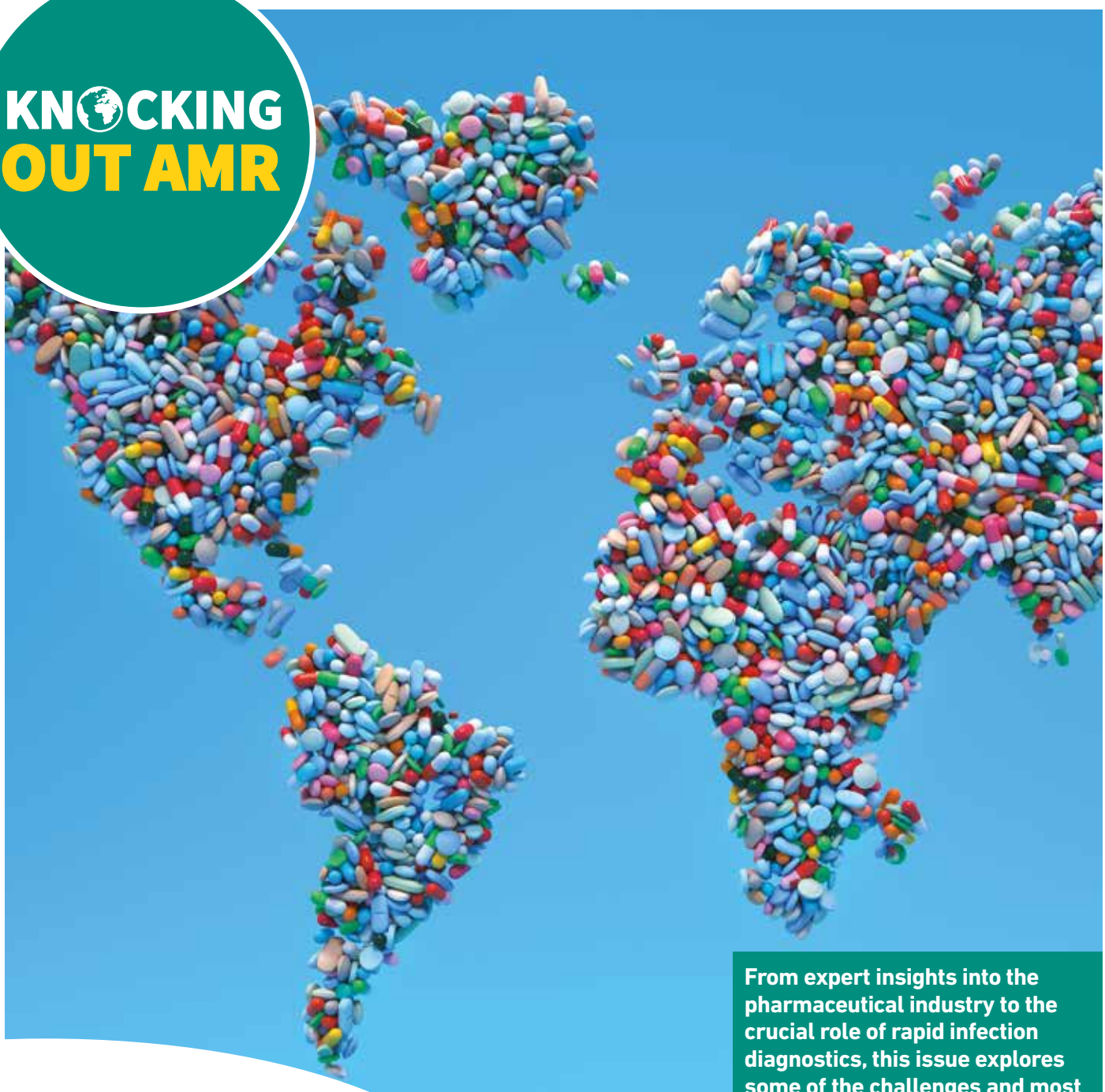
MICROBIOLOGY TODAY

50:2 October 2023

KNOCKING OUT AMR



From expert insights into the pharmaceutical industry to the crucial role of rapid infection diagnostics, this issue explores some of the challenges and most recent advancements within antimicrobial resistance (AMR) research.

MICROBIOLOGY SOCIETY

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From the Editor

"Hello and welcome to the October 2023 issue of *Microbiology Today*!"

We have somehow reached the end of another summer (albeit quite a wet one in the UK, as I write this in August), but we have another exciting and jam-packed issue awaiting you beyond this editorial. Before you go on, we have a few big announcements to take you through.

First, is the theme for the October issue! In this issue, we focus on antimicrobial resistance (AMR) and, in particular, the work going on to try to reduce the ongoing threat from what has been referred to as the 'Silent Pandemic'. I'm excited to show you what we have to offer in this issue, not only because my research background is in AMR, but because this issue coincides with the launch of the Microbiology Society 'Knocking Out AMR' project. On the next page, we have an extra editorial from Catrin Moore and Tina Joshi telling you more about this project and how you can get involved. We have a summary of our themed articles at the bottom of this Editorial.

Second, this is my final issue as Editor of *Microbiology Today*. When I was announced as Editor at the start of 2021, several former Editors sent messages on Twitter saying 'It's a great job and loads of fun...' (Gavin Thomas) and 'it's a most rewarding job with a great team' (Paul Hoskisson), and '...one of the nicest jobs ...ever!' (Laura Bowater). I couldn't agree more with these comments. This has been such a fantastic role; it's been great to speak with people about exciting science, and to work with some brilliant people at the Society. A huge thank you to everyone who has contributed such engaging and informative articles during my tenure, and thank you to the Editorial board for all of your ideas and support. I need to say an extra special thank you to Society staff on the magazine past and present, in particular to Kimberley Ndungu as Managing Editor for keeping the magazine (and me!) on track this last year.

As we move forward into 2024, Dr Victoria Easton will be stepping into the Editor role after working as Deputy Editor this last year. I wish you all the very best, Vikki, it's a great job!

Our final announcement involves another change in 2024. The October 2023 issue of *Microbiology Today* will be the final print version of the magazine. As part of the Society's digital first policy, 2024 editions of *Microbiology Today* will be published online – via the same popular digital book format we currently use. This allows readers everywhere to enjoy the content at any time they wish. It is part of an overall drive to be more environmentally sustainable, to recognise the growing popularity of the Society's digital channels and to ensure we reach the widest possible audience worldwide. You can find out more about this change on our website at **microb.io/46rFyOJ**.

With the announcements done, let's take you through the articles we have in the October issue.

We start with Jane Freeman (National Clinical Lead for AMR Diagnostics, NHS England) who describes how rapid infection diagnostics, which facilitates more targeted antibiotic use instead of empirical ('best guess') strategies, could help us preserve our existing antibiotic arsenal.

This is followed by Chris Longshaw (Shionogi) giving us a view of AMR from the pharmaceutical industry. Chris shows us the historical challenges faced by large Pharma companies with antibiotic discovery and development, and how this led to a shift in research focus and investment away from the field. Chris finishes by taking us through the various 'PUSH' and 'PULL' initiatives to incentivise antibiotic R&D in the hope to revitalise industrial involvement.

From there we move on to our third article with Anderson Oaikhena, Dorothy Cyril-Okoh, Chinenye Ekemezie and 2023 Peter Wildy Prize winner Iruka Okeke giving us a tour of their many varied outreach activities in Ibadan, Nigeria. While Professor Okeke's lab focuses on antimicrobial resistance research and surveillance in Nigeria, they also understand the huge importance of outreach programmes in communication and education – powerful tools indeed! They describe this as an 'antimicrobial adventure', and I can't help but agree.

To finish the issue we have a comment from Martha Clokie. Martha is the Director of the recently established Centre for Phage Research. Whilst bacteriophage have long been considered for the treatment of bacterial infection, there has been little clinical interest in their use (at least in the West). Martha notes that with the rise of AMR and advances in 'omics' and other technologies, the interest in phage as a viable alternative to antibiotics is changing quite dramatically.

And with that, I am signing off as Editor for the last time! I do hope you enjoy the issue, and I'm looking forward to seeing what Vikki and the team have in store for us in 2024!

Chris Randall
c.p.randall@leeds.ac.uk
@randall_uk

Knocking out AMR Editorial

While often referred to as the silent pandemic, recent estimates from the Global Research on Antimicrobial Resistance (GRAM) study emphasise the importance of Antimicrobial Resistance (AMR) as one of the most urgent global threats to public health today.

Catrin Moore

Tina Joshi

Estimates outline between 1.27 million deaths were attributable to and 4.95 million deaths were associated with (95% Uncertainty Intervals 0.91–1.71 and 3.62–6.57 million, respectively) AMR globally in 2019. AMR was associated with more deaths in 2019 than malaria and HIV/AIDs combined. We are already witnessing the devastating consequences of AMR for healthcare systems, economies, the environment and animal health. Left uncontrolled, the impacts will be catastrophic. The World Bank estimates the global costs associated with AMR might exceed $1 trillion USD annually by 2030, and AMR will kill 10 million people per year by 2050, which is more than cancer and diabetes combined.

We need to develop innovative solutions to minimise this growing global threat of AMR and we need to act now. Microbiologists in academia, industry and clinical settings are at the forefront of the fight against this threat both in the UK and internationally. However, to harness the power of these possible solutions, it's essential that the microbiology global community work collaboratively to expand our reach.

Now is the time to take action. We need to focus on an interdisciplinary, solutions-driven approach within a 'One Health' context. To this end, The Microbiology Society is leading the way with the 'Knocking Out AMR' project. This is an ambitious, bold, extensive and wide-reaching programme of work designed to promote feasible and effective solutions to AMR through cross-disciplinary and multi-sector collaboration worldwide. We are delighted to formally launch the project here today.

In this edition of *Microbiology Today* we capture a small snapshot of the range of expertise within the Microbiology Society community, with the understanding that the knowledge of AMR spans the entire global community of microbiologists and beyond. The 'Knocking Out AMR' project aims to bring together everyone working in AMR, whoever they are and wherever they are.

We have identified three categories of solutions the Knocking Out AMR project will focus on:

1: Therapeutics and vaccines

Using the Society's cross disciplinary expertise, the Knocking Out AMR project will support activities in key areas such as research and development of preventative measures and alternative therapeutics; interdisciplinary co-working in the antimicrobial pipeline; and the reduction of inappropriate antimicrobial exposure.

2: Diagnostics and surveillance

Through effective knowledge sharing in the UK and internationally, the Knocking Out AMR project will act as a conduit between the Society's expert membership and external stakeholders in order to integrate efforts of those across different sectors working on diagnostics and surveillance.

3: Policy engagement

The Knocking Out AMR project aims to drive knowledge exchange between AMR experts and policy-makers in order to increase our collective voices and drive policy discourse around AMR in the UK and worldwide. We aim to ensure the full diversity of voices of microbiologists working on AMR are heard.

We look forward to sharing details of the upcoming activities in due course. These will include AMR content published across our wide-ranging publishing portfolio together with a stream of events including focus groups and larger meetings.

In the meantime, if you work on AMR in any field, we encourage you to sign up via the QR code on page 15 to keep in touch about how you can get involved.

Further reading

Antimicrobial Resistance Collaborators. Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis. *Lancet* 2022;399:629.

Review on Antimicrobial Resistance. Tracking drug resistant infections globally: final report and recommendations; 2016. https://amr-review.org/sites/default/files/160525_Final%20paper_with%20cover.pdf (accessed 31 August 2023).

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Dr Catrin Moore
Senior Lecturer
St George's
University of London
camoore@sgul.ac.uk

Dr Tina Joshi
Associate Professor
of Molecular Microbiology
University of Plymouth
tina.joshi@plymouth.ac.uk

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+44 (0)20 3034 4870 mtoday@microbiologysociety.org Microbiology Society, 14–16 Meredith Street, London EC1R 0AB

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From the President

"Each year in the last week of October, we join the global scholarly community in celebrating Open Access Week"

For 2023, the theme is 'Community over Commercialisation', which resonates particularly with the Microbiology's Society's work as a not-for-profit publisher. The organisers of the event explain that this year is 'an opportunity to join together, take action, and raise awareness around the importance of community control of knowledge sharing systems'.

In the Chief Executive's piece on page 6, Peter explains that changes in the landscape for publishing your science are among the most exciting opportunities the Society has encountered in its 78 year history. I am proud that during my term as President we have relaunched *Access Microbiology* as an Open Research Platform and that our founding journal, *Microbiology*, has transitioned to fully Open Access.

The Microbiology Society supports sustainable Open Access models (such as Publish and Read, facilitating fee-free Open Access for researchers) and offers high-quality peer review, maintaining a scholarly publishing environment that fundamentally helps microbiologists to improve, validate and share their research widely. What's more, as a not-for-profit organisation, revenue raised by publishing helps us to continue serving our community in the form of events, grants and professional development opportunities.

This is why this year's theme for International Open Access Week struck me as such an important one. Wherever you are reading this magazine, you are doing so because, like me, you care deeply about our community – the community for anyone interested in microbes, wherever they are in the world. Publishing one article with us generates the revenue to give grants to four early career researchers to attend Annual Conference – just two articles generate the revenue to fund a Harry Smith Summer Studentship, providing invaluable experience in research and supervision.

The move to Open Access is undoubtably going to enhance the impact of microbiology. With fully accessible scientific research, we can hope that there will be ever-improving communication of sound science to other scientists, to the public, to the media and to policy-makers. The Microbiology Society is committed to amplifying its members' voices and ensuring members' expert opinions are heard by those who need to hear them.

To this end, I'm pleased to announce that we are launching what is potentially our biggest engagement project to date, 'Knocking out Antimicrobial Resistance'. This will be a wide-ranging, multi-disciplinary programme of work designed to generate solutions to the global challenge of AMR.

I hope you enjoy this issue of *Microbiology Today*. It's a wonderful snapshot of the members of our community working on the global health crisis that is AMR, and an example of what can be achieved by our community coming together.

Gurdyal Besra
president@microbiologysociety.org

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president@microbiologysociety.org

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karen.robinson@nottingham.ac.uk

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tina.joshi@plymouth.ac.uk

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laura.bowter@uea.ac.uk

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nigel.brown@ed.ac.uk

Dr David Clarke
d.clarke@ucc.ie

Dr Andrew Edwards
a.edwards@imperial.ac.uk

Professor Kim Hardie
kim.hardie@nottingham.ac.uk

Professor Alan McNally
a.mcnally.1@bham.ac.uk

From the Chief Executive

"Changes in the landscape for publishing your science are among the most exciting opportunities..."

When the Council of the Microbiology Society produced a five-year strategy to support and invest in the microbiology community for the benefit of everyone, it seemed like a long time horizon, especially after the upheaval and confusion that had characterised the COVID-19 pandemic. But time flies when you're busy, and we are already almost a year in. Exciting things are happening to deliver the widest possible participation in the Society's programmes so that we can amplify the voices of all Microbiology Society members, wherever you are and whatever your career stage.

One of the main features of the strategy is the recognition that the world is changing around us, that the field of microbiology is always evolving, and that both the challenges and opportunities we face as a community are different from at any time in the Society's 78 years.

Changes in the landscape for publishing your science are among the most exciting opportunities but they also carry real risks. Open Access publishing models offer chances for your research to receive greater attention and for the Society to capture funding from places and people that have never before been customers – that is important because all of the activities we undertake on your behalf depend on the income from publishing. As just one example, as the President pointed out in his opening address at this year's amazing and vibrant Annual Conference in Birmingham, the income from one article in one of our journals funds grants for four early career researchers to attend the event, benefitting from all the networking and scientific exchange that happens there. But the journey to full Open Access publishing requires some significant changes in the ways we work, many of which are behind the scenes and not always obvious to you, the Society's members, and authors and readers of the journals.

One of the most obvious changes in the way we live our lives in recent years is a big shift in the ways we communicate. As such a high proportion of interaction now happens online, as Chris explains on page 1, this will be the last printed edition of *Microbiology Today*. This is one example of several changes to the activities you will see in the coming months, from communication to the way we administer grants to how we organise events.

The reason for these changes is that we need to be able to seize opportunities as they arise, and none could be more important than the chance to make a difference to the world's fight against antimicrobial resistance. We all know that microbiologists will play a major role in this global challenge, which threatens to leave tens of millions of people a year at the mercy of lethal infections and to make routine surgery dangerous. As Tina and Catrin describe on page 2, the Society's new project, 'Knocking Out AMR', will be an ambitious, bold and extensive scheme of work. It will do far more than bringing together the scientific experience of our membership, by linking that expertise with insights from policy, social science and other disciplines to promote feasible and effective solutions to AMR.

So, as I look forward to the coming months and years, I am excited to be working with engaged, far-thinking colleagues to navigate the challenges and seize the opportunities that face the community, and the reason I am optimistic is that every time I get together with members of the Microbiology Society, I come away energised and raring for the next challenge. As just one example, at the President's Roadshow in Cambridge last month, Éva Bényei, Jack Ferguson, Alan McNally, Alain Richard, Rebee Penrice-Randal and others spoke about everything from summer studentships to navigating the publishing landscape to the transition from academia to industry. And in each case, they spoke about how important the Microbiology Society has been on their microbiological journey.

Peter Cotgreave
p.cotgreave@microbiologysociety.org

KNOCKING OUT AMR

We are building a **Knocking Out Antimicrobial Resistance (AMR)** collection to serve as a central hub for the AMR content published in our portfolio.

Read more here:

#KnockingOutAMR

MICROBIOLOGY SOCIETY

Journal of Medical Microbiology Editor Q&A

Fiona Walsh

For this issue of *Microbiology Today*, we spoke to Fiona Walsh, Editor of the *Journal of Medical Microbiology*, about her work within AMR and how the journal can support the advances in this research field.

What is your lab currently working on?

The overall theme of my lab is antimicrobial resistance across One Health. I lead several projects and there are currently six PhD students, two MSc research students and two postdocs working in the group. We're investigating AMR in soil from different perspectives, mainly focusing on agricultural soil but also forest soil, and the microbiomes present in these soils to understand the resistome and the impact changes such as flooding will have on AMR and the microbiomes. We are working with hospitals to understand the roles of bathroom environments as sources of AMR pathogens and if they are linked to infections in patients. We are investigating animal gut microbiomes and how they can be changed to maintain health. Another project is investigating what is happening within the bacteria when an AMR plasmid is present and how this then causes the bacteria to become resistant. Each area uses omics, molecular biology and culture-based tools to address the questions.

What do you think are the most promising areas for antimicrobial development?

I think the expansion of our understanding is really key to developing antimicrobials or modes of ensuring our current antimicrobials keep working. Areas such as understanding AMR in the context of the microbiome in which it exists and transfers are very promising as many microbes are already limiting the spread of AMR in the natural environment. If we can enhance this to minimise the movement of AMR then I think we might buy ourselves some more time but we need more ways to inhibit or kill pathogens, especially in immunocompromised patients/people, and we need to ensure that we can treat infections in animals, both farm and companion animals.

What is the impact of AMR on the human microbiome?

Antimicrobial resistance in a human microbiome will always provide an advantage to the bacteria carrying those mechanisms but also a disadvantage to those without them. This means the human microbiome, whether it is the gut or skin or nose, becomes skewed when anything giving those bacteria an advantage occurs. This skew will get greater the larger the variety and number of AMR mechanisms present in the microbiome not only in terms of what will survive in the presence of antimicrobials but also in terms of what else is carried on the mobile elements carrying the AMR genes.

How can the *Journal of Medical Microbiology* help to support advances in AMR research?

Scientific data are biased towards countries that have been performing research the longest. This means that we have a biased view of AMR research, through the lens of countries with the largest data and greatest timeline of research. For me, the greatest thing any researcher or journal can do to aid AMR research is to help those in countries or locations or topics where there is the least data to have it published. One example is when a manuscript is submitted from a country with little or no data on the genomics of AMR pathogens. The Editor and reviewers should do all they can to make sure these data are published because they bridge a huge gap in our knowledge even if the study is small. Another is to maintain the open access of our data and publications. This leads to equity of knowledge access globally, which will inspire leaders in these fields and generate new ideas.

Fiona Walsh
Editor *Journal of Medical Microbiology*
Maynooth University, Ireland

Microbial Genomics Editor Q&A

Danielle Ingle

Danielle Ingle is Editor of *Microbial Genomics*. Her fellowship centres around priority bacterial pathogens, encompassing *Shigella* species, various *Salmonella enterica* serovars, and diverse *Escherichia coli* pathotypes.

Please introduce yourself

I am a Research Fellow at The University of Melbourne, Australia, where I currently hold an Emerging Leader Fellowship from the National Health and Medical Research Council of Australia. My research focuses on several priority bacterial pathogens, including *Shigella* species, serovars of *Salmonella enterica* and pathotypes of *Escherichia coli*. I currently work collaboratively with public health and academic partners to better understand the evolution and epidemiology of these enteric pathogens.

What motivated you to get involved with *Microbial Genomics*?

Microbial Genomics was established as a journal when I was completing my PhD (in the area of *Escherichia coli* genomics), and it was exciting to have a journal focused on representing my research niche. My involvement was first as an author submitting manuscripts for publication and then acting as a reviewer for the journal, before becoming an Editor. It's been a great experience to develop the skills required as a scientist, keep up to date with current research and to engage with the broader research community.

Why are Society journals so important to the microbiology community?

Society journals play a key role in developing and engaging the broader microbiology community. Publication in reputable, peer-reviewed journals is critical for science. Society journals not only provide support for publishing, for example by providing discounts to members of the Microbiology Society and corresponding authors from low- and middle-income countries, they also support the development of emerging scientists through a range of initiatives. It's wonderful that this means the cost to publish results is circulated back into support for the microbiology community.

Why should people working within AMR engage with *Microbial Genomics*?

The threat posed by antimicrobial resistance cuts across research sectors – a quintessential One Health issue. Sequencing technologies and analyses are central to current research efforts to tackle this problem and will continue to remain so as the scale of the problem continues to increase and the broad and numerous insights gained from this technology are realised. The policies of *Microbial Genomics* of Open Access code and data availability ensure accessibility for all researchers, which will help propel future research efforts.

What do you think the future holds for research in AMR?

I think the future of research in AMR will be multi-faceted, with the development of new methods including use of sequence data and computational models, more research into the fundamentals of how AMR arises in different bacterial populations and the role of mobile elements such as plasmids, and translational research efforts such as enhanced genomic surveillance and implementation in clinical settings.

Danielle Ingle
Editor *Microbial Genomics*
University of Melbourne, Australia

danielle.ingle@unimelb.edu.au
@DrDanielleIngle

Microbiology Editor-in-Chief's Journal AMR Highlights

iStock/Claudio Ventrella

We spoke to Professor Andrew Preston, the recently appointed Editor-in-Chief of *Microbiology*, to share his thoughts on what motivated him to take on the role and why Society journals are important to the microbiology community.

For me, the Society is a long-standing and important aspect of being part of the microbiology research community. It has an outstanding tradition and track record of supporting microbiologists, particularly in their early careers. Publishing is a key component of the Society's activities. Our papers are the currency of research, so it is vital the Society is involved in this. Importantly, proceeds from our publishing activity are used to support our members, in the form of bursaries to support attendance at meetings and conferences, not just those run by the Society. This support is priceless to helping our community to stay connected and to enable so many PhD students and postdocs to present their work to others.

Microbiology is the founding journal of the Society, and let's face it, we have the best name of all the micro journals. It has a distinguished history as one of the original microbiology journals, so taking the reins as Editor-in-Chief is a great opportunity to be a small part in the history of the journal, while working with a great set of colleagues and hopefully playing some role in maintaining high-quality publishing of microbiology research. I aim to make *Microbiology* a natural choice for authors, offering an author-focused service, while maintaining a rigorous but fair review process. Of course, I recognise that we are not directly competing with *Nature* or *Cell*, but there are many sound and important studies that, while they may have a more limited impact than those appearing in these magazines, need to be put into the public sphere. I want the community to recognise that a paper published in *Microbiology* is a high-quality paper, and for authors to feel proud that their work is in our journal.

Crucially, the ever-increasing fees associated with publishing mean enormous amounts of hard-won funding are being drained away from the core activities of conducting research and training scientists. I am deeply uncomfortable with this. While publishing in Society journals does carry a cost, we can at least ensure we feed financial support back to the Society for the benefit of our members. To me, this is a stark distinction from many other journals, and one that I view as increasingly important. I recognise the dilemma faced by researchers in that publications in some of those high impact (expensive) journals are considered key to career development, but where there is a clear choice between submitting to a Society or a non-Society journal, I would urge authors to consider the wider benefits of supporting a Society.

Microbiology's broad scope means that it can accommodate work across a wide range of antimicrobial resistance (AMR) research. The journal has a dedicated subject section for 'Antimicrobials and AMR', and a number of publications in the recent Antimicrobial Efflux collection have highlighted the varied roles that efflux systems can play in AMR.

This breadth of scope can be seen across recent publications in *Microbiology*. *Pseudomonas aeruginosa* has been the focus of several articles, from the role of *Candida albicans* in increasing *P. aeruginosa* resistance to meropenem via a dual-species biofilm [1], to the reduced susceptibility to tobramycin (and to other classes of antibiotics) for strains of *P. aeruginosa* evolved in the presence of tobramycin and the inhibitor of quorum sensing, furanone C-30 [2]. The influence of efflux systems on AMR for other bacteria has also been highlighted; Holden *et al.* [3] utilised genome-wide mutagenesis, using TraDIS-*Xpress*, in *Escherichia coli* and *Salmonella typhimurium* to catalogue genes involved in the expression of acriflavine efflux. Additional transport systems were also identified as being important for the expression of efflux, as were glutathione metabolism, systems involved in cell membrane maintenance, and general stress responses; several of these were suggested to act via a direct effect on regulators of the Acr system. On the whole, the same systems were identified in *E. coli* and *S. typhimurium*, suggesting that the regulation of efflux as a generalised stress response is evolutionarily conserved. Targeting these various systems may provide ways to circumvent efflux for efficacious antimicrobial treatments. AMR clearly extends beyond bacteria, and the review from Islam *et al.* looked at the range of protective mechanisms employed by fungi against antimicrobials and considered whether fungal mitochondria might also contain pumps that efflux antibiotics away from these organelles [4]. Finally, beyond the theme of efflux, Walker-Sünderhauf and colleagues proposed that AMR could be tackled by employing bio-engineering and enlisting plasmids [5]. They cloned a CRISPR-Cas system that specifically targets the gentamicin resistance gene *aacC1* into the backbone of the broad-host-range conjugative plasmid pKJK5. The resulting element, pKJK5::csg, could block uptake of incoming resistance plasmids across a range of genera and, when transferred into a new recipient strain by conjugation, could displace resident resistance plasmids. Utilising CRISPR-Cas (and other 'genome defence' systems) may provide exciting new possibilities to artificially combine naturally occurring microbiological machineries to address the problem of AMR.

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Andrew Preston
Editor-in-Chief *Microbiology*,
Department of Life Sciences and Milner Centre for Evolution, University of Bath, UK

a.preston@bath.ac.uk
andrew-preston-49324787
@apreston243

Peer review is an **essential cornerstone** of the research process for **ensuring quality, credibility,** and **integrity.**

Kevin Chau
Former mentee, Early Career Board of Reviewers, *Microbial Genomics*

Peer review is **vital** to **publishing. Review** with **us** to **shape** the **future** of **microbiology.**

Find out more:

MICROBIOLOGY SOCIETY

Champions Spotlight

Thiru Vanniasinkam

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This is a regular column to introduce our Champions and the work they do to promote microbiology and the Society. In this issue, we're pleased to introduce Thiru Vanniasinkam.

Where are you currently based and what is your role?

I am Associate Professor in Immunology at Charles Sturt University, Australia. I am also a Programme Director. I am involved in vaccine research, teaching and education research.

Why did you decide to become a Microbiology Society Champion?

I have been a member of the Microbiology Society for many years, and becoming a Society Champion seemed to be a great way to engage with other Champions and contribute to the Society. In addition, as the Microbiology Society has a number of international members, I felt it would give me the opportunity to contribute to the global microbiology community.

You have been working with policy-makers to provide AMR education to healthcare professionals; could you tell us more about this project and how/why you got involved with it?

I work in a regional university, and for many years I have participated on committees supporting the work of the local health district. As part of my role in advisory committees, I worked closely with healthcare providers and practitioners for some years. I became aware of the need for continuing professional development; education and support of nurses in regional/rural hospitals – both in microbiology generally and more specifically in Healthcare Associated Infections (HAIs) and AMR. Colleagues I work with in healthcare are based in government organisations such as the Public Health Network and local health district; some are also involved in policy development. While many policies are also developed at national level, policies are developed at the local or regional level to implement in various healthcare facilities. As someone working with local healthcare professionals it was important for me to be able to offer my support to initiatives as a microbiologist, involving the development of policies on infection control and AMR.

What have been some of the highlights of this work?

I have worked with colleagues in healthcare to deliver workshops to nurses working as infection control leads in regional New South Wales, which is where my university is based. We recently gave a workshop on HAIs and infection control. Part of this involved a discussion on AMR. I am also working with a colleague on developing information sheets about specific pathogens, such as *Clostridium difficile*, which can be used to support nurses in local hospitals.

Have there been any challenges you have needed to overcome during the project?

One of the biggest challenges has been finding funding to run the workshops. It can also be challenging to find the time to organise meetings and events. Another challenge is finding support from colleagues to help run meetings and workshops.

What advice would you give to other microbiologists looking to get more involved with science policy?

Get involved with local health networks and committees. Attend healthcare-related conferences, as these are often attended by policy-makers. Look out for opportunities to contribute to policy-related discussions where you work, e.g. university, laboratory.

Often, microbiology societies will also offer the opportunity to contribute towards policy development or membership of committees such as parliamentary advisory committees. Reaching out to colleagues who are already on these committees is a great way to get started.

GET INVOLVED **If you would like to find out more about becoming a Microbiology Society Champion, please get in touch via getinvolved@microbiologysociety.org.**

Thiru Vanniasinkam
Associate Professor in Immunology
Charles Sturt University, Australia

vanniasinkam@csu.edu.au

iStock/Yalax

Black History Month:

An interview with Kishana Taylor

To mark Black History Month this October, Members Panel member and Champion I'ah Donovan-Banfield has caught up with co-founder and President of the Black Microbiologists Association, Kishana Taylor.

Could you tell us a bit about yourself?

I am a virologist who studies zoonotic and vector-borne viruses. I am interested in understanding the different factors and mechanisms that contribute to viral emergence and how we can use that information to better prepare for future pandemics. I am a co-founder of Black in Microbiology Week and President of the Black Microbiologists Association.

We have a saying in the States that "Black history is everyday" because Black people have made paramount contributions to society, not only in the US, but around the globe. However, we have often been ignored or erased from that history and so Black History Month, to me, is a time to shift the conversation and the focus to those contributions by Black people that have been pushed to the margins. It is also a celebration of the greatness of Black people as a diaspora and a time to revel in the greatness of our people and our culture.

What motivated you to create Black in Microbiology Week, and then the Black Microbiologists Association?

It was the summer of Black Lives Matter protests in the US and because of COVID and most people having to stay home it felt like, for the first time, other people, especially white Americans, were actually paying attention. This was not the first time Black Lives Matter had made headlines, and I remember the first time feeling helpless as a graduate student with no power. At work, no one would be talking about these huge events or acknowledge the pain that I, or any other Black person for that matter (though there were none in my department) might be in. So this time, as a PhD, I knew I had to do something. There had already been a few other STEM discipline movements online, so I thought I should organise something for microbiology. I contacted people I knew in the field, either from personal connections or online, and just went from there. This year's Black in Microbiology Week takes place virtually on 23–26 October. See our website for more details.

As a Black woman working in science, what are some of the challenges you have faced?

I have experienced a number of different challenges but I think the ones that stand out the most to me are:

1. The pushback from institutions and organisations when trying to make changes to the culture and the dynamics. Often times while there is a stated interest in things like equity and inclusion, the methods to achieve such often don't have a lot of teeth and when you ask or push for more substantial change there is a lot of resistance.
2. The isolation: I am a fairly social person who grew up in a culturally diverse place. We often took time to learn about each other's cultures and celebrate together. I also grew up in a place with a large (30+%) Black population. The further into my education and training I got, the less Black people I saw, and oftentimes I have been the only one. It can leave you feeling isolated when there is no one who understands or shows real interest in your culture or considers it a valuable experience to begin with.

Do you have any role models and, if so, who?

Absolutely! I have been blessed over the years, especially in the last five years, to meet some great people who have since become great role models and sometimes mentors. Some of them have been my bosses and others I have met through different events and conferences. My top five are Beronda Montgomery, Renetta Tull, Sam Diaz Munoz, Liz Wayne and Chanda Prescott-Weinstein.

Honourable mention to Queen Latifah, who is not a scientist, but was (and still is) my role model when I didn't know the awesome scientists I listed existed.

Is there any advice that you would give to other Black women working in science?

Community is EVERYTHING. I would not have survived without the communities that I made for myself and others. Communities that were diverse, multi-faceted and shared my values. You have to seek these people out because you need the support from any and everybody who is willing to offer it. Your career will come with highs and lows and you need people who want to both celebrate you and pick you up when you need it.

GET INVOLVED

If you are interested in finding out more about, or joining, the Black Microbiologists Association you can visit their website (blackinmicrobiology.org) and follow them on Twitter (@BlackInMicro).

I'ah Donovan-Banfield
Director of Public Relations at
Black Microbiologists Association and
PhD Student at University of Liverpool

publicrelations@blackinmicrobiology.org
i-donovan-banfield
@idb_virology

Kishana Taylor
President
Black Microbiologists Association

president@blackinmicrobiology.org
kishanataylor
@KYT_ThatsME

KNOCKING OUT AMR

Register your interest:

The **Microbiology Society** is excited to launch the **'Knocking Out Antimicrobial Resistance (AMR) project'**, an **ambitious, bold** project designed to promote **feasible** and **effective solutions** to AMR through cross-disciplinary and multi-sector **collaboration** worldwide.

#KnockingOutAMR

MICROBIOLOGY SOCIETY

Start Smarter, Focus Faster: The Role of Infection Diagnostics in the Battle Against Antimicrobial Resistance

Jane Freeman

National Clinical Lead for AMR Diagnostics, NHS England

Antimicrobial resistance (AMR) is a global threat to health, and it should be everybody's business. We are all potential patients, who may need antibiotics to work for us. As well as the urgent need for new antimicrobials to be developed, we must urgently protect those that we already have. Antimicrobial Stewardship strategies like Start Smart, Then Focus and the TARGET toolkits have allowed us to reduce the number of broad-spectrum antimicrobials being used. However, we need to go further and faster if we are to bring patients the targeted antimicrobial treatments they need in a timely fashion.

Good antimicrobial stewardship starts with high-quality, rapid infection diagnostics, but these work best when they are part of an optimised patient pathway. In the AMR Diagnostics team, we have been working with multiple healthcare professionals – medics, scientists, pharmacists, nurses and patients – to identify the points in our patient pathways that could be performing better, and then to identify where innovative technologies could boost that performance even further.

Improving pathways

We are focused on four infection diagnostic pathways that are major contributors to antimicrobial prescribing: blood cultures and sepsis, respiratory tract infections, urinary tract infections and surgical site infections.

Making sure the diagnostic pathways are working properly is a major part of our programme. There is no point in putting a top-of-the-range engine in a car if there's a wheel missing. Similarly, we cannot make the most of the new technologies coming our way if the pathways that host them are not working optimally.

A major piece of pathway optimisation work from the AMR Diagnostics team is the Blood Culture Pathway Improvement project. Blood cultures are a hugely important test. They help to detect more than 138,000 bloodstream infections each year in the UK. Blood culture diagnosis can impact the treatment and management of multiple serious infections, including sepsis. In particular, we know that the accurate and timely diagnosis of sepsis can have a significant influence on rapid, targeted antimicrobial treatment. If we can build on and improve the diagnostic systems we already have in place, we can potentially bring better treatments to patients faster. This is crucial for a serious condition like sepsis which can have devastating impacts upon patients, carers and their families.

Patient benefit is the ultimate driver for our work, but we also need to see benefits in terms of reducing the drivers of antimicrobial resistance. Timely appropriate and effective antibiotics are a major pillar of blood stream infection treatment, but at the moment most antibiotic treatments for this condition are empiric – this is based on the best evidence, but we know that between 19 and 34% of patients

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with bloodstream infections are not on an effective antibiotic treatment. The 'Start Smart', Then Focus campaign has improved targeting of antimicrobials by encouraging patient review and switching/stopping antimicrobials where necessary. Optimising the collection of blood for blood cultures means that patients have the best chance of an accurate diagnosis: getting the sample to the analysers quickly means that happens as fast as possible. Each diagnosis offers the chance of timely, accurate treatment and better outcomes for the patient.

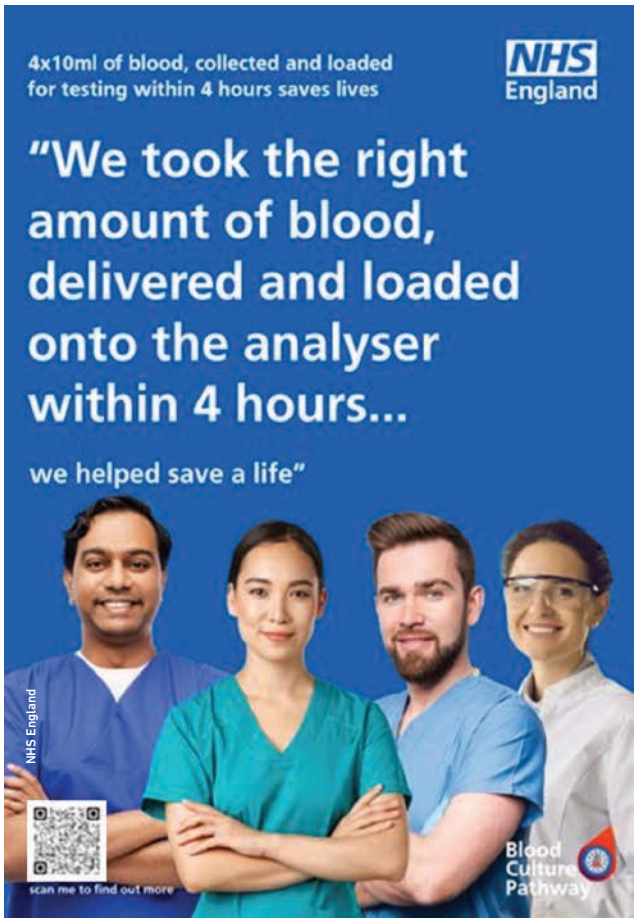
It's true that improvements like this need investment, and it's also true that not enough work has been done to look at the health economic benefits that pathway improvement and diagnostic innovation can bring. We cannot expect trusts and integrated care boards to invest in new kit without demonstrating that it is value for tax-payers money. However, a top-level health economic analysis has shown that money is not lost by investing in a fully compliant blood culture pathway and it will save lives. I hope that we will see a greater emphasis on health economic analyses in evaluations of diagnostic pathway improvements and innovations, supported by funders.

Bringing the whole diagnostic community together is the best way to make sure we tackle unmet needs. Working together will give us the right tests, in the right place, at the right time so that we really can 'Start Smarter' and 'Focus Faster' for our patients.

Identifying innovative technology and new ways of working

Horizon scanning with the NIHR Innovation Observatory and NICE for current and future products that could really improve how we diagnose patients and how we use antimicrobials has been a key component of this work. We've been able to use this to help inform existing studies, such as the NIHR-sponsored TOUCAN study. This platform trial is looking at rapid UTI tests in primary care. A substantial amount of antimicrobial prescribing for UTIs occurs in primary care and is not supported by a microbiological test in the first instance (in line with current guidance). While urine dipsticks can help with UTI diagnosis, they are not reliable in all populations, and laboratory testing is time consuming. Bringing rapid pathogen ID and AST to the patient when they access healthcare could change the way they are managed and reduce inappropriate antimicrobial prescribing.

The COVID-19 pandemic brought about dramatic changes to how infection testing happened: at home, in clinics and in hospitals. In particular, the rollout of Lateral Flow Devices for home testing and the early adopter scheme for rapid COVID-19 Point of Care testing (POCT) in emergency care over winter 2021 are evidence of that changed approach and the successes they can bring. Learning from these experiences is essential if we are to make innovations work for our patients. This means augmenting our existing, excellent diagnostic microbiology laboratory services to include POCT for infections out in primary care, Community Diagnostic and Acute Respiratory Infection hubs and other community healthcare settings. There are exciting rapid tests for determining whether a respiratory illness has a bacterial or viral cause that could potentially have a significant impact on empiric antimicrobial prescribing. The explosion of multiplex respiratory POCT diagnostics following COVID-19 also brings the possibility of rapid access to antivirals for those who need them, and better Infection Prevention and Control opportunities.

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It's an exciting time for infection diagnostics, but we could be doing things better. There are still unmet needs in infection diagnostics.

Better together

If we want everybody to play a part in tackling antimicrobial resistance, then we must also listen to what they have to say. The process of being diagnosed with an infection involves many different people; the clinician taking the sample, the porter transporting it, the manufacturers of the tests, the service commissioners, but most importantly, the patients and their carers. Listening to patients and understanding their experiences of diagnosis and treatment is extremely important and can give a completely different perspective on what the focus of improvements and innovations should be. Similarly, the healthcare workers who use tests and systems on the ground are best placed to advise what would help them to deliver the best care for their patients. We need to assess what those needs are and clearly signal them to the innovators and developers of the diagnostic community: academia and industry. How we evaluate those tests and bring them into clinical practice requires the input of regulators like the MHRA and networks like the Academic Health Science Networks and the Accelerated Access Collaborative.

Bringing the whole diagnostic community together is the best way to make sure we tackle unmet needs. Working together will give us the right tests, in the right place, at the right time so that we really can 'Start Smarter' and 'Focus Faster' for our patients.

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Biography

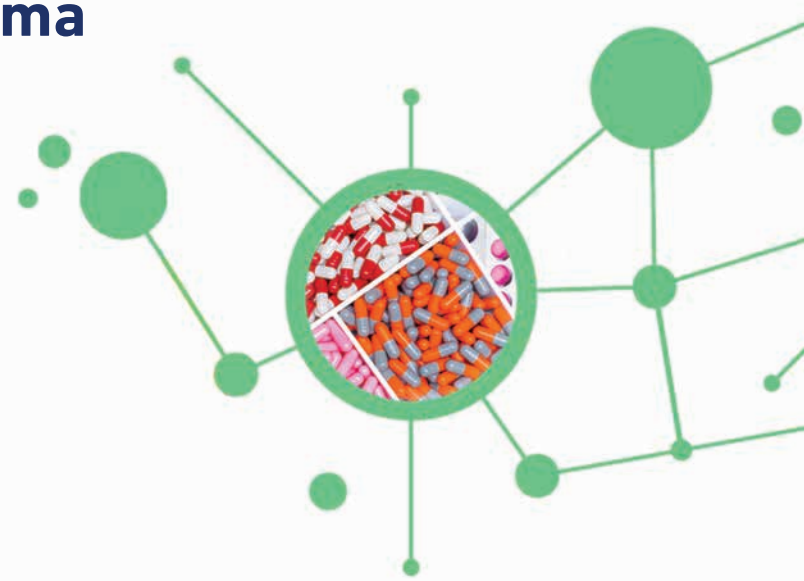
Jane Freeman is the National Clinical Lead for AMR Diagnostics.

Jane Freeman
National Clinical Lead for AMR Diagnostics,
Office of the Chief Scientific Officer,
NHS England, UK

jane.freeman4@nhs.net
@drjanefreeman

Antimicrobial Resistance (AMR): A View From Inside Pharma

Christopher Longshaw



What is the problem?

"What doesn't kill you, makes you stronger..." sang pop singer Kelly Clarkson, reaching number eight in the UK in 2012 and paraphrasing the 19th Century German philosopher Friedrich Nietzsche, while also perfectly describing the driving force behind antimicrobial resistance.

Over a decade later and awareness of the global public health threat from infectious diseases and AMR has increased inexorably. According to a paper published in *The Lancet*, AMR caused 1.27 million deaths worldwide in 2019, more than HIV/Aids and malaria combined. Furthermore, models forecast AMR to cause the deaths of 10 million people a year by 2050, way more than the current 7 million deaths attributed to COVID-19 since 2019, with some scientists now referring to AMR as the next 'Silent Pandemic'.

So, you might ask, why doesn't the global pharmaceutical industry just discover new antibiotics to treat resistant infections? Surely, where there is an urgent unmet medical need, there is a lucrative market for new antimicrobials?

New antibiotics are hard to find, hard to develop and hard to sell

To answer the first question, we need to go back to the period from the 1950s to 1970s when the young and ambitious pharmaceutical industry took the baton from Messers Flemming, Florey and Chain and found incredible success discovering a wealth of novel antibiotic classes.

During this time, the inspiration for most antibiotic classes, as for penicillin, came from Mother Nature as secondary metabolites produced by soil bacteria or fungi. However, when this rich seam of novel chemistry inevitably dried up, companies dispatched intrepid scientists around the globe to search for untapped microbial biodiversity in exotic locations, while others put their trust in the ingenuity of medicinal chemists and screened vast synthetic chemical libraries. Neither route was as successful in finding new antibiotics as they had been during the so-called 'Golden Age'.

To make matters worse, having picked the 'low hanging fruits', it was increasingly difficult to identify novel targets that were essential for bacteria yet different enough from human enzymes not to cause toxicity. Many companies looked to genomics to try to provide solutions, but despite huge research programmes and vast expense, few new validated targets leading to novel antibiotics were discovered.

Instead, research and development (R&D) departments focused on modifying existing antibiotics with validated targets, improving their pharmacokinetic/pharmacodynamic properties, and leading to multiple generations of cephalosporins and fluoroquinolones.

More recently a shift to protecting the existing antibiotics resulted in development of hugely successful β-lactam/β-lactamase inhibitor combinations. Finally, taking inspiration from Greek mythology, scientists have tried to trick bacteria by bolting iron-binding siderophore groups to an antibiotic core; like Odysseus's wooden horse at the gates of Troy, the unwitting bacteria actively transports the antibiotic into its own cell.

The good news is that increased awareness and concern about AMR in the medical community and wider media has moved AMR up the global political agenda and it is being discussed at global summits such as the WEF, G7, G20, WHO and UN.

The clinical development and regulatory pathway for lead compounds is also challenging to navigate. It's been estimated that a new antibiotic candidate has 1:70 chance of reaching the market and takes 10-15 years and >$1.7 billion. The issue is that AMR remains at low prevalence in most high-income countries where new antibiotics are first approved, so patients are scarce. Antimicrobial stewardship and market access barriers further restrict new antibiotics to salvage, when all other treatments have failed, meaning companies are highly unlikely to achieve the $25 million/year revenue necessary to maintain supply chain and regulatory commitments required to keep a drug on the market.

For these reasons, many large Pharma companies shifted research focus to more tractable therapy areas such as oncology or immunology. The R&D space is therefore populated largely by small- and medium-sized enterprises (SME) reliant on securing private investment from venture capitalists and angel investors to fund their pipeline. Development pipelines can stall until new sources of funding are secured, and even achieving regulatory approval is no guarantee of commercial success. Sadly, a number of companies have filed for bankruptcy despite successfully bringing a new antibiotic to market. Achaogen launched their antibiotic plazomicin targeting AMR infections in July 2018, but only made $800,000 in the first year and filed for bankruptcy in April 2019.

So, is anything being done to address this?

The good news is that increased awareness and concern about AMR in the medical community and wider media has moved AMR up the global political agenda and it is being discussed at global summits such as the WEF, G7, G20, WHO and UN. This political spotlight led to 'PUSH' incentives such as ND4BB, CARB-X, REPAIR, JPI-AMR and GARDP

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who offer funding to help offset R&D costs and mentorship to help guide SMEs through the antibiotic development pathway.

Looking at the other side of the problem, economic 'PULL' incentives aim to create a more predictable and sustainable antibiotic market, encouraging private investment and helping secure SMEs while attracting partnerships with Pharma who have the global commercial and distribution infrastructure necessary to ensure widespread access. While the best way to provide pull incentives are still under political debate, in 2019 NHS England led the world in launching their 'Netflix-style' Antimicrobial Products Subscription model which paid a fixed annual fee for supply of novel antibiotics decoupled from the volumes prescribed in hospitals. After a successful pilot programme, the NHS have announced plans to expand the programme to additional antibiotics and include the UK devolved nations.

A similar subscription-based market incentive is currently being debated in the USA under the PASTEUR Act, while the European Commission favours transferable exclusivity vouchers which could be used by companies to extend patent-life of more profitable medicines. While neither the USA nor EU have yet to fully commit to implement pull incentives, the direction of travel is positive.

What about the future?

The 21st Century has seen increased recognition of AMR as a global public health problem, with the need to incentivise development of new antibiotics and create a sustainable market.

The COVID-19 pandemic showed that Pharma can refocus R&D priorities to address urgent medical needs. In the early 1990s epidemic strains of MRSA became prevalent in hospitals with widespread calls for new Gram-positive active antibiotics.

In response, the industry mobilised and throughout the 2000s a number of new anti-MRSA antibiotics were approved. A similar call to action for *Clostridium difficile* led to fidaxomicin, cadezolid, surotomycin and ridinilazole being developed, although only fidaxomicin succeeded to market. Interestingly, for *C. difficile*, therapies under development included not only small-molecule antibiotics but also bezlotoxamab, an antitoxin antibody, as well as microbiome-restoring products such as Rebyota and SER-109.

What was important in both of these examples was a clearly defined target that R&D departments could focus their efforts against. The challenge for the current AMR landscape is that it's very difficult to predict which pathogens or resistance mechanisms will be the major threat in 15 years' time. The WHO has published Priority Pathogens lists for R&D, firstly for bacteria in 2017, then fungi in 2022, but these largely describe the current unmet need. It remains to be seen whether an updated bacterial list expected later in 2023 will provide insights into what might be the target profile in 2038.

Ultimately, no matter how ingenious the scientists working within Pharma R&D departments, bacteria will be one step ahead. AMR is the perfect example of Darwin's evolution, and while we have been engaged in an escalating arms race with bacteria over the past century, we are ultimately unlikely to win the war, so perhaps we also need to evolve our approach to fighting. After all, the goal of antibiotics for most patients is not to eradicate the pathogen alone, but to buy time for the patient's own immune system to clear the infection.

Perhaps as well as incentivising new antimicrobials we need to change regulatory guidance to make it easier to design studies to assess efficacy and safety of complementary strategies that support our immune system, switch off virulence factors and resistance genes or even look to bacteriophage and microbiome-based therapies … after all the enemy of our enemy is our friend.

Further reading

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I would also recommend the **AMR.solutions** website of Professor John Rex which contains lots of resources, and you can also sign up to his regular newsletter for updates on AMR.

Biography

Chris has worked in the Pharmaceutical sector for the past 21 years, both in early stage R&D as well as Medical Affairs, joining Shionogi's European team in 2017 and focusing on the infectious disease therapy area. Chris is also Honorary Treasurer of the British Society for Antimicrobial Chemotherapy.

Christopher Longshaw
Senior Director, SEU Scientific Affairs,
Shionogi B.V., UK

christopher.longshaw@shionogi.eu
christopherlongshaw
@ChrisMLongshaw

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Antimicrobial Resistance Awareness Adventures in Ibadan, Nigeria

Anderson O Oaikhena, Dorothy U Cyril-Okoh, Chinenye L Ekemezie and Iruka N Okeke

Much of our group's research generates new knowledge on antimicrobial resistance, and our laboratory supports national antimicrobial resistance surveillance in Nigeria, which is coordinated by the Nigeria Centre for Disease Control (NCDC). Our UK National Institute for Health and Care Research-supported Global Health Research Unit for Genomic Surveillance of Antimicrobial Resistance is staffed almost entirely by postgraduate students, who interact with several stakeholders as they provide genomic and reference laboratory services. We also prioritise communicating what we do to other users, and potential users, of antimicrobials, and have engaged the public in short- and medium-term initiatives around the World Antimicrobial Resistance Awareness Week (which takes place in mid-November) every year since 2016.

Our outreach programmes are student-designed and honed, co-opt and train microbiology students beyond our group, and creatively engage people across different formal education and socio-economic strata. We use interpersonal approaches, as described here, but also employ radio, and create and use visual aids on social media. We amplify our messages on social media, most commonly on the platform formerly called Twitter.

Learning from the market outreach

Ibadan is one of West Africa's oldest market cities and much of its present-day activities revolve around small- and large-scale trading. In 2018, we engaged in street sensitisation at Ibadan's busy Bodija food market. We interviewed and

AMR instruction at one Ibadan high school.

provided antimicrobial awareness information to market traders, most of whom had limited formal education, and gained knowledge about local perceptions around antimicrobials and resistance that have informed future outreach programmes. Our visuals and communication were in Yoruba, Ibadan's local language. We found most marketers unaware of the public health impact of indiscriminate antimicrobial use, and many admitted to self-medicating with antibiotics, which can be easily purchased over the counter in Nigeria. When we probed respondents about the names of medicines they had taken in the past we found that favourites included 'red and yellow capsule' (tetracycline) and 'ampiclox' (ampicillin–cloxacillin). The practice of sharing unfinished doses with friends was common, as was self-medication based upon recommendation from a neighbour that had successfully treated similar symptoms in the past. Furthermore, most market respondents alluded to discontinuing therapy once symptoms abated. Interestingly, some respondents complained that 'red and yellow capsules' were no longer as effective as in the past (we too record tetracycline resistance rates approaching 100%), providing us our opportunity to explain antimicrobial resistance. We communicated the importance of using antimicrobials as prescribed and encouraged people to visit the hospital or primary health care centres instead of self-medicating. We however learned that for the average Nigerian, it is more convenient to buy medicines or herbs than to commit significant amounts of time and money to hospital care. Until we enact Universal Health Care, containing antimicrobial resistance will be a challenge.

Antimicrobial resistance is not taught at all in Nigeria's secondary school curriculum. We have designed a short secondary-level course for training the next generation of antimicrobial stewards...

Catching them young

We and others reach out to secondary school students in a bid to ingrain positive behaviours before economic disincentives demotivate antimicrobial conservation. Antimicrobial resistance is not taught at all in Nigeria's secondary school curriculum. We have designed a short secondary-level course for training the next generation of antimicrobial stewards that outlines the biological basis for resistance, the consequences of misusing and overusing antimicrobials, and how concerned citizens can actually address the problem.

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Outdoor AMR awareness outreach on the University of Ibadan campus.

The GHRU-GSA's 'Microreact Challenge' – enabling microbiologists to make sense of whole-genome sequence-derived phylogenetic trees.

Our earliest experiences revealed limitations of rapid-fire one-day 'awareness' programmes. We, therefore, designed an engaging four-week educational course and used a trained teaching crew to reach out to multiple schools, with institutional permission. In 2019, 115 students from four schools (we have not managed to do this since the pandemic) learned a new concept from the curriculum each week. Our volunteer teachers were pre-trained postgraduate students in the Faculty of Pharmacy and the Oyo State Young Pharmacists Group, a local early career pharmacists' society. After training, the high school students elatedly participated in an interschool essay and quiz competition at the University of Ibadan during World Antimicrobial Resistance Awareness Week, where we and invited health professionals were able to see what they had learned. The curriculum trains the students to educate their peers, and we hope that this will amplify AMR containment messages. In addition to delivering and evaluating the course content, we created social media posts about the course content and activities on Twitter and recorded engagements in the form of retweets, comments and direct messages from individuals and corporate health associations across the globe, increasing the reach and impact of the initiative.

AMR is everyone's business – if we say so ourselves

A lot of our engagement takes place in our backyard. As part of our 2022 World Antimicrobial Awareness Week activities, we engaged Arts and Humanities students within our university, on the premise that non-science students (admittedly not verified) are less likely to be informed about antimicrobial resistance. Our approach was to engage students individually and in small groups within the vicinity of the Faculty of Arts, University of Ibadan, between classes. We assembled and trained a team of interested and motivated postgraduate students that could drop in on shifts. Our resistance ambassadors introduced themselves, offered a soft drink and then discussed common misconceptions about antibiotics – and learned new ones – while emphasising the significance of responsible antibiotic use. Students were invited to connect to a scheduled programme on Antimicrobial Resistance, in which two of our ambassadors were interviewed, on Diamond FM, the University of Ibadan's radio station.
In response to our advocacy for seeking medical care as opposed to self-medication, students suggested that TV commercials for over-the-counter pharmaceuticals promote self-medication. While antibiotics and other prescription

drugs are not advertised this way, many people do not know that there are different advertising regulations for different categories of medicine, and most medicines can be obtained without prescription. Our interactions with the targets of these messages suggest that regulators could attempt to shift the focus of health product advertising to promoting informed health choices by emphasising medication use only after consulting a health professional.

Much of our AMR outreach in and between World Antimicrobial Resistance Awareness Weeks targets health professionals and health professional trainees. We have hosted seminars, webinars and roundtable discussions with academics, clinicians and health profession students, and on-air discussions as well as one-on-one outreach to antimicrobial prescribers. We also conduct formal and informal programmes and courses for laboratory scientists to improve how they generate, interpret and use AMR surveillance data in their facilities. These include introductions to data analysis and visualisation tools that can help them share AMR data with broad audiences. We offer this training in response to the need to provide support for using genomic data, which we generate as our own contribution to AMR surveillance.

Outreach around antimicrobial resistance can range from a quick chat about antimicrobials with a market lady to enabling sentinel surveillance sites to better use their data for stewardship and infection control. We are encouraged by the active engagement of our audiences during discussions, allowing us to effectively get the message through. Experience with our programmes reinforces the need for a multifaceted approach in tackling AMR in Nigeria and the tremendous under-exploited resource in postgraduate microbiology programmes that could be engaged for this. Our AMR outreach trainers are future AMR containment ambassadors that can lead and sustain successful outreach programmes in and beyond their future professions.

Perhaps most importantly, our outreach programmes highlight for us gaps and complexities of AMR, which feed into our work and future programme design. Education and communication are powerful tools in the fight against AMR.

Acknowledgement

Each of the outreach programmes described here is delivered by an extensive team of volunteer staff and students. We are grateful to all of them, to the NCDC, WHO-Nigeria and other contributors that have supported our outreach initiatives and to other AMR researchers that have generously shared experiences and resources.

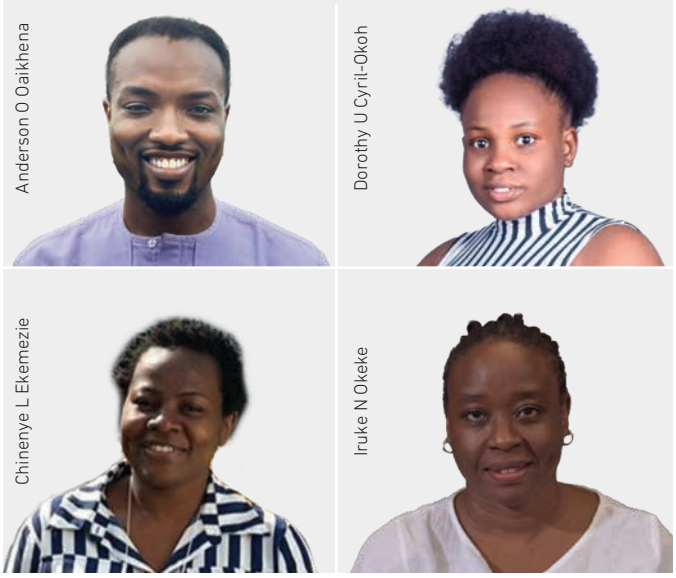
Biography

Dorothy Cyril-Okoh, who led the 2022 Faculty of Arts outreach, and Chinenye Ekemezie, programme lead for the 2019 school's outreach, and Anderson Oaikhena are recent Master's graduates of the Department of Pharmaceutical Microbiology, University of Ibadan. Anderson is completing a PhD with the Okeke group at the University of Ibadan, whilst contributing to antimicrobial resistance surveillance in Nigeria, and Chinenye is a doctoral student at the University of Newcastle.

Anderson O Oaikhena, Dorothy U Cyril-Okoh, Chinenye L Ekemezie and Iruke N Okeke
Global Health Research Unit for the Genomic Surveillance of Antimicrobial Resistance, Department of Pharmaceutical Microbiology, Faculty of Pharmacy, University of Ibadan, Nigeria

nigeriaghru@gmail.com

@anderson_ose, @dorothy_uche
@ChinenyeEkemez2, @iruka_okeke



Lesson planning by three members of the 2019 AMR teaching crew.

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My Story

Victorien Dougnon

The Unlocking Potential Fund is the Society's first fundraising initiative designed to support early and mid-career members. Victorien Dougnon, one of the recipients of a grant underwritten by the fund, shares his story.

"The damage caused by epidemics, emerging and re-emerging infectious diseases led me to microbiology as a teaching and research discipline. My main research focus is the fight against antimicrobial resistance... and another of my priorities in the academic field is the training of future experts in [this] field."

As Victorien's Professor, Lamine Saïd BABA-MOUSSA, puts it, "[he] still has great challenges to meet to fully realise his potential and build a prosperous scientific career in the service of sustainable development. This great vision requires strengthening his leadership skills so he can have a greater impact on the African scientific community in the field of health and microbiology".

> **You can't give a value to this sort of grant ... I was able to think differently and impactfully ... you need this kind of programme, where [the Society] can connect you to great people.**

Victorien continues, "I have identified two priorities [to help achieve this], career coaching and leadership training. I want to make an impact for young scientists... I contribute to many activities... I invite scientists from all over Africa to discuss in-depth research topics that will make young scientists think. It's not like a traditional student–professor relationship... [instead] it's a participatory activity where we all learn from each other. [However, there is a time] in your career [where] you need to be guided... get inspired, get [the] leadership skills you will never learn at school. You can be good, very skilled but you need this guidance to be more than what you could be alone... to think differently and impactfully".

The grant you've helped fund has given Victorien access to a network of experienced mentors that will help him grow as an effective leader, as well as career coaching to "help me develop international collaboration strategies necessary to meet such challenges."

Victorien is just one mid-career microbiologist you have supported through the grant. Together we can support many more. Donate today on our website at **microbiologysociety.org/UnlockingPotentialFund**.

Victorien Dougnon
University of Abomey-Calavi, Benin

victorien.dougnon@gmail.com
victorien-dougnon

A Year of the Members Panel

One year on from the formation of the Members Panel, co-Chairs Edward Cunningham-Oakes and Kevin Maringer reflect on the panel's achievements and look to the future.

Formed in 2022, the Members Panel feeds into Council via the General Secretary's Group, which the co-Chairs sit on. From the outset, we wanted our actions to be transparent, and to bring historically marginalised communities to the forefront of the Society's Equality, Diversity and Inclusion (EDI) efforts. This wish resulted in our co-Chair manifesto, which was informed by the Society's 2020 EDI survey and experiences of the Panel members. The objectives and outcomes of our manifesto are shared below.

1. "We will establish a reliable, visible and accessible presence for underrepresented members of the Society."

We increased representation within the Society's governance structure, with members of the Panel now participating in every Committee meeting. To effect more sustainable long-term change, the Panel pushed for an upcoming consultation on increasing engagement from the full diversity of the membership across the Society's governance structure. The Society struggles with a lack of diversity in the members who put themselves forward for Committee and Council positions, and we are keen to hear views from the membership on what barriers are holding people back.

2. "We will increase access to role models for members from underrepresented groups."

We forged new links between the Microbiology Society and grassroots organisations including the Black Microbiologists Association, Pride in Microbiology and Bioinfo4women. These organisations seek to increase equity, diversity and inclusion in microbiology and allied fields, and have participated in interviews that will be released soon (check out Panel member I'ah Donovan-Banfield's interview with the Black Microbiologists Association's President, Kishana Taylor, in this issue of Microbiology Today). We are also launching a new membership network by the time our terms as co-Chairs end. Keep an eye out!

3. "We will leverage the Society's position to achieve wider impacts in EDI across the sector."

We launched a brand-new EDI session at Annual Conference 2023, featuring keynote speaker Dr Sharon Brookes (Animal Plant Health Agency, UK) and an open panel discussion that explored the experiences of historically marginalised groups in microbiology across industry, government and academia. A key goal of this session is to share knowledge and resources to empower members to enact wider change within their institutions and spheres of influence. Please join us for next year's session and a Members Panel meet-and-greet where you can share your views with us.

An important role of the Members Panel is to respond to members' feedback. This led to a members' consultation on trans and nonbinary inclusion (look out for opportunities to feed into this!) and a new Neurodiversity and Disability social at Annual Conference 2024, along with better signposting to gender neutral bathrooms and the quiet room.

It has been a pleasure to work with the Members Panel over the past year. We encourage all Society members to approach us directly with open and honest feedback, so that we can continue to make positive changes. Please also engage with the Society's diversity surveys, which directly influence the Society's activities. All members can actively participate to make the Microbiology Society more inclusive. There are many initiatives, like the LGBTQ+ social, that are led directly by passionate members, and the Society is always looking for more ideas and volunteers!

Look out for our Members Panel social media campaign in November 2023, where the Panel members will reflect on why they joined, what they are most proud of, and what their hopes are for the future.

Edward Cunningham-Oakes
Postdoctoral Research Associate,
University of Liverpool

Edward.Cunningham-Oakes@liverpool.ac.uk

@edcoakes

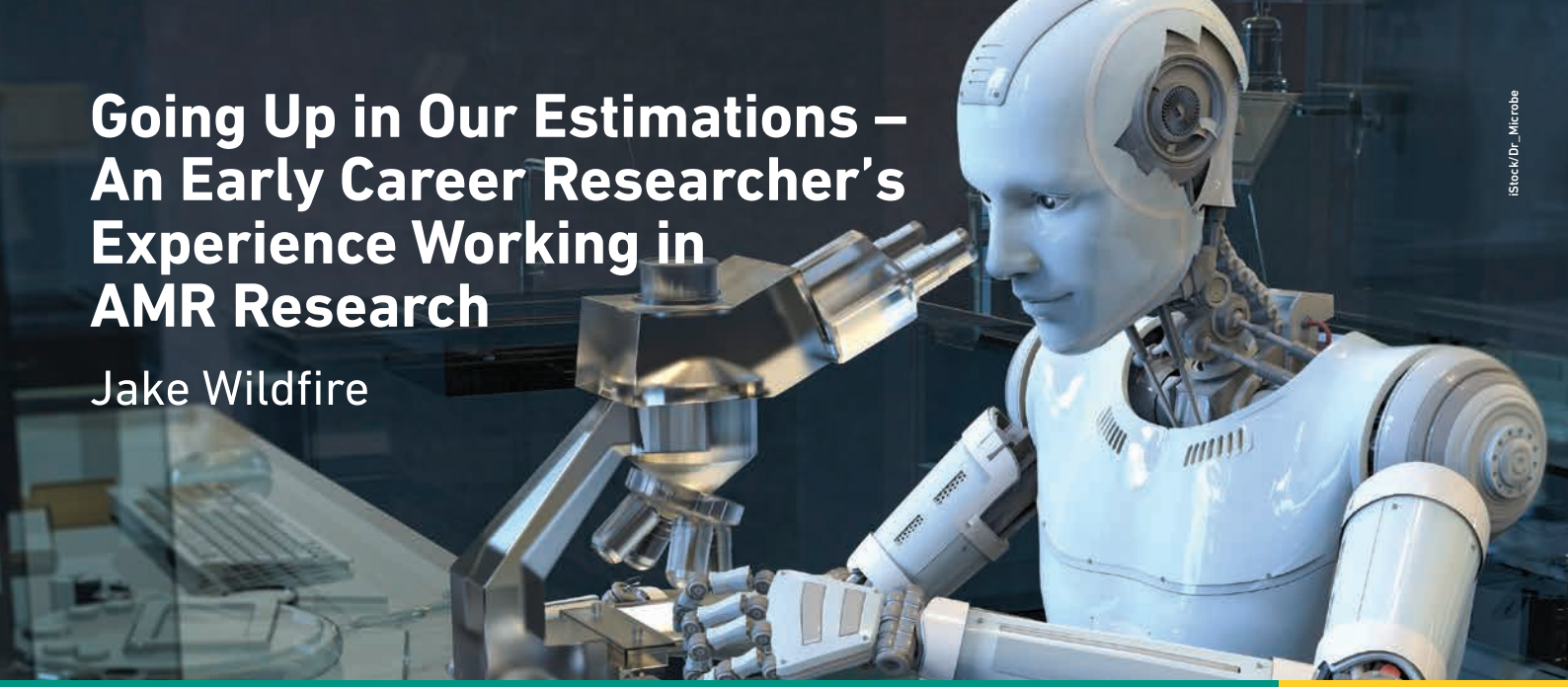
Kevin Maringer
Group Leader,
The Pirbright Institute

kevin.maringer@pirbright.ac.uk

@MaringerLab

Going Up in Our Estimations – An Early Career Researcher's Experience Working in AMR Research

Jake Wildfire



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Jake Wildfire, an early career researcher at London School of Hygiene and and Tropical Medicine, shares his journey from a tepid Zoom introduction to a profound realisation of the urgency surrounding antibiotic resistance.

My PhD in AMR began not with a bang, but with a tepid 2020 Zoom introduction. The lecturer welcoming the new recruits asked each of us what we would be researching. The only one entering the field of resistance, I proudly replied that I'd be working on the golden superbug, MRSA. Thirty minutes into my career, I endured a most humbling experience. The lecturer announced, "Not much of an issue anymore, but I suppose it's important to keep studying these things".

MRSA was recently estimated to have been the most common cause of AMR-related death in 2019 – the year before my first day as a PhD student [1].

This is a poignant reminder of why I've chosen a career within AMR. From day one, I felt that resistance was woefully underestimated. Feeling your topic isn't appreciated is common in science – we're all engaged in an ironically collective battle to champion our areas of research. But this particular developing disaster is insidiously accelerating and demands recognition. Much like with climate change, the water's starting to boil, and the impacts will be felt down the line.

My PhD has been dedicated to learning through basic science how resistance spreads in bacterial populations. One thing I've learned is that there are just too many gaps in our knowledge to fully grasp the shape of this problem. Yes, antimicrobial usage plays a role, but that relationship is far from simple. We need more basic scientists to help us understand the underlying forces that govern the development of AMR. Understanding the causes will help us develop better solutions.

To effect these solutions, we also need greater communication between fields. What began as a healthcare issue is now evidently an environmental issue, a political issue, and a farming issue to name a few. AMR is a multisectoral problem, and we therefore need multidisciplinary action.

It does, however, feel as though perspectives are changing, and therefore I'm incredibly lucky to be an early career researcher on this topic, at this time. Even within the three-year timespan of my PhD, we've seen attention-grabbing research, from antibiotics discovered using AI [2] to alarming global AMR burden estimates [1]. My supervisor used to have to sneak AMR into grants as an aside – alone, it wasn't fundable. Now, AMR consortiums are emerging all over the world.

In this rapidly evolving field, it's an exciting time to be starting out. Recognition of the problem is increasing, and collaboration is improving. But we must still be careful not to underestimate this issue. A rough, back of the envelope calculation using recent estimates [1, 3] allowed me to approximate that around eight million AMR-related deaths have occurred since I started higher education, circa 2016.

Although it may feel as though we're many miles from the proverbial dismissive lecturer, I believe we need more early career researchers studying the basics and spanning disciplines – even at the risk of the odd scoff.

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Jake Wildfire
PHD student at the the London School of Hygiene and Tropical Medicine (LSHTM) UK

@JacobWildfire

The Importance of One Health to Tackle the Antimicrobial Resistance Crisis

Chiara Borsetto

In this piece, Dr Chiara Borsetto emphasises the need for public engagement and citizen science to help mitigate the AMR crisis.

In the last decade, Antimicrobial Resistance (AMR) has gained more attention across the scientific community as well as the general public. The emergence and spread of AMR in pathogens worldwide has become a burden on the health care systems, with more people suffering from infections with resistant bacteria and resulting in a growing number of deaths due to or associated with AMR. One of the most important questions that we keep trying to answer is 'What are the drivers of the AMR crisis?'. This question always triggers debates across the scientific community. Recent research has shown that AMR selective pressures are not only linked to overuse of antibiotics in the clinical and veterinary sectors, but also environmental pollution from human activities. Pollutants such as pharmaceuticals, disinfectants and other chemical compounds can be released in the natural environment by several different sources including industrial and wastewater effluents, raw sewage and manure on fields. These are only some of the most important sources of environmental pollution for land and freshwater which have a direct impact on indigenous natural microbial communities, including AMR.

What is the role of the natural environment in One Health for AMR?

As observed with several diseases, the environment can act as a reservoir for pathogens. Interactions with wildlife, farm animals and humans can lead to transfer of pathogens and genes (or mobile genetic elements) amongst all groups. Antibiotic-resistant bacteria are no exception, and their ability to share genetic material across genera amplifies this problem exponentially. It is therefore fundamental to integrate the study of the environmental AMR to fulfil the One Health approach and investigate the risks for human and animal health associated with exposure to pollutants and emergent AMR in pathogens and indigenous natural microbial communities. These studies will be essential to better predict the rise of potentially novel mechanisms of resistance and investigate solutions such as technological improvements in waste disposal processes, bioremediation strategies and other attempts for mitigation strategies.

What else can we do?

An important aspect that is often forgotten is the role that anyone can play in slowing the AMR crisis. It is vital for the scientific community to share their expertise and knowledge not only amongst experts but more importantly with the public. In recent years, citizen science has proven to be very efficient in catalysing changes and pressuring responses through local and central government policies. People have shown their growing interest in helping the scientists to achieve better ways to study the natural environment to protect health. Thus, promoting research engagement with the public provides an opportunity to inform a wide audience and influence communities and individuals. The younger generation especially embraces more holistic approaches and behaviours which can help in preserving a cleaner environment, reducing the selective pressures that currently fuel AMR. This will ultimately lead to the implementation of a truly One Health concept for AMR.

Dr Chiara Borsetto
Assistant Professor
School of Life Sciences, University of Warwick, UK

c.borsetto@warwick.ac.uk
chiara-borsetto-899a6897

chiara_borsetto
@knowyourriverUW

AMR research highlights from Annual Conference 2023

Carolina Coelho

Carolina Coelho is a researcher from the University of Exeter, UK, whose passion lies in unraveling the complexities of microbes and host–pathogen interactions.

As the co-organiser of a pivotal joint session at Annual Conference 2023, Carolina orchestrated an interdisciplinary meeting of minds between the Microbiology Society's Eukaryotic (Carolina Coelho and Anastasios Tsaousis) and Prokaryotic (Lorena Fernández-Martínez and Gavin Paterson) Divisions. With an emphasis on interconnectedness, her session highlighted the pervasive nature of AMR issues across various microbial domains.

What were some of your highlights from the AMR session at Annual Conference 2023?

We were all aligned in our efforts to demonstrate how issues in AMR research and broader society are interconnected across all microbes. We made a real effort to cover the breadth of topics related to AMR, from surveillance to molecular research. Our invited speakers discussed cross-kingdom communities, novel technology for diagnostics, and the fundamental biology supporting novel resistances. This was emphasised by the last talk of the day, which drove home the point that AMR is a One Health problem. There is data showing that MRSA may have originated from our environment. This one example we showcased showed interactions between antibiotic-producing microbes, fungi and commensal bacteria in the skin of wild animals and which drives antibiotic resistance in bacteria which infect cattle and humans (https://doi.org/10.1038/s41586-021-04265-w), and, crucially, demonstrates that there will always be a tug-of-war between microbes and antimicrobials.

We also aimed to provide a platform for early career researchers to speak, and this was facilitated by our abstract submissions. Our session received the most abstract submissions outside of the Forum sessions.

Lastly, we were delighted to see a strong community both in the UK and abroad dedicated to AMR research.

How have scientific conferences benefited your career?

Scientific conferences are both exhausting and invigorating. They are tiring due to the various activities, social interactions and almost overwhelming amount of new information, but they are also revitalising as they expose you to the forefront of your field and allow you to connect with other researchers and their work.

That being said, some preparatory work is necessary: ensure you know who you want to engage with and be prepared to ask for introductions if you're not comfortable introducing yourself. I usually come out of conferences with new mentors and collaborators!

What is the most enjoyable/rewarding aspect of engaging with the Microbiology Society community?

The remarkable breadth of research and researchers within the Society stands out. The Society has allowed me to become more acquainted with UK researchers – I hadn't really worked in the UK before, so it was a great opportunity to meet both the opinion makers and the broader community.

What are your hopes for the future of AMR research?

I would like for significantly increased public and governmental awareness of the dangers posed by AMR; too many people still die from untreatable infections. Additionally, we hope to see more interdisciplinary grants that facilitate One Health research.

For more of the latest research in AMR, please visit the Society's cross-journal AMR collection here: microb.io/2WT7lJi.

Carolina Coelho
University of Exeter, UK

c.coelho@exeter.ac.uk
carolina-coelho-phd
@caipcoelho

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Member Q&A

Alain Richard

This is a regular column to introduce our members. In this issue, we're pleased to introduce Alain Richard.

Where are you currently based and what is your role?

I am Alain Richard, PhD, Microbiology-Immunology. I live close to Montréal, Canada. I am retired from the biotechnology industry and from technology transfer, after a 25-year career. I am currently studying archaeology in the Certificate of Higher Education, Department for Continuing Education, University of Oxford, UK.

What area of microbiology did you specialise in?

I was involved in the early commercial development of antimicrobials, biologics and viral gene delivery. I am now interested in microbial archaeology and bioarchaeology.

Tell us about your educational background.

After my bachelor's degree in microbiology, I studied innate immunity: a Master's on allergies (basophil cells) and a doctorate on inflammation (neutrophil cells), both at Laval University in Québec City, Canada. I also did a short postdoctorate on cellular signal transduction modulated by the AIDS virus.

When and why did you first become interested in microbiology?

When I was 9 years old, I read the story of Joseph Meister, a 9-year-old boy who had contracted rabies in 1885. He was the first human to be saved by the rabies vaccine Louis Pasteur was developing. The achievement of saving a child of my age from a terrible death strongly impressed me.

As a retired member, what keeps you engaged in the field of microbiology?

I want to give back to the scientific discipline that allowed me to pursue a highly stimulating career. I am interested in offering tips to undergraduate or graduate microbiologists, regarding technology transfer from academia to the industry. I also wish to be active in microbial archaeology and bioarchaeology, by participating in meetings and writing essays.

Do you have any role models and, if so, who?

Louis Pasteur is considered by many microbiologists to be the founder of our scientific discipline, and Alexander Fleming is the founder of the Microbiology Society. Both realised the importance of their initial discoveries and demonstrated the vision to investigate them: the identification by Pasteur in 1857 of unique crystals produced by microorganisms during fermentation, and the discovery of penicillin by Fleming 1928. Those were landmark laboratory works that would lead to changes of paradigm in life sciences, as well as contributing to improvements in our lives.

If you hadn't gone into science, what career path do you think you would have chosen?

It would have been archaeology or history, with the idea of better understanding our present through the exploration of our past. Nowadays, archaeology and microbiology can be converging disciplines, for instance, using genomic tools.

What would you say was the highlight of your career?

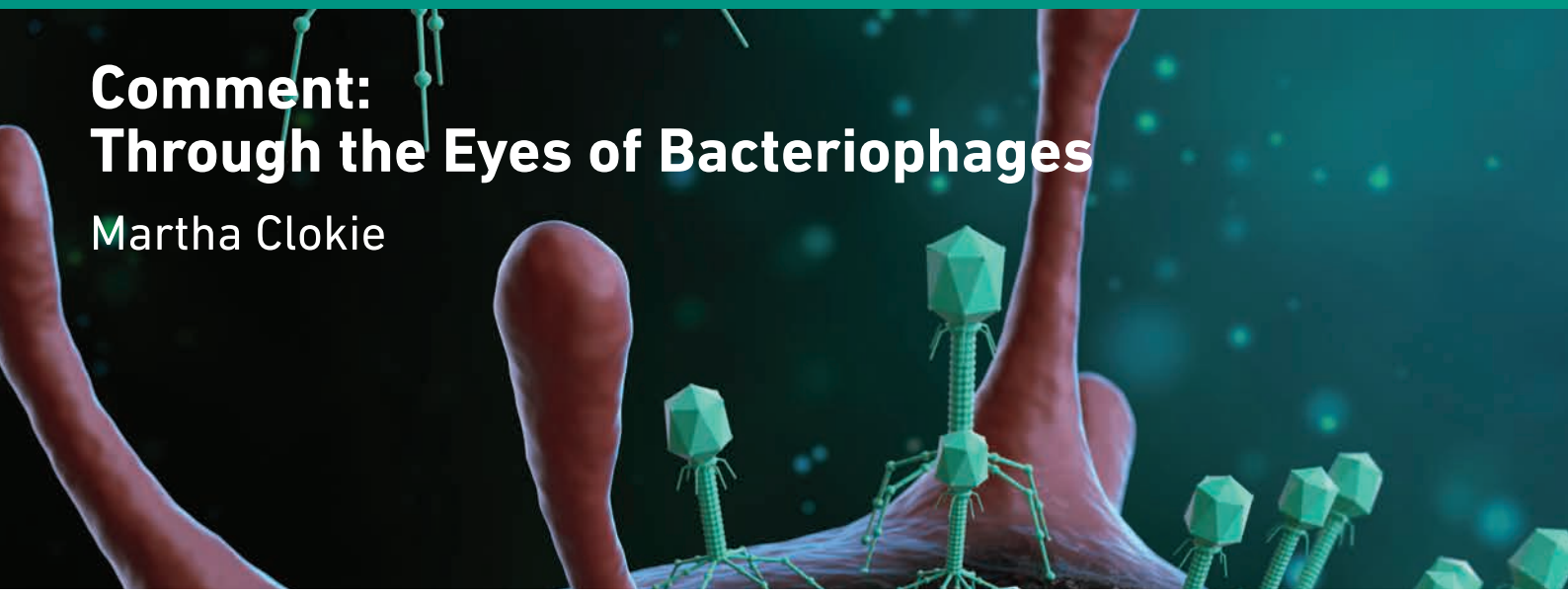
There was one recurrent assignment through which I felt I could have a real impact: showcasing technologies from academia during partnering sessions in biotechnology conferences. The challenge was to adapt the offer from academic scientists to the conditions of business, with the common goal of developing technologies for the community.

GET INVOLVED

If you would like to be featured in this section or know someone who may, please get in touch via getinvolved@microbiologysociety.org.

Alain Richard
Retired member and Champion, Canada

alainrichardg1@gmail.com
alainrichard2
@AlainRi68693399



Comment: Through the Eyes of Bacteriophages

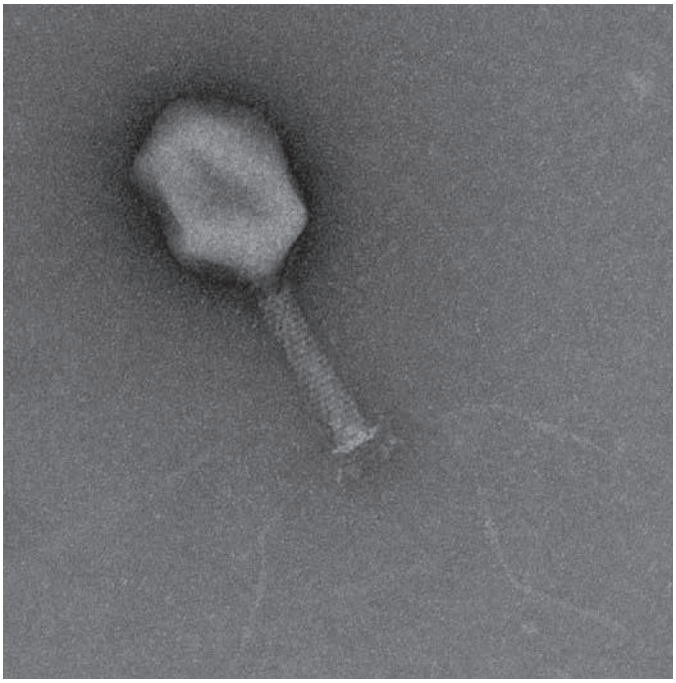
Martha Clokie

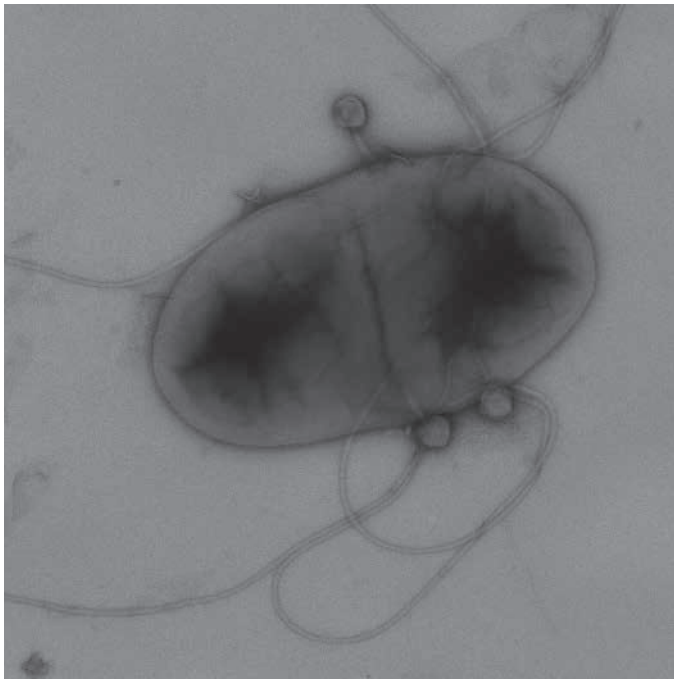
Bacteriophages, or phages for short, are viruses that target and kill bacteria. All bacteria have these natural enemies, and they are part of natural microbial ecosystems where they shape bacterial populations, controlling their structure, evolution and sometimes even their physiology. For the last two decades I have largely seen the world through a bacteriophage-focused lens, scouring the landscape via sampling pots, filters and bacterial lawns for novel phages and trying to understand why they are where they are, what they are doing, and how this could be useful to treat or diagnose diseases. Previously, these efforts to collect and characterise phages were largely seen as niche, but the rise in antimicrobial resistance (AMR) has been a major driver for it to become mainstream.

During these two decades of phage hunting, I transitioned from a postdoctoral researcher to a professor as my fascination with ecology and evolution took me from the prettiest flowers in rainforests to the smallest known biological organisms of the oceans – the phages. It is at this point my phage-lens was fixed, although as I became interested in specific diseases, it arguably worsened, leading me to sample human bodily fluids, sewage systems and plenty of anoxic mud. Some of the most effective phages in our collection have hailed from the excrement of farmyard animals, polluted estuaries or from human sputum. In these endeavours I feel privileged to have worked with scientists from many disciplines and countries, often puzzling together over where we can find and how we can develop new phages to cure diseases that current treatments don't work for. A decade ago, when my father visited to help look after my children so I could travel to Thailand and Vietnam, he lamented with a wry smile that most people visit these countries to find themselves, yet I was going to find phages for multidrug-resistant *Burkholderia* and *Klebsiella*.

However, even on that trip, there was little clinical interest in using phages in the UK to treat infectious diseases. Times have changed now, and recently myself, Andy Millard and colleagues at the University of Leicester have combined our efforts to collect, sequence and study phages to open the first UK Centre for Phage Research (CPR). The centre's aim is to carry out the fundamental science needed to facilitate the development of novel antimicrobials for humans, animals and plants. In addition to our new CPR, the large shift in interest in using phages as medicines can be evidenced from the recent UK Commons Science, Innovation and Technology Committee Inquiry on the Antimicrobial Potential of Bacteriophages and the launch of Innovate Knowledge Transfer Network's Phage Innovation Network.

Phage (left) and phage infecting a bacterium (right). N Allcock, Leicester Core Biotechnology Services EM Facility





Our CPR consists of five phage-focused academics – one of whom, Dr Melissa Haines, spends half of her time with patients in hospitals wearing her infectious disease doctor/clinical microbiologist hat. We also work with eight highly talented postdoctoral researchers and 17 postgraduate students from across the globe, many of whom will return to start or progress phage labs in their country of origin. We seldom have a dull day, and often delicious cakes or other treats are brought in to boost morale or celebrate success depending on whether or not our phages are behaving.

It is important to remember that while most of the world forgot about phages after antibiotics were discovered, Georgian researchers and those from other former Soviet Union countries had seen enough evidence to realise the benefits of using bacteriophages. Therefore, despite often very difficult circumstances, they carried on storing, producing and using them. Georgia has a particularly rich history of using phages to treat bacterial diseases and of phage scientists working with doctors to best use them to treat a range of intestinal, lung and topical diseases. This work was started by George Eliava who worked with Felix D'Herelle from the Pasteur institute in France, who, at the same time as Frederick William Twort from St Thomas Hospital in London, independently discovered phages. A wonderful full history of this was recently published by Nina Chanishvili from the Eliava Institute [1]. Indeed, the Eliava Institute of Bacteriophages remains a major draw for phage scientists, and this summer Georgian phage biologists warmly hosted over 500 international delegates for the Viruses of Microbes conference. Much of the current work to use phages therapeutically draws on valuable lessons learned during the last century, and in a recent Phage Therapy meeting in Paris the director of the Eliava, Mzia Kutateladze, pointed out the pitfalls of endlessly reinventing the wheel, reminding folks to build on the things they have learned over their long history of working with phages.

Looking at the trajectory of phage research and moving firmly to the present, one of the key reasons that it is now a very exciting time to be a microbiologist but particularly a phage biologist is the ease by which we can access 'omics' technologies in order to characterise our phages. Isolating new bacteriophages can quickly lead to us sequencing and interpreting their genomes and, if we so wish, also their transcriptomes, proteomes and metabolomes. We can also move from genomic data to protein structure and predict how proteins interact. Advanced imaging data from electron microscopy (EM), including cryogenic EM and tomography, can also resolve the most intimate of structural details, helping to interpret how phages work and unravel the diverse strategies they utilise to infect bacteria. Until recently, making sense of 'omics' data wasn't easy, in particular interpreting the host bacteria from phage metagenomes wasn't possible, but today advances in bioinformatics and machine learning can often robustly link experimental phage data to efficacy and hosts. These technologies can now be firmly embedded in all aspects of our experimentation, meaning that we can move from studying phenotypes to figuring out mechanisms of action. Learning about phage strategies can also inform genetic engineering strategies to add new features into phages to boost performance in certain scenarios.

So as we await the government recommendations from the Science, Innovation and Technology Committee it is clear actions need to be taken to progress phage technology. Phages have been evolving alongside their bacterial hosts for millennia, and we ignore learning from them at our peril. In the Leicester Centre for Phage Research, we hope to play a key role in helping support the UK phage, clinical and veterinary communities by providing a critical mass of knowledge and a large collection of biological and genomic resources. I still have my phage lens on and in light of AMR am unlikely to remove it, as the need to develop phage-based diagnostics and treatments is intensifying on a daily basis.

Reference

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Biography

Professor Martha Clokie is a Professor of Microbiology at the University of Leicester and the director of the UK's newly founded Centre for Phage Research. Her research investigates the biology and development of bacteriophages that kill human and animal pathogens in order to develop new antimicrobials.

Martha Clokie
Professor of Microbiology,
University of Leicester, UK

mrjc1@le.ac.uk
martha-clokie-467b191a
@martha_Clokie
@Leicester_Phage

An interview with the FIS Chair-Elect

Ash Otter

We asked FIS Chair-Elect, Ash Otter, about what he hopes to achieve in his role and what he's most looking forward to at this year's FIS conference.

Describe your role as FIS Chair-Elect

My Federation of Infection Societies (FIS) Chair-Elect role in the Microbiology Society is to support the current chair (Dr Tina Joshi) in helping to organise the FIS annual conference, which is an event that is primarily organised by organisations with lots of members that are involved in infection science: Microbiology Society, British Infection Association, and Healthcare Infection Society. There are also many other organisations that take part and contribute content. As well as helping with the organisation of FIS, my role is also to represent the interests of FIS across the Microbiology Society, either at society governance meetings or at conferences.

What motivated you to take this role?

Having worked at UKHSA over the pandemic, one theme was consistent – the collaboration between academia and NHS and public health to help answer some essential questions on SARS-CoV-2 immunology, diagnostics and sequencing. I wanted to drive this cross-sector collaboration and thought the FIS Chair-Elect position would be an excellent way to try and further strengthen some of these ties and extend across the spectrum of microbiology, not just during a pandemic.

What are you most looking forward to at FIS 2023?

Bringing together researchers from across academia, NHS and UKHSA in beautiful Edinburgh! As the Microbiology Society is also the hosting society this year, I think it is an excellent opportunity to showcase the research of some of our members to new audiences, including clinicians and biomedical scientists.

What would you like to achieve during your term as FIS Chair from 2024?

There are a multitude of avenues in which people can work together to solve some of the biggest threats to us right now, including AMR, emerging pathogens and climate change. I'm hoping to be able to help with some of these issues through further strengthening cross-collaborative work across the infection societies, which will be essential for things such as new rapid diagnostics, new vaccine development and public engagement.

With AMR being a big topic for the Society in the next few years, what do think are the main opportunities and challenges for the infection science community?

I would say we are at a unique opportunity right now in that we are moving from a fast-paced pandemic caused by SARS-CoV-2 and into the territory of the 'silent' AMR pandemic. We have to strengthen our research and development, build new collaborations outside of our typical networks, engage the public on the importance of AMR and think outside the box for new ways to combat the threat of AMR. And this is why I am thrilled to be part of the FIS community and the Microbiology Society, as I believe we can bring researchers together from diverse areas across the Microbiology Society.

Bringing together microbiologists from a range of fields, such as veterinary microbiology, diagnostic development and genomics will enable us to look at new avenues of research to further the field and help answer the problems of AMR that currently face us.

GET INVOLVED

FIS 2023 will be taking place 14–15 November in Edinburgh and one day for an online meeting on 17 November. To learn more about the event visit our website at microbiologysociety.org/FIS23.

Dr Ash Otter
UK Health Security Agency

ashley-otter
@asherichia

FEDERATION OF INFECTION SOCIETIES CONFERENCE 2023

Edinburgh ICC, UK

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Unlocking the Value of Rapid Diagnostic Tests in Combating Antimicrobial Resistance

Magdalena Karlikowska

In his influential 2016 report on antimicrobial resistance (AMR), Lord Jim O'Neill said: "I find it incredible that doctors must still prescribe antibiotics based only on their immediate assessment of a patient's symptoms, just like they used to when antibiotics first entered common use in the 1950s". He boldly advocated for a change, stating that by 2020, it should be mandatory to employ rapid diagnostics before prescribing antibiotics. Despite his strong appeal, the reality in 2023 remains disheartening: nearly half of global antibiotic treatments lack a proper diagnosis, often leading to the use of incorrect drugs.

Empowering precision in infection management

Central to effective infection management is antimicrobial susceptibility testing (AST), a cornerstone of personalised and precision approaches to antibiotic prescribing. By determining the susceptibility of bacterial pathogens to specific antibiotics, AST empowers healthcare professionals with the information they need to make informed decisions. Moreover, AST serves as a valuable tool for assessing the efficacy of infection control measures, ultimately leading to improved patient outcomes and saving lives.

However, while AST platforms offer considerable value to clinical diagnostic microbiology laboratories, they bring significant challenges. Cost, relatively long time-to-result, and lack of automation hinder their broader utilisation. Notably, the European Congress of Clinical Microbiology and Infectious Diseases (ECCMID) in Copenhagen this year showcased a wave of innovative rapid AST solutions, highlighting a growing interest and advancements in this field.

Critical role of rapid diagnostics in battling bloodstream infections and AMR

The impact of rapid diagnosis becomes particularly apparent in the context of bloodstream infections (BSIs). Even a minor delay in treatment can trigger severe consequences, rapidly escalating to life-threatening sepsis. BSIs stand out as a major infectious syndrome that significantly contributes to the global burden of antimicrobial resistance. As per 2019 data, these infections accounted for a staggering 2.91 million deaths worldwide, with around 13% directly attributable to AMR and 40% associated with it.

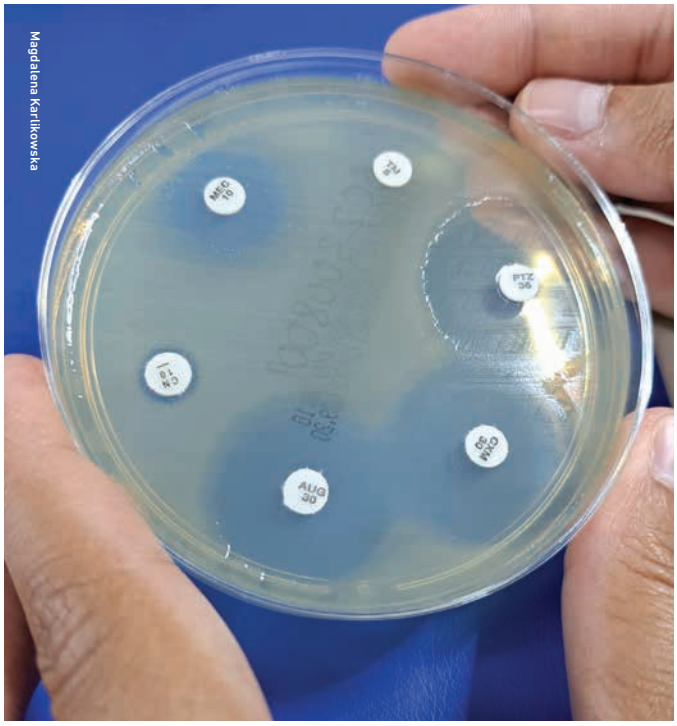
Yet, establishing effective antimicrobial stewardship practices for BSIs and sepsis poses considerable challenges. The lack of rapid and accurate diagnostics, coupled with the severity of these infections, often results in patients receiving suboptimal therapy, such as empirical broad-spectrum antibiotics. Addressing these challenges, the Antibiotic Review Kit introduced in 2019 focuses on expediting antibiotic review within 72 hours and facilitating treatment revisions or cessation. The timely availability of AST results is pivotal in implementing such change. Rapid access permits quicker adjustments in treatment, including de-escalation to narrow-spectrum agents, which reduces the impact on the patient's microbiome and minimises selective pressure for AMR spread. Indeed, the clinical importance of diagnosing bloodstream infections led NHS England to call for improvements in the diagnostic pathway earlier this year.

Reimagining AMR strategy evaluation: harnessing the power of rapid diagnostics

The journey towards improved sepsis management necessitates collaboration across healthcare professionals, diagnostic laboratories, researchers and technology developers. Partnerships that stimulate innovation and involve clinicians in early developmental stages ensure diagnostic tools closely align with clinical needs.

However, the challenge extends beyond technology innovation: the funding landscape for diagnostics poses a significant hurdle. Adequate funding must be allocated to support the implementation and maintenance of these diagnostic tools. Researchers and policy-makers must collaborate to quantify the costs of antibiotic resistance, providing a basis for necessary funding to preserve antibiotics for future generations.

To fully capture the benefits of diagnostic strategies and assess the value of interventions against AMR, economic evaluations must go beyond traditional approaches. They should consider not only immediate health gains but also the future health outcomes of those infected by resistant pathogens or receiving alternative treatments due to increased resistance. This broader perspective offers a better understanding of rapid diagnostic test value in preventing AMR and its impact on public health.



Furthermore, the selection of appropriate health outcome measure remains a challenging task. Economic evaluations of AMR containment strategies require measures that offer valuable insights for global health prioritisation. Alternatives such as the Disability-Adjusted Life Year (DALY) and cost-benefit analysis (CBA) can help in this regard. DALY captures the disease burden, whilst CBA offers a comprehensive assessment of individuals' willingness to pay to avoid resistant infections or secure future treatment benefits. Adopting a broader societal perspective in economic evaluations is crucial, including long-term indirect costs. This approach provides a comprehensive understanding of the economic impact of AMR containment efforts.

Moreover, economic evaluations must stretch beyond short-term direct health effects. They should factor both direct and indirect costs across adequate time horizons, acknowledging that the implications of AMR accumulate over the long term and need to be included in the evaluation process. Lastly, considering how people value time matters for tacking AMR strategies. Divergent time preferences – some prioritising the future, others focusing on the present – can significantly impact decisions like antibiotic use. For example, some people choose to use antibiotics carefully to safeguard their effectiveness for the future, while others want to use them immediately. Understanding these perspectives helps create better solutions for addressing AMR.

Recent guidance from the National Institute for Care and Health Excellence (NICE) provides a thought-provoking lesson, introducing an innovative model to assess the value of new antimicrobials. Alongside direct health benefits, it includes elements like insurance, diversity, transmission and enablement. Applying this approach to rapid diagnostics has the potential to drive transformative benefits across the healthcare landscape.

Firstly, rapid diagnostics can function as an insurance policy against inappropriate treatment by precisely identifying resistant infections. Additionally, rapid diagnostics respond to diverse patient requirements, offering personalised treatment plans. Recognising that various infections may require distinct antimicrobials, these tests quickly pinpoint exact pathogens, enabling optimal interventions. By facilitating timely infection control measures, rapid diagnostics prevent the further transmission of infectious agents. This reduces the spread of infections within healthcare settings and the community, thus alleviating the overall burden of disease. Lastly, the integration of rapid diagnostics provides healthcare practitioners with real-time information, facilitating well-informed decisions. This rapid access to accurate results enables clinicians to promptly administer targeted treatments, enhancing patient outcomes and reducing reliance on broad-spectrum agents.

As AMR continues to pose global challenges, maximising the value of rapid diagnostics becomes very important to control its spread. Collaboration, innovative financing, comprehensive evaluation and understanding diverse time preferences will be the bedrock on which effective solutions are built, ultimately safeguarding public health and economies.

Further reading

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Biography

As the CEO of Cytecom, a University of Warwick spinout, Magdalena is leading the development of an innovative diagnostic test that shortens the time for targeted antibiotic therapy selection from days to minutes. She holds a PhD in microbiology and has 9 years of academic and industrial research experience with a special interest in tuberculosis and clinical diagnostics.

Magdalena Karlikowska
Chief Executive Officer
Cytecom Ltd, UK

magdalenakarlikowska
@M_Karlikowska

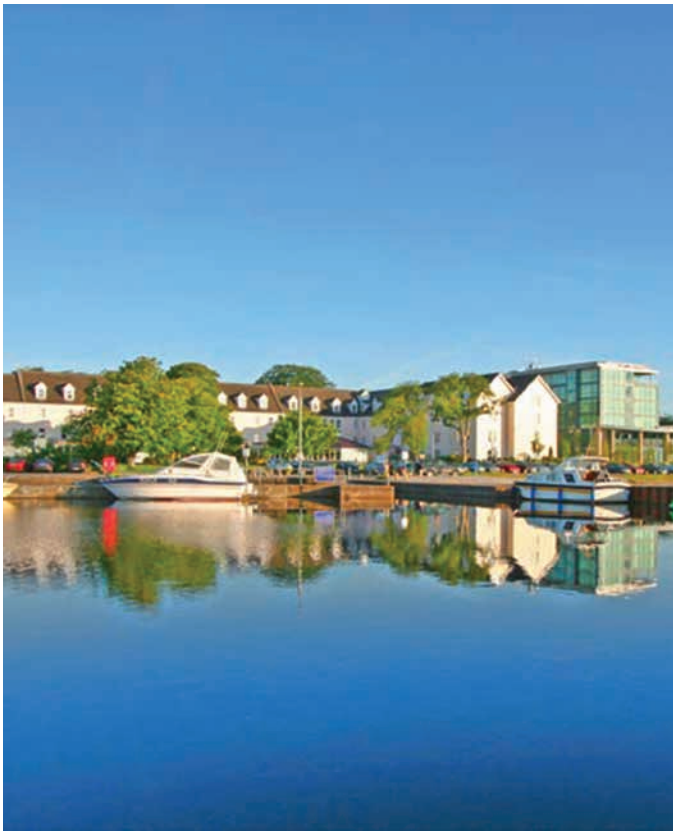
News

The Microbiology Society welcomes the UK'S return to Horizon Europe

The Microbiology Society has long maintained it is in the UK's best interests to be part of Horizon Europe, as association to the research and innovation programme is fundamental to international collaborative endeavours which foster knowledge transfer and innovation. Membership of Horizon Europe underlines that science is an international endeavour, and the Society champions the important contribution of microbiology in the global fight against antimicrobial resistance (AMR). Read more here: **microb.io/3Rd3voa**.

The Microbiology Society Annual Meeting in Ireland

The Irish Division of the Microbiology Society invites you to join us in Athlone, for a one and a half day meeting that is focussed on bringing people together, building new relationships and reaffirming those already established. At the meeting we will learn about some of the fantastic microbiology research that is happening on the island of Ireland across a diverse range of topics, reflecting the idea that interdisciplinarity can broaden horizons and open new doors to breakthroughs. Find out more on our website (**microb.io/483vw7s**).



2022 Revision of the International Code of Nomenclature of Prokaryotes

The International Committee on Systematic Prokaryotes (ICSP) is pleased to share that the 2022 Revision of the International Code of Nomenclature of Prokaryotes (ICNP) was published in May 2023 in the *International Journal of Systematic and Evolutionary Microbiology* (**doi.org/10.1099/ijsem.0.005585**).

Effective communication in microbiology depends on the ability to name the micro-organisms on which we work. The nomenclature and ways in which prokaryotes are named is governed by specific Principles and Rules, compiled in the ICNP which is administered by the ICSP.

In the period since the most recent 2008 revision, multiple proposals to modify the ICNP accumulated. The Editorial Board of the ICNP, and the ICSP itself, have recently collated and debated these many proposals, allowing the ICSP to vote on which to incorporate. This has allowed the compilation of the new edition of the ICNP. This will be an important resource for those seeking to name cultured prokaryotes, and those doing so are encouraged to consult this new edition. Learn more on our website (**microb.io/3q5Uzp8**).

Transformative Agreement Signed Between the Microbiology Society and National Taiwan University

The Microbiology Society and National Taiwan University (NTU) are pleased to announce a five-year transformative agreement, starting in 2024. The Publish and Read agreement, the first for the Microbiology Society in Taiwan, will allow affiliated researchers to publish an unlimited number of Open Access articles and enjoy full read access in Society titles. Find out more on our website (**microb.io/4500yPl**).

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Annual Conference 2024: What we're doing to improve your experience

The Microbiology Society is a membership charity and not-for-profit publisher. We support and invest in the microbiology community for the benefit of everyone. In order to do this as effectively as possible; to seize opportunities as they arise and, to meet the ambition of our strategy 2023–2027, we are evolving.

At Annual Conference 2024, you will see some changes to the programme, additional social events and improvements to meet your needs at the venue, which are all based on the feedback we have received from you, with the aim of providing a better experience for all our delegates. To read about all the changes in full please visit our website (**microb.io/3FbtHlv**).

FEMS Grants

Research & Training Grants – up to EUR 5000 to support your travel and accommodation costs to pursue opportunities at a European host institution.

Industry Placement Grants – up to EUR 5000 to support your travel and accommodation costs to pursue opportunities at a European industry.

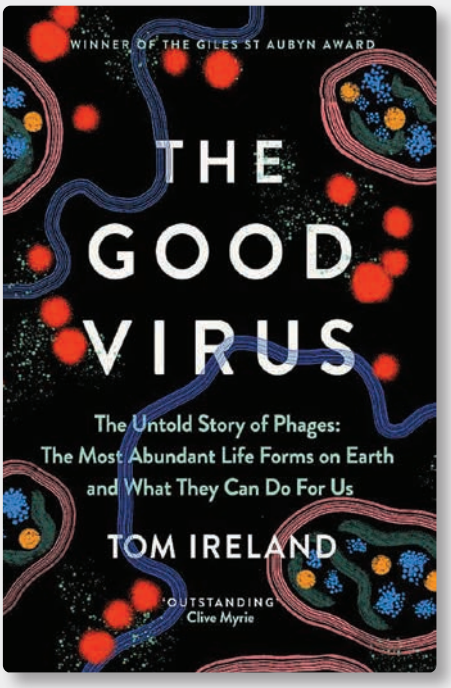
Meeting Attendance Grants – get up to EUR 750 to help you attend any microbiology meeting in the world.

Meeting Organizer Grant – receive up to EUR 15000 to help organise a conference, workshop or training course within Europe. FEMS can also support marketing of the event via promotion on our Opportunities Board.

To take advantage of this great opportunity, please see the following link: **microb.io/469rys6**.

Review

Read the latest book review below. To read more reviews from our members, please visit our website: microbiologysociety.org/MicrobiologyToday



The Good Virus: The Untold Story of Phages: The Most Abundant Life Forms on Earth and What They Can Do for Us

By Tom Ireland
Hodder & Stoughton (2023)
£20.00 – ISBN: 978-1-529-36524-5

As the world pushes back against the COVID-19 pandemic, Tom Ireland leads readers into the fascinating world of a silently coexisting 'Good virus' – Phages. The writer embarks on educating and guiding readers into discovery of these unseen allies, elucidating their nomenclature and tracing their historical rise and fall entangled with antibiotic discovery, politics and warfare. These narratives are fortified with detailed and vivid illustrations showcasing choices in choosing phage for both scientific and non-scientific audiences, emphasising their importance in application not only in health but also in technological advancement.

The book is organised into five broad named 'Parts' comprised of 'Chapters'. Navigating through each chapter, the diligence of the writer in collating the information together is evident. The analogies and wording are equally fun, engaging and captivating. The case-based evidence of use of phage as a last resort in treating severe cases with controversial approval, 'finding your own phage' experiments, CRISPR-Cas 9, discovery of phage structure, and synthetic phages are a few of the writer's detailed illustrations that captivate readers, forcing them to contemplate the significance of phages and their use.

The writer addresses both positive and negative aspects of phages, highlighting the importance of clinical trials. This guides readers towards an understanding of advanced genetic engineering and its unknown but exciting potential in personalised phage treatment.

Throughout the reading experience, and particularly towards the end, the reader resonates with Tom Ireland's statement in his epilogue: 'These vast unknowns ensure there are many more exciting discoveries to come'.

The book is intended for all readers interested in well-informed information on phage science in an antibiotic-resistance era.

Sonu Shrestha
Senior Research Assistant at University of Oxford, Oxford Vaccine Group, UK, and master's student at the University of Birmingham, UK