The Australian Society for Microbiology
bringing Microbiologists together

NSW-ACT Branch

Syntrophy

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From the editor

By Tim Newsome

Dear Branch Members,

We have a bumper issue for you this month.

Not only has our Syntrophy Editor Nick Coleman collated a beautiful looking issue, he has provided an inspiring and hopeful vision of how microbiology and microbiologists can meaningfully contribute to a sustainable future. What really struck me was how this vision is delivered across all levels, starting in first year biology all the way to lab research and influencing policy. There are so many applications of microbiology to a low impact, sustainable and healthy society; we must push to be part of the conversation. Thanks to Arthika Manoharan for putting together this article.

Another PhD student, Aditi Aiyer, has provided a report on her participation in the 3 Minute Thesis, representing The University of Sydney with her work on cystic fibrosis and bacterial biofilms. We seem to be flush with gifted science communicators in the current early career generation. We should also acknowledge the role of our own past committee chair Jim Manos for nurturing such great students (Aditi and Arthika) in his lab !

Finally, committee member Jai Tree reports on the highlights of BacPath 2021.

I hope everyone is staying safe and looking forward to the rapidly approaching end of year.

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Focus Article

Microbiology and a sustainable future: how to engage undergraduates with this mission?

Arthika Manoharan[1], Nicholas Coleman[2]

1. **Department of Infectious diseases and Immunology, Charles Perkins Centre, Faculty of Medicine and Health, The University of Sydney**
2. **School of Life and Environmental Sciences, The University of Sydney**

Microbiologists are continually involved in addressing diverse global challenges and contributing innovative solutions to these problems. The multi-faceted role and commitment of the microbiology discipline in tackling global challenges has never been more visible as it is in the current COVID-19 pandemic. Microbiologists have been involved and consulted at every stage of the COVID-19 response, from drug and vaccine development to enhancing public understanding of the science behind the virus and the vaccines. Microbiology plays a major role in achieving the UN's Sustainable Development Goals (SDGs)[1]. The SDGs are a collection of 17 interlinked global goals stated to be a "blueprint to achieve a better and more sustainable future for all"[2]. These goals aim to tackle global issues that affect social, economic, and environmental sustainability.

Antimicrobial resistance (AMR) is one such key challenge that needs to be tackled under SDG 3: Good health and wellbeing. Over 10 million deaths annually are predicted to arise from AMR, with this number potentially gravely enhanced due to the dramatic increase in use of antimicrobials during the COVID-19 pandemic[3]. In addition, AMR is estimated to cause $3.4 trillion in global economic losses annually[4]. This now makes AMR a central problem that must be solved to address SDGs 1 (poverty), 2 (hunger), 6 (sanitation), 8 (economic growth) and 17 (partnership)[2], and in fact, the problem of AMR is relevant to almost SDGs (Figure 1). International collaborations between microbiologists and other researchers are addressing AMR with regards to the SDGs in multiple ways. These include developing and identifying new antimicrobials, investigating alternative therapies such as faecal transplants and phage therapy, and preparing drug resistance action plans.

Future microbiologists will be required to produce creative and multidisciplinary approaches to solve the AMR problem to address these SDGs, and undergraduate curricula providing opportunities to practice and develop these skill sets are crucial in the process[5]. This is described under SDG 4: quality education, and universities play a key role in achieving this. It is stated that universities help SDGs by providing knowledge, innovations, and solutions to the SDGs, thus creating current and future SDG implementers[6].

To equip future microbiologists with the tools and knowledge required to tackle such complex problems, microbiology graduates need to learn and understand the role of microbiology in sustainability. While fundamental theories such as microbial evolution and pathogenesis of diseases are covered by most undergraduate microbiology curriculums, the question arises "How can we better teach microbiology to emphasise its role in achieving a sustainable future?".

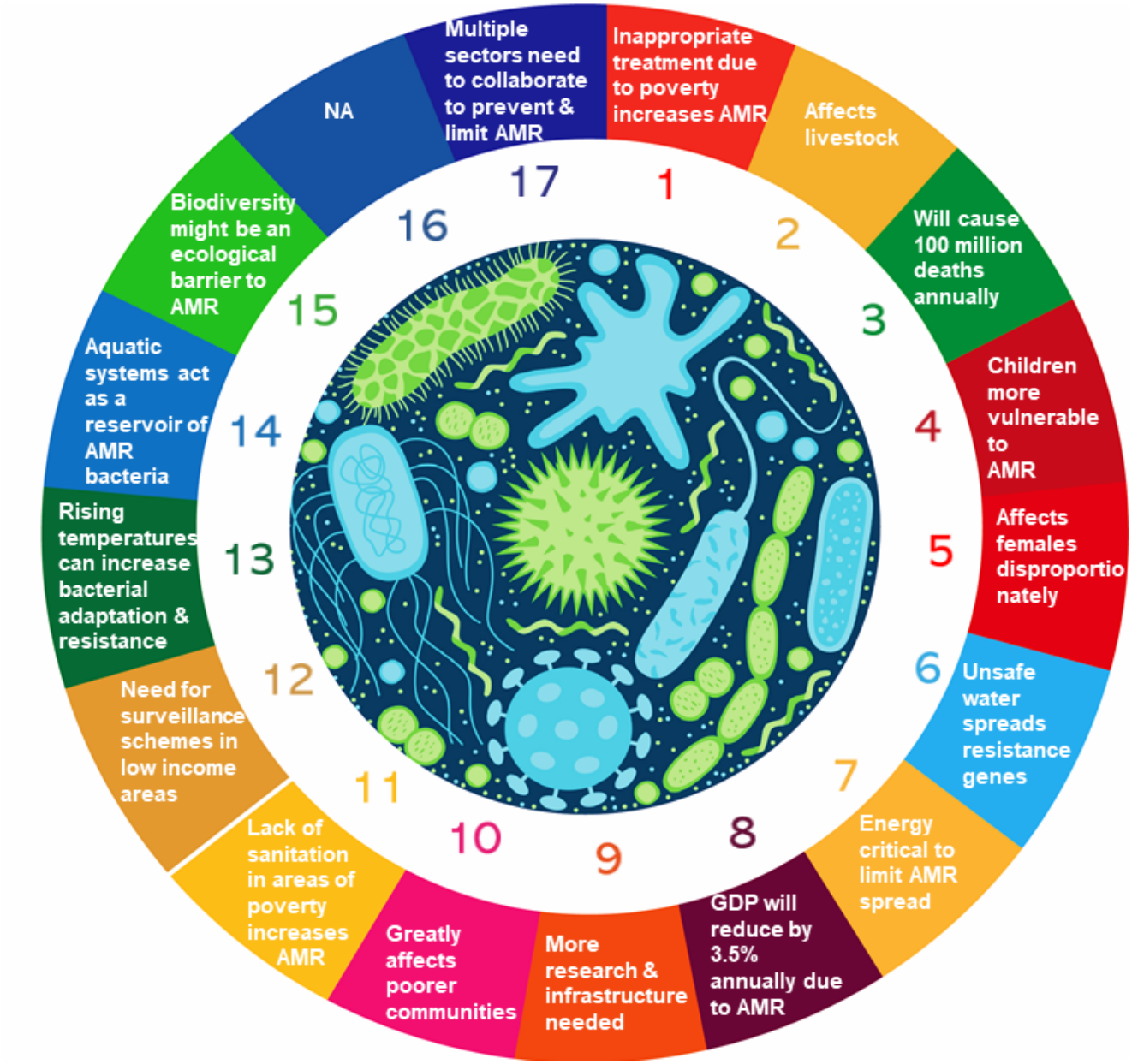

Figure 1. How the problem of Antimicrobial Resistance is relevant to Sustainable Development Goals.

Associate Professor Nick Coleman, who teaches microbiology in several courses at the University of Sydney, was consulted for this article. He helped bring into perspective how we can address some of the gaps that exist in emphasising the role of microbiology in the development of a sustainable future to our undergraduates.

AM: How can we tailor undergraduate curricula to highlight microbiology's contributions to the SDG's?

> **NC:** One way in which this is happening currently at USyd via the introduction of '3888' and 'SCPU' units which are intended to cross at least two disciplines, allowing undergraduate students from different majors to work together to tackle real-world problems, sometimes also involving industry partners. These initiatives are difficult to get up and running e.g., due to problems of which faculty or school 'owns' the unit, and how to effectively teach and assess students from different backgrounds, but these are all solvable problems.

AM: Is there existing course content that can be taught from the angle of microbiology and sustainability, eg. AMR, climate change, ocean management, biofuels?

> **NC:** We try to do this as much as possible. In collaboration with my colleague Dee Carter, I recently developed new lectures for 1st year biology students that use 'One Health' as a unifying theme for all the microbiology content. This is a powerful way to link together different kinds of problems such as the ones you mention (e.g., AMR, climate change etc) and it is a great way also to bridge the divide between 'medical' and 'environmental' science. The more you dig into these two disciplines, the more it become apparent that they are inseparable, ranging from deforestation practices that lead to exposure of people to new zoonoses, or warming climate leading to expansion of the range of mosquito-borne diseases etc.

AM: How can we highlight the importance of interdisciplinary collaborations to successful outcomes in microbiology research?

> **NC:** One good way to do this is for funding agencies to offer funding specifically aimed at projects that are genuinely interdisciplinary. I was involved in one such initiative recently (SREI 'Sydney Research Excellence Initiative') which brought together academics from microbiology, soil science, and civil engineering to tackle issues of pesticide pollution and remediation. Similarly, the formation of cross-disciplinary research institutes such as the USyd-based Drug Discovery Initiative or the Macquarie University-based ARC Centre of Excellence in Synthetic Biology are also good ways for microbiologists to learn from other kinds of scientific specialists (and vice versa).

AM: Could you highlight an example of microbiology influencing policymaking and do you think this is something that can be covered in a microbiology course at university?

> **NC:** The management of the current pandemic is perhaps the best example of this. Microbiologists and other bioscientists have been consulted more than ever over the past couple of years, to help formulate responses to this unprecedented public health challenge. The need for effective science communication in microbiology is an important part of this. We as microbiologists need to be able to provide information to politicians, the media, and the public in a way that is accessible and easy to digest, but still accurate and meaningful. Professional societies like ASM are also part of this picture, as trusted entities that can be approached for expert opinion. We should absolutely be teaching these aspects of science (policy impacts and communications skills) as part of our microbiology curricula. I have tried to do this in my own units of study where possible. For example, in one unit we discuss the controversies around GMO microbes and plants, their possible health and environmental risks, and the changing legal landscape around these.

From vaccine development to increasing farming productivity[7], to the global "One Health" concept, the study of various microbiological processes continues to evolve and overlap in their outcomes. Some courses cover this by exploring the significance of innovations in medical, environmental, and applied microbiology and their role in improving human and planetary health. In Australia, dedicated undergraduate microbiology units such as Microbes in a Changing World (USYD), Environmental Microbiology (UNSW) and Applied and Environmental Microbiology (UTAS) emphasise microbial processes impacting global change. These are great examples in adapting existing curricula to cover microbial fundamentals alongside the ever-evolving role of microbiology in achieving a sustainable future. However, there is a lot more that can be done, particularly:

1. Highlighting the contributions of medical, environmental and food microbiologists in meeting the SDGs
2. More critical analysis of advanced research topics, some of which may not fit into the SDGs.

The global community of microbiologists plays a fundamental role in the UN goal of achieving all SDGs by 2030[2]. To do so, academics need to equip future microbiologists with the necessary knowledge and skills through research and education in an inclusive manner. This task requires scientists to collaborate across disciplines and take initiatives to ensure that our microbiology curriculum continues to evolve and expand.

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About the author

Arthika is currently in the third year of her PhD under the supervision of A/Prof Jim Manos and Dr. Theerthankar Das at the University of Sydney. Her research aims to tackle biofilm formation in UTIs using novel antioxidants to circumvent antibiotic resistance and decipher how these antioxidants interact with uropathogens and the host bladder. She teaches microbiology and immunology as a teaching assistant. Arthika is passionate about science communication and increasing visibility for researchers, which underpins her role as an ASM comms ambassador. She is also secretary and co-social media manager for the EMCR committee at the Charles Perkins Centre, University of Sydney. Outside the biosafety cabinet and Pubmed, she loves salsa dancing, dogs, and playing tennis.

Event Report: 3 Minute Thesis Competition

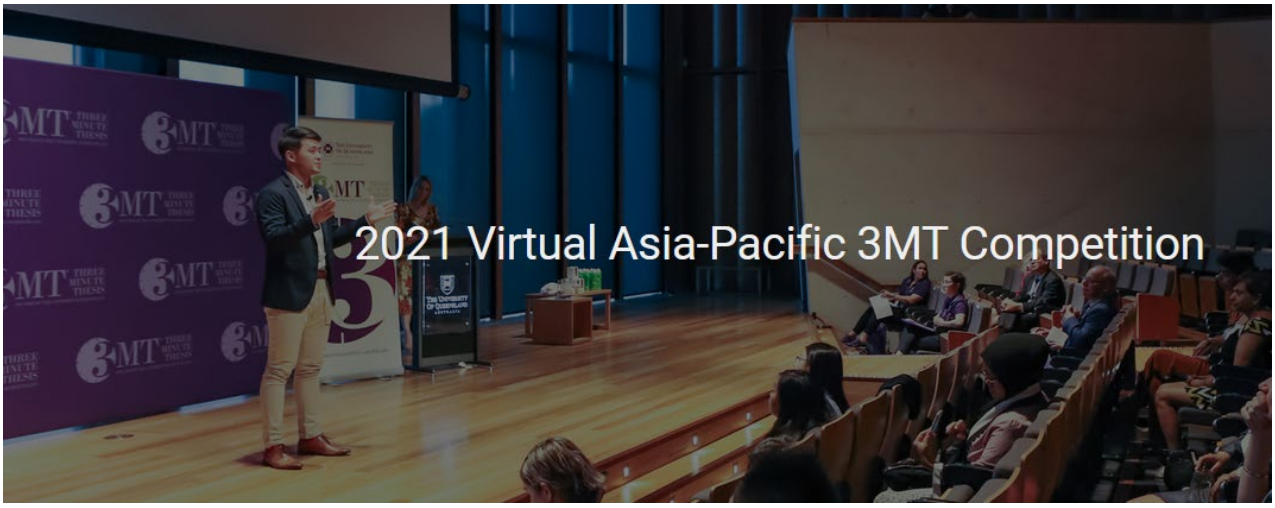
Report by Aditi Aiyer

I'm sure many of us know the ins and outs of our research projects like the back of our hands. We know the minute details that contribute to the successful fruition of our experiments and the prevailing theories that dictate their direction. However, could you we communicate all of that to a lay audience? Allow me to add one more proviso, could you explain it in just three minutes with only one PowerPoint slide?

The Asia-Pacific Three-minute thesis (3MT) competition challenges PhD candidates from 54 institutions internationally to do just that; to tell the story of their research in a succinct and engaging way to a broad audience. This year's competition has seen a high calibre of presentations from many different fields; from "could we print organs?" to "how does medicinal cannabis affect the brain?".

I was proud to represent the University of Sydney in this competition with my presentation "The Wolf and the Big Bad Biofilm"; where the cystic fibrosis (CF) microenvironment has been reimagined as a flipped fairy tale of a good wolf huffing and puffing against the three evil pigs. Patients with CF are predisposed to having poor lung function as they lack a gene that aids in thinning out the mucus that naturally coats the lung. These patients end up having thick lung mucus that unfortunately creates a perfect environment for bacteria to grow in and leads to bacterial infections in the form of "biofilms". In my PhD, I hope to address how to blow-down these biofilm brick houses by investigating novel formulations of antibiotics and antioxidants against various bacterial biofilms.

If you would like to follow along with the 3MT competition, and watch any of the presentations, please check out their website: https://threeminutethesis.uq.edu.au/asia-pac/2021



About the author

Aditi is a third year PhD student in the field of Infectious Diseases and Microbiology at the University of Sydney. Her research focuses on the development of a novel combination therapy to disrupt and destroy bacterial biofilms in the cystic fibrosis lung. She hopes that this treatment will pave the way for more effective therapies for patients suffering from this disease and improve their outcomes.

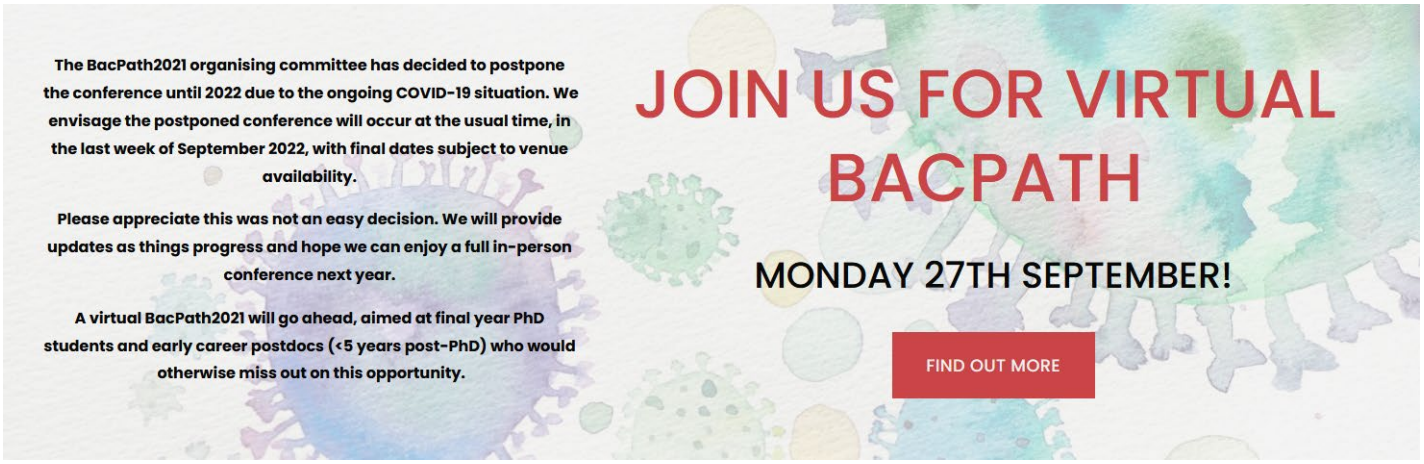
Event Report: BacPath meeting 2021

Report by Jai Tree

Over its 32-year history, BacPath has become a must-attend event for the bacterial pathogenesis community in Australia. This year, due to the pandemic and travel restrictions across many states, BacPath16 was held as a short virtual conference. The conference organisers Makrina Totsika and John Atack did an excellent job of putting together an engaging list of speakers that reflect the diversity of bacterial pathogenesis research in Australia.

The keynote speakers were Assoc. Prof Catherine Satzke (Murdoch Childrens Research Institute) who spoke about the impact of viral co-infection on *Streptococcus pneumoniae* colonisation, and Dr Tim Barnett (Telethon Kids Institute) who spoke about resistance to antibiotics that target folate metabolism. As with previous years, the conference focussed on providing a platform for early career researchers and PhD students. In the first session speakers discussed work on anti-biofilm silver nanoparticles (Riti Mann, UTS), non-coding RNAs in MRSA (Daniel Mediati, UNSW), unusual Dsb proteins (Pramond Subedi, La Trobe), glycosylation in *Burkholderia* (Jessica Lewis, UMelb), and galactose metabolism in *S. pneumoniae* (Kimberley McLean, UAdelaide). The second session delved further into glycobiology (Greg Tram, Griffith), and biofilm formation (Tanuka Sen, ANU), before diving into phospho-proteins in *Bordetella* (Laurence Luu, UNSW [now UTS]), UPEC genomics (Veronica Jarocki, UTS), and immune modulation by streptolysins (Johanna Richter, UQ).

As John Atack tweeted after the conference: it seemed that “research into bacterial pathogens in Australia is in good hands!”. BacPath16 will return live and in-person to the sunshine state (Qld) in 2022 and I know the pathogenesis community will be eager to connect with colleagues again in person.



Upcoming Events

JAMS

Joint Academic Microbiology Seminars

MINIMA MAXIMA SUNT

6:00pm: Jason Lee, University of Sydney
"The Specificity of the Wzx translocase in O antigen synthesis"

6:30pm: Dr. Paul Jaschke , Macquarie University
"Engineering phage ΦX174: Lessons and Potential"

Online via zoom:
Meeting ID: 890 0388 6528, password: 366790
Hosts: Nathan Williams and Jo Rothwell
When: 6pm Tuesday 26th October 2021

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