peleg and Dr. Xenia Kostoulias (Monash University, Melbourne) emphasized that the goal of the "Biofilms in Australia" meeting was to combine the expertise of a multidisciplinary team composed of chemical engineers, microbiologists, infectious disease physicians, and surgeons to develop more effective preventative and treatment strategies for biofilm-related infections.

On the third day (October 22nd), there were two venues for the sessions covering the topics of "Foodborne Biofilm Microbiology" and "Basic Microbiology and Anti-Biofilms". The "Foodborne Biofilm Microbiology" session was organized by Dr. Junyan Liu (Zhongkai University of Agriculture and Engineering, Guangzhou) and the first keynote speaker Dr. Steve Flint (Massey University, Palmerston North) discussed the use of mild UV-stress as a novel method for controlling Listeria monocytogenes on lettuce. Dr. Manuel Simões (University of Porto, Porto) focused on an important but understudied issue within biofilms: the viable but nonculturable cell state. He presented recent findings showing that molecules from plant secondary metabolism were promising for biofilm dispersal. Dr. Romain Briandet (University of Paris-Saclay, Paris) shared his recent work on "Spatio-temporal diversification of Bacillus subtilis cell types in surface-associated communities", which highlighted a heterogeneous differential expression of central carbon metabolism by spatial transcriptomic remodeling using in situ 3D imaging. In the "Basic Microbiology and Anti-Biofilm" session, organized by Dr. Zhenbo Xu and Dr. Yulong Tan, the first keynote speaker Dr. Xuesong He (Dental Medicine of Harvard University, Boston) explained how Fusobacterium nucleatum, a symbiont, opportunist and oncobacterium, could be targeted through chemical modifications of host-derived transfer RNA fragment, which act as ribosome-targeting antimicrobials for cross-kingdom modulation. Interspecies interactions during bacterial biofilm formation in clinical samples, molecule/single cell/community level and in vitro/ex vivo models, were comprehensively discussed by Dr. Liang Yang (Southern University of Science and Technology, Shenzhen, Co-Chair of the conference). Dr. Yilin Wu (Chinese University of Hong Kong, Hong Kong) shared his recent work "Selforganized canals enable long range directed material transport in bacterial communities", which provided new design principles for fabricating synthetic microbial communities with mechanical functionalities and new forms of self-organization in structured bacterial communities and their biological functions.

The last day (October 23rd) of the conference was dedicated to environmental and applied microbiology, with two venues for the topics of "Environmental Biofilm Microbiology" organized by Dr. Guanglei Qiu (South China University of Technology, Guangzhou) and "Applied Biofilm Microbiology" organized by Dr. Gamini Seneviratne (National Institute of Fundamental Studies in Sri Lanka, Kandy, Founder Fellow of the National Academy of Sciences of Sri Lanka). The opening Keynote of the "Environmental Biofilm Microbiology" session was provided by Dr. Stefan Wuertz (Singapore Centre of Environmental Life Sciences Engineering (SCELSE), Singapore, Deputy Director of SCELSE). He discussed biofilm detachment during intermittent and continuous water supply

and its effect on water quality in a controlled pilot-scale water distribution. Drinking water delivered through intermittent water supply present a different microbiome from continuous water supply in both the outlet bulk water and pipe biofilm. After this the founder of the MiDAS database, Dr. Per Halkjær Nielsen (Aalborg University, Aalborg, Fellow of the Danish Academy of Technical Science) shared how cuttingedge sequencing technology, bioinformatics and in situ ecophysiological tools was utilized to achieve breakthrough in the understanding of identity, function, and ecology of process-critical microorganisms in >750 wastewater treatment systems across the world. This included retrieval of a million high-quality, full-length microbial 16S and 18S rRNA gene sequences, recovery of >1000 high-quality metagenomeassembled genomes from activated sludge using long-read sequencing as well as identification of novel polyphosphate accumulation organisms. Dr. Aijie Wang (Harbin Institute of Technology, Shenzhen, Head of Key Laboratory of Environmental Biotechnology at Chinese Academy of Sciences, Distinguished Fellow of International Water Association) discussed the charging memory effect of microbial communities, where electrostimulation was used to shape the activated sludge community and enhance the pollutant transformation efficiency and the expression of functional genes. In contrast to other session on the last day of the conference, the presentations in the "Applied Biofilm Microbiology" session were dedicated to the development of beneficial biofilms in the environment. Opening the session, Dr. Gamini Seneviratne, introduced how engineered biofilms can be utilized as biofertilizers in agriculture to improve ecosystem function and the environment. Progress and prospects of the beneficial use of engineered fungal-bacterial biofilms were discussed by Shezmin Ismail (Monash University, Melbourne). This session was concluded by a short session on biofilms and synthetic biology, in which Dr. Cheng Li (Massachusetts Institute of Technology, Cambridge) introduced metabolic engineering with a Corynebacterium glutamicum co-culture system to utilize lignocellulose hydrolysate for efficient production of α -carotene. At last, Dr. Zhenbo Xu closed the conference and announced the date for Asia-Pacific Biofilms 2024 (October 22-27, 2024).

Please see https://www.asiapacificbiofilms.org/2022/for more information of the conference.

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