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microbiologist

Can tropical insects provide us with life-saving drugs?

SfAM sponsor their first Daphne Jackson Fellowship

Using manga comics to spread microbiology literacy

Organic soil management

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Copy dates

Vol. 23 No. 3 September 2022
Wednesday 13 July

Vol. 23 No. 4 December 2022
Wednesday 5 October

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Wednesday 11 January

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The hero's journey

Paul Sainsbury
Editor

The way we traditionally communicate science is through journals and presentations. These formats are not only inaccessible to people that do not speak our language, but they can be a daunting task even for the people that are meant to read/attend them. As scientists we are taught to remove the storyteller and let the science speak for itself, but this is not a great way to communicate if you want your science to reach a wider audience.

Recently, I have been thinking about the monomyth, or what is sometimes called 'the hero's journey'. This classic story structure is shared by cultures worldwide and appears in countless stories from ancient myths to modern television shows, religions and movies – think about Odysseus, Hamlet, Luke Skywalker, Katniss Everdeen, Captain America or Dorothy from the Wizard of Oz. A lonely protagonist in an ordinary world who is trying to find themself. A sudden and unexpected journey promising adventures and threats. A revelation that tests the character, strength and skill of the hero. An ultimate battle that tests the hero's resolve and a victorious return home.

Now, if you want to dig deeper into this art of storytelling then there are some excellent essays on one of the most notorious scholars of the monomyth pattern, Joseph Campbell. His work is widely criticised as sexist, racist, colonialist, and harmful to the expression and appreciation of world cultures. Many detail how an over-reliance on monomyth-inspired movies makes it harder for audiences to appreciate stories that don't quite fit this mould.

However, criticisms aside, applying a simplified template of 'the hero's journey' to your work is a tried and tested communications technique that will help bring people through any complicated non-fictional scientific story.

When thinking about how to present your work, I urge you to watch any video by Dr Freya Harrison, SfAM's WH Pierce Prize Winner for 2021, including the one on the SfAM website **https://bit.ly/SfAMWHPierce2021**. Dr Harrison is an incredible scientific communicator and, although I am uncertain as to whether Freya has even heard of the monomyth, we can see the structure in her presentations.

The ordinary world (introduce the idea)

'Here's a thought, what did people use to cure infections before modern medicine and germ theory?'

A transformative journey (journey through what we know to see how we reached this point)

'Why can't we, with the evidence we have, clearly understand what it was in medieval medicines that made them popular – and were any of them effective?'

Revelation (a revelation leads us to the takeaway message)

We translated historic texts and identified the ingredient and/or combinations of ingredients in medieval medicines needed to provide antimicrobial properties.

The return (what have we done with the takeaway message to drive our science forward)

This collaboration between ancient arts and microbiology has given rise to a new area of research fighting a deadly drug-resistant bacterial infection endemic in hospitals.

Sarah Wettstadt and Nicky Williams (page 34) also show us a skilful use of the hero's journey in their creation of a comic book. They use manga-based art to explain the bioluminescent properties of *Vibrio fischeri* to a younger audience. You can download the full comic at **https://bit.ly/SfAMVibbyandRio**.

…and lastly, being the bunch of nerds we are here on the editorial team, we couldn't help but have a stab at it ourselves using an excellent paper from *Environmental Microbiology* on microbiome-related aspects of locust density-dependent phase transition (page 28). We will be keeping an eye on the downloads!

Dr Banaz Star-Shirko
SfAM Daphne Jackson Fellowship
page 44

During her fellowship, Banaz will apply next-generation sequencing and bioinformatics to investigate the impact of *Campylobacter* on the chicken gut microbiome

CONTENTS

News

Features

Education & Public Outreach

Must-read Articles

People & Places

Policy & Public Affairs

Industry

Addressing the challenges

Much of our discussions at the Society for Applied Microbiology over the past year have focused on how best we can fulfil our aim to be the voice of applied microbiology, especially as we move through the pandemic into a new way of living alongside SARS-CoV-2.

Of course, we are not out of the woods by any means, with high numbers of new cases reported globally each week, and new variants of omicron continuing to emerge, but again our focus returns to the future. Applied microbiology impacts the daily lives of citizens across the globe, from climate change, health and well-being, clean water, economic growth and prosperity, to microplastic pollution and our healthy soils and oceans which impact the livelihoods of us all. If you're reading this column, then it's a fair bet that applied microbiology has a major impact on your work and career, but for many more outside of the discipline of microbiology, applied microbiology forms an important aspect of their work. In addition, the understanding of fundamental principles of applied microbiology has entered the public space in a way that we could not have predicted a decade ago, from the perennial issue of antimicrobial resistance to the antibiotics that underpin medical, scientific and economic progress, to the global pandemic that continues today. Already, the scientific community are addressing the challenges of outbreaks of avian influenza, with the first human cases arising from this outbreak reported in the US in April and May, and an outbreak of monkeypox in Europe and the US. These have kept microbiology in the headlines, and many of our members have already engaged in outreach and media activities, which increase the public understanding of these infectious diseases. The need for the voice of applied microbiology to be heard has never been greater. SfAM has, and will continue to lead, stimulate and enrich public understanding of microbiology, through improving microbial literacy across these disciplines and the general public.

As this column goes to print we are preparing for our first face-to-face Early Career Scientists Research Symposium in Cardiff (20 June 2022) since before the pandemic. In 2019, our ECRs responded quickly to the demands of finding new and innovative ways to share and celebrate their work, to ensure that early career scientists could continue to meet, share ideas and support each other through the most difficult and unsure of times. The word symposium comes from Ancient Greek meaning 'drinking together' which speaks to the importance of social interaction in the dissemination of ideas. At last, we have the opportunity now to meet in person, enjoy the best early career science, build professional and personal networks, and stimulate new ideas and collaborations. One of the most rewarding aspects of this role is seeing the outworking of these collaborations, and hearing from our members and colleagues whose ideas first took flight through an SfAM event or grant. This meeting continues to reflect the core values of the Society for Applied Microbiology, and I want to thank everyone who has contributed to making it such a success.

Many of our members are preparing to host students in your labs over the summer through our Summer Student Placement Scholarship, I want to thank you sincerely for helping us together support the future of our community of applied microbiologists. This year, more than any time I can recall, the need for students to gain valuable laboratory and practical skills has never been more acute, as the pandemic has made it impossible to deliver the normal face-to-face and practical experience to students in academia and industry during these important formative years. Students will benefit from your guidance and mentorship and I thank you for generously supporting them. The Society for Applied Microbiology support more student placements than any other Society and we are proud to play our part in helping shape future applied microbiologists, I wish you every success and I look forward to hearing about their experiences.

Brendan Gilmore
President of the Society for Applied Microbiology

A PRESIDENT SPEAKS

The understanding of fundamental principles of applied microbiology has entered the public space in a way that we could not have predicted

How collaboration impacts innovation

The benefits of collaboration in research are well understood. A *Nature* editorial from 2021 highlights the '*benefits to science and society of working across borders, cultures and disciplines*'.

Interdisciplinary research is needed to solve global challenges

Antimicrobial resistance is an example of a global challenge that needs collaboration between researchers in multiple areas of applied microbiology and beyond. From infection control to environmental microbiology, we need expertise from social science to understand cultural and behavioural differences in attitudes to antibiotic use, as well as input from the veterinary community to understand stewardship in animal welfare. And that's scratching the surface!

COVID-19 has acted as the catalyst for many scientific collaborations

The SARS-CoV-2 pandemic has been the catalyst for change in a myriad of ways. It has accelerated successful collaboration in the scientific community in the development of vaccines and other treatments. All of which are obvious exemplars of what can be achieved when scientists in academia and industry work together towards a common goal that is of clear benefit to society.

Lucy Harper
Chief Executive of the Society for Applied Microbiology

Collaboration produces results that are greater than the sum of the parts

Here at SfAM we benefit from many collaborations with like-minded organisations. For example, a fruitful partnership with the Federation of Microbiology Societies to co-host their Congress in Glasgow in 2019. This was a productive partnership, which provided multi-faceted benefits to both organisations. And in 2021, we partnered with Responsible Use of Antimicrobials (RUMA) to produce a webinar focusing on 'Responsible antibiotic use in animals: change is coming' – which is available to view on the Society's **YouTube channel**. We work with learned societies in the sector on pan-science policy work, we have strategic partnerships with many other organisations, such as the Science Media Centre and Sense About Science, and have benefited enormously from the expertise and networks provided by our partner organisations.

However, despite the obvious benefits of teamwork, we must acknowledge that many of the structures in place that reward and recognise science are based on the performance of the individual scientist. This can hinder collaboration: awards, prizes and the naming of laboratories all recognise a named individual, when, like all productive ecosystems, results come about most effectively through the combined efforts of a team or teams of scientists.

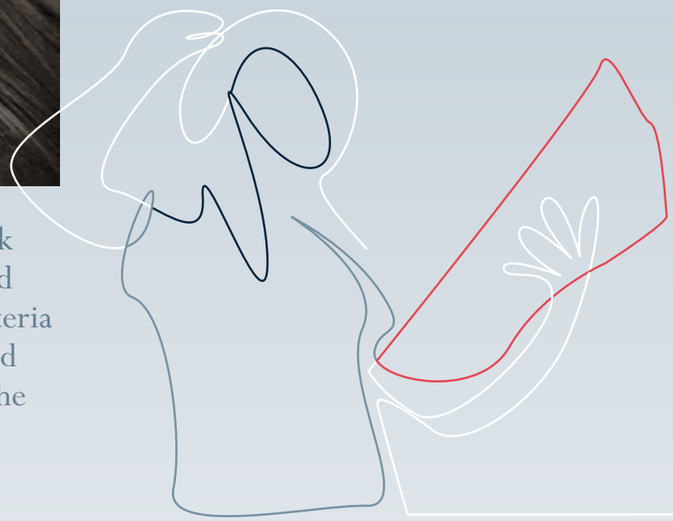
As signatories to the Declaration on Research Assessment (DORA) since 2019 (our publishing partners, **Wiley** have now also signed the declaration), SfAM supports collaboration and recognises the need to improve the ways in which research and researchers are recognised. To that end, if you or a colleague have an idea for a collaborative project that you think SfAM can facilitate, do search the website for potential grant opportunities or contact us on **communications@sfam.org.uk**.

FURTHER READING

Anon. Research collaborations bring big rewards: the world needs more. *Nature* 2021; 594(7863), 301–302 doi:10.1038/d41586-021-01581-z.

The SARS-CoV-2 pandemic has been the catalyst for change

PhD in a pandemic



Starting a PhD is a challenging task to navigate – motivation, drive and determination are all essential criteria for a new candidate. Now, for good measure, throw a pandemic into the mix and the pressure can test the nerves of even the most dedicated of students.

Since before I started my undergraduate degree, I had big dreams of becoming 'Dr Trivett' so I eagerly began to apply for PhD programmes in early 2020. As COVID-19 was making its way around the world, and working from home became the new norm, my PhD interview was online. A few days afterwards, I was offered a PhD at the University of Liverpool. There were a lot of unknowns surrounding PhDs starting in the autumn of that year, with many current students having to adapt quickly to an online presence overnight, but I was eager to begin a project I was passionate about, developing my research skills as a PhD candidate.

Fast forward to October of that year, and I had moved to Liverpool (a city I now call home). With the pandemic still in full force, the hurdles I would have to overcome were obvious. As a very sociable person, I love nothing more than to be sat in the office having a chat with those around me. So undoubtedly one of the hardest things I found during the start of my PhD was working from home. Although I had successfully worked from home for the end of my degree, finishing my dissertation, second semester modules and exams, working from home on a new project proved challenging. Starting a PhD at any time can be isolating as you begin to navigate a new path in your education and career, but the lack of those in a similar position around you seemed to have a huge implication: there is nobody to validate how you are feeling through shared experience. Overcoming loneliness during the work-from-home era, I began to learn the importance of staying connected online. We have all experienced our fair share of 'Zoom fatigue' but being able to chat to peers in regular virtual coffee mornings, making the most of Slack channels and connecting with people on social media created a feeling of connectivity and virtual camaraderie, confirming that you are not the only person going through these experiences.

Hannah Trivett
University of Liverpool, UK

As I mentioned previously, a PhD requires motivation and drive. During the pandemic, I found maintaining motivation to be much harder than expected. The motivation was not a constant; it came in waves. Some days, I could work with little distraction, whereas other days, more time was spent staring out the window at passers-by on their daily walks than looking at my computer screen. In the first few months of my PhD, I quickly realised the weight I was carrying on my shoulders; I was expecting lists and lists of tasks to be completed without considering the impact the pandemic may have had on me. I found that adding structure to my working day and setting boundaries for working hours improved my productivity, whilst having breaks little and often kept me focused and on task. Over time, my mentality changed towards work, rewarding myself for what had been done rather than punishing myself for things that had not been completed. Changing the way I planned my days and being realistic in what I was expecting myself to do during such uncertain times saw an improvement in my work and what I was able to achieve during my first year.

The path of a PhD is very fluid and often how your PhD plan starts isn't always how you submit your thesis. The direction of a PhD often changes course as new data or new papers emerge with exciting developments in that particular field. However, when COVID-19 hit, many PhD students had unexpected changes to their project when restrictions on lab access, reagent and materials and being able to attend placements was hindered. During my first year, I found it important to adapt and modify my PhD so that the project was robust, accounting for the consequences of a pandemic. Being able to have the flexibility in my work ensured I was able to work efficiently, working with the pandemic rather than against it. When there were times I was twiddling my thumbs due to accessibility or lulls in workload, I was able to explore new avenues of research and enrol on postgraduate courses to learn new skills that would be relevant to my PhD. Although at times I found the uncertainty of the project path a little frustrating, the effects of the pandemic on my PhD overall were positive, creating a multidisciplinary PhD, which incorporated wet lab, bioinformatics and qualitative enquiries, diversifying the skills I could acquire through my PhD.

Looking back at my PhD journey so far, I can certainly say it has been a bumpy one! But the experiences I have had starting a PhD in a pandemic have not only shaped my project but also my character, as I am learning to be more resilient, self-disciplined, adaptable and patient. There has been a myriad of lessons learnt from the pandemic and that in itself has caused changes in the way in which PhDs are completed, such as greater flexibility for hybrid working and conferences. Soon to hit the halfway mark in my PhD, I am excited to see where the next part of my journey takes me. What new lessons and skills will I learn? How will my character evolve? What new challenges will I face?

Viva la vida

For most PhD students, the viva is something you try your best to forget about until the day it arrives but for some reason, like the PhD itself, it refuses to give you sovereignty over your own brain for the best part of 4 years. Those who have had their viva will remember all the advice people give you that it's 'impossible' to follow. 'Remember to enjoy it', they say… 'Don't worry, you'll be fine'… 'Relax'. Like I said – impossible. I can confirm, however, that it wasn't that bad. In fact, dare I say it, I did actually enjoy it.

In the weeks leading up to the viva I pored over my thesis, trying to identify all the little gaps in the data (not that there were any, of course), preparing my defence for little things that only the author would notice. I started to make a list of papers that I should also memorise. I put one reference on it before having a panic and going straight back to analysing my own data. Where's all the data! I'm sure there was more of it somewhere.

My preparation progressed from scanning the thesis cover to cover in 20 minutes and wondering how on earth someone could ask me several hours of questions about this piece of ?@%! – to spending several hours on each chapter and hoping that no-one ever asked me questions about certain parts of it.

This fixation on the quantity, as well as quality of data in my thesis is again something that I'm sure that most PhD students will be familiar with – and is something that I carried through my PhD. I think it's because of this that I had expected the viva to be much more data focused – requiring me to provide a justification for whether something really showed what I suggested it did. In reality, it was a lot more focused on how the research applied to the wider context of the field, and the strengths and weaknesses of the methodology – which I'm sure we can all agree is a lot less daunting. Especially, as it turns out, that studying something in minute detail for over three years means that you can talk about it for quite literally hours on end. Someone said to me before going in that in the viva you realise where the 'philosophy' in 'Doctor of Philosophy' comes from. And I think that's certainly true.

In the viva, as we got to the end of my final data chapter, I realised there must only be, at most, half an hour left – and that I surely must have 'done it'. I got this big surge of adrenaline, the edges of my vision went a bit funny and I had to remind myself to listen to the question my examiner was halfway through asking. When the moment came when they finally announced my fate, I thought back to all those times I'd visualised it in the last three years. Why didn't any music start playing? Why didn't Sir David Attenborough himself come through the door and give me a hug?

For about two weeks after I heard my examiners tell me I'd passed with minor corrections, my brain kept trying to make me fret about the PhD. I kept accidentally thinking that I should do some revision or worry about my thesis in that same old generalised existential kind of way – before remembering that I'd already had the viva. Very surreal. This article actually took me about a month to write, because the way I felt about the PhD as a whole has continued to change every day since the viva.

One of the main things that came out of my viva experience was that the viva should exist as a chance for you to talk about your research in a positive light. Easy for me to say now that it's over! The thought that the viva might be the last time ever that anyone will listen to you talk about your PhD in depth will either be disappointing or liberating – never having to think about your PhD *ever again* might sound like a highly attractive option to some people. It certainly did for me by the end of it.

Strangely, however, after several years of questioning my ability to do science, my viva experience actually did make me feel positive about my research, allowed me to see it as an achievement and rekindled an interest in scientific discovery that a year of solitary writing in front of a computer screen will squeeze out of most people. It's funny that it should come as a realisation, but after all the literal blood, sweat and tears that went into my PhD I do actually feel like I can do science...postdoc, anyone?

Matthew Koch
University of Plymouth, UK

Why didn't Sir David Attenborough himself come through the door and give me a hug?

SHAPING THE FUTURE

11TH ECS RESEARCH SYMPOSIUM 2022

sfam society for applied microbiology

Early Career Scientists

Mercure Hotel Cardiff
20 June 2022 / 10:30–17:15

PROGRAMME

FREE TO SFAM MEMBERS

TIME (all times BST)	SESSION
10:30–11:00	REGISTRATION
11:00–11:15	INTRODUCTION **Lucy Harper** *Chief Executive, SfAM*
11:15–12:30	10-MINUTE ECS TALKS Chair **Kate Bamford** *UKHSA* **Joanna Stephens** *University of Nottingham, UK* **Josephine Giard** *Heriot-Watt University, UK* **Lucy Owen** *De Montfort University, UK* **Gurdeep Singh** *University of Manchester, UK* **Amira Hamdy Hassan** *United Arab Emirates University, UAE* **Fritz Ka-Ho** *University of Bath, UK*
12:30–14:00	LUNCH AND POSTER SESSIONS
14:00–15:00	20-MINUTE TALKS SESSION 1 Chair **Caleb Marsh** *University of Nottingham, UK* **Robin Dawson** *University of East Anglia, UK* **Kelly Capper-Parkin** *Sheffield Hallam University, UK*
15:00–16:00	CAREERS FAIR AND EXHIBITION
16:00–17:00	20-MINUTE TALKS SESSION 2 Chair **Hannah Trivett** *University of Liverpool, UK* **Elizabeth Archer** *University of East Anglia, UK* **Thomas Thompson** *Queen's University Belfast, UK*
17:00–17:15	SYMPOSIUM CLOSE AND PRIZES

www.sfam.org.uk/ecs-symposium-2022.com

www.sfam.org.uk

Novel strategies for combating fungal biofilms in catheter-associated infections

Renato Kovacs
Institute University of Debrecen,
Department of Medical Microbiology, Hungary

Each year, millions of central venous catheters and other indwelling devices are inserted in various healthcare settings worldwide. These widely used devices predispose to the emergence of central line-associated bloodstream infections (CLABSIs), which contribute to prolonged hospital stays. Furthermore, these infections may require a complex therapeutic strategy, which may have limited efficacy. One of the most important predisposing factors to CLABSIs is the biofilm-forming ability of pathogenic microorganisms. The bacterial and/or fungal cells adhere to these abiotic surfaces and develop a thick, three-dimensional, polysaccharide-based matrix, which provides resistance to various environmental factors, the immune response and the majority of antimicrobial drugs. Moreover, the dispersed cells from these sessile communities may be a continuous source of life-threatening systemic infection.

Based on data from the Centers for Disease Control and Prevention (CDC), a remarkable decrease in rates of pathogen-specific CLABSI rates in intensive care units was observed between 2011 and 2017. However, this trend could not be detected in cases of *Candida*-related central line-associated infections. In addition, these microbes were the most common CLABSI-related pathogens in 2017. Based on current medical guidelines, immediate catheter replacement must be applied in cases of confirmed *Candida*-associated catheter-related infections. Nevertheless, catheter replacement is not feasible for all patients, especially for those who have limited venous access.

Recently published alternative therapies for the treatment of *Candida*-related CLABSIs include high-dose therapy with licensed antifungal drugs, combination-based therapeutic approaches and antifungal lock therapy. Experimental data have revealed the therapeutic potential of echinocandins and amphotericin B formulations against fungal biofilms, both in traditional therapies and in the above-mentioned alternative approaches such as antifungal lock therapy. However, the number of resistant fungal infections has been steadily increasing, and new potentially multi-resistant fungal species have emerged in clinical practice, such as *Candida auris*, multiazole-resistant *Aspergillus* isolates or *Lomentospora prolificans*, causing further challenges for therapy.

Despite the relatively widely used antibacterial lock protocols, unfortunately there is no approved antifungal lock therapy in clinical practice. Lock therapy uses prolonged instillation of a solution containing high concentrations of antimicrobial compounds within an infected catheter in order to sterilise it and remove intraluminal biofilms. A relatively novel and innovative alternative therapeutic approach against *Candida* biofilms – which can even be used as part of a potential antifungal lock protocol – is the disruption of the fungal quorum-sensing process. Quorum sensing is a major mechanism of microbial cell–cell communication, acting as a population density-dependent stimulus response mediated by hormone-like low-molecular weight secreted molecules called quorum-sensing molecules. To date, four major fungal quorum-sensing molecules have been described, including farnesol, tyrosol, phenylethanol and tryptophol, which have a remarkable effect on the regulation of morphogenesis.

In the last decade, the number of studies dealing with the effect of farnesol against *Candida* species has steadily increased, supporting the comprehensive understanding of the potential antifungal effect exerted by this compound.

At physiological concentrations, farnesol has no significant inhibitory effect if hyphae development or biofilm formation have already begun. However, several studies demonstrate that farnesol at supraphysiological concentrations can cause biofilm degradation, particularly increasing the rate of apoptotic fungal cells. Furthermore, it can enhance the activity of several traditional antifungal agents such as azoles, amphotericin B formulations and echinocandins. Moreover, it may cause resistance reversion, especially in the case of azoles. The antifungal activity exerted by farnesol can be explained by the extensive production of reactive oxygen species and the inhibition of fungal survival strategies. Farnesol has an amphiphilic nature, allowing its integration into fungal cell membranes, potentially influencing the membrane integrity. Furthermore, it inhibits manganese, zinc transport and iron metabolism, and increases the fungal intracellular copper content – thereby disrupting intracellular metal homeostasis. Interestingly, fungal metabolism is modulated towards beta-oxidation following farnesol exposure.

Tyrosol is a relatively understudied and underappreciated molecule compared with farnesol, with regard to its antifungal activity and synergistic effect with antifungal drugs. Previous studies have described a potential antifungal effect similar to that of farnesol at supraphysiological concentrations; furthermore, the compound enhanced the activity of certain traditional antifungal drugs against biofilms. Based on deep molecular analysis, tyrosol exposure may be able to enhance oxidative stress, and inhibit growth, ribosome biogenesis and virulence in the case of *Candida* cells. Surprisingly, metabolism is modulated towards glycolysis and ethanol fermentation, unlike on exposure to farnesol.

In summary, the possible introduction of this novel type of therapy into clinical practice even in lock therapy is unlikely to occur in the near future. To date, the extent of the available data focusing on fungal quorum sensing is limited. Nevertheless, there may be huge potential in this innovative therapeutic approach against fungal biofilms that would be a mistake to leave untapped.

Funding acknowledgements

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FURTHER READING

Jakab Á, Balla N, Ragyák Á, Nagy F, Kovács F, Sajtos Z *et al*. Transcriptional profiling of the *Candida auris* response to exogenous farnesol exposure. *mSphere* 2021; 6(5), e0071021

Jakab Á, Tóth Z, Nagy F, Nemes D, Bácskay I, Kardos G *et al*. Physiological and transcriptional responses of *Candida parapsilosis* to exogenous tyrosol. *Applied Environmental Microbiology* 2019; 85(20), e01388-19

Kovács R, Majoros L. Fungal quorum-sensing molecules: a review of their antifungal effect against *Candida* biofilms. *Journal of Fungi* 2020; 6(3), 99

Kovács R, Majoros L. Antifungal lock therapy: an eternal promise or an effective alternative therapeutic approach? *Letters in Applied Microbiology* 2022; doi: 10.1111/lam.13653. Epub ahead of print

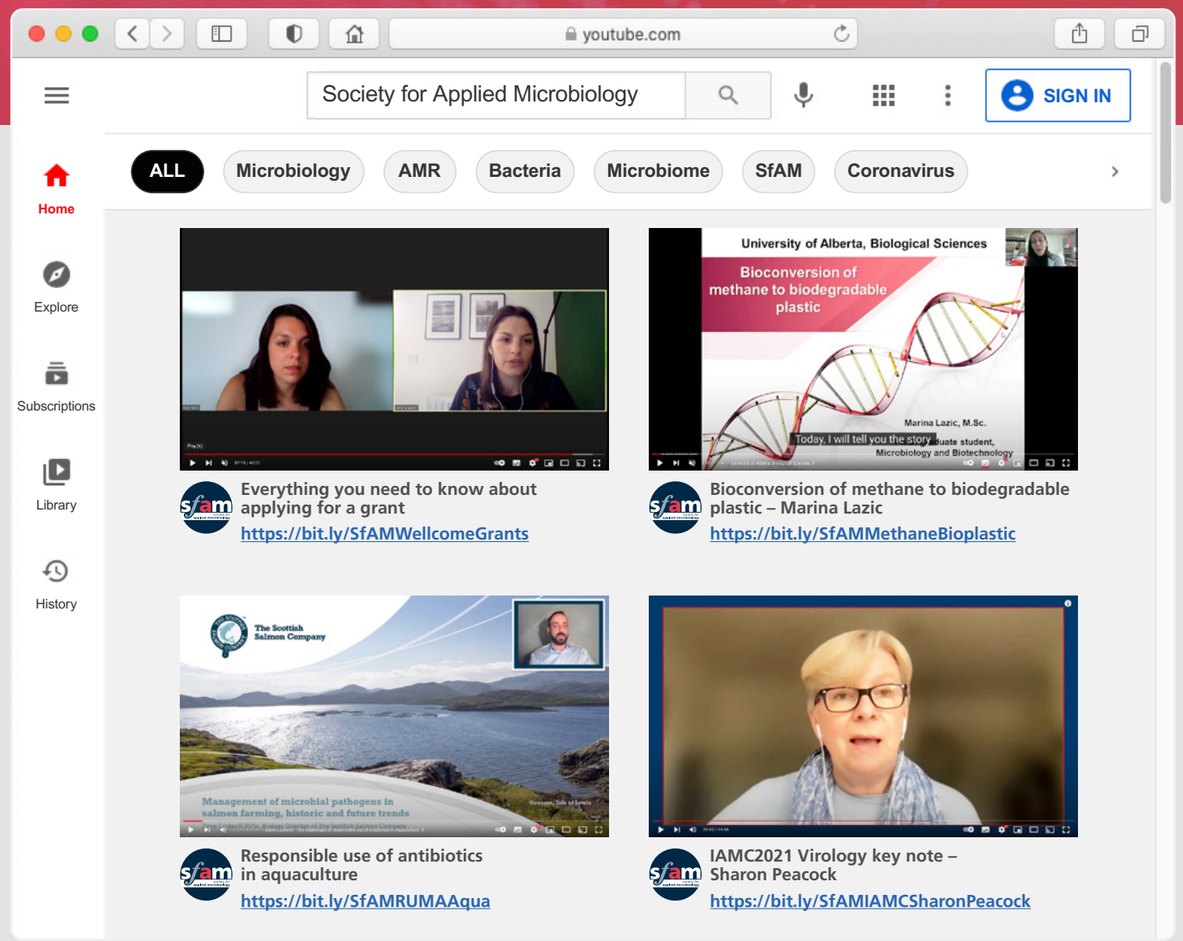
New potentially multi-resistant fungal species have emerged in clinical practice

Have you heard? SfAM is now on YouTube

Robert Millar
Digital Communications and Engagement Officer

With all the digital content we've been generating in the past year, we wanted to make it more accessible to watch our digital events and other activities.

Head to...
https://bit.ly/SfAMYouTube
to subscribe and watch some of our latest events!



Everything you need to know about applying for a grant
https://bit.ly/SfAMWellcomeGrants

Bioconversion of methane to biodegradable plastic – Marina Lazic
https://bit.ly/SfAMMethaneBioplastic

Responsible use of antibiotics in aquaculture
https://bit.ly/SfAMRUMAAqua

IAMC2021 Virology key note – Sharon Peacock
https://bit.ly/SfAMIAMCSharonPeacock

From ants to antibiotics, can tropical insects provide us with life-saving drugs?

Rebecca Devine, **Hannah McDonald**, **Barrie Wilkinson** and **Matt Hutchings**
Department of Molecular Microbiology, John Innes Centre, UK

The natural world provides us with many of the life-saving medicines we take for granted, including painkillers, immunosuppressants, anticancer drugs and antibiotics, because many of these drugs are based on, or inspired by, the natural products of bacteria, fungi and plants.

Antibiotics are a fundamental aspect of modern medicine; they don't just cure infectious disease, they are also used as prophylactics during life-saving procedures, including heart transplants and chemotherapy, and much of modern medicine would not be possible without them. Microorganisms naturally make an incredibly diverse range of compounds as part of their normal growth and development, and microbial natural products account for two-thirds of clinically used antibiotics. The most famous antibiotic is penicillin, which is made by the *Penicillium* mould, and was the first natural product antibiotic to be purified and used to treat human disease. Penicillin (and other beta-lactam antibiotics) is still widely used in medicine, and its discovery, by Alexander Fleming, and development as a drug by Howard Florey and colleagues at the University of Oxford, triggered a Golden Age of antibiotic discovery. These scientists shared the 1945 Nobel Prize for Medicine and only one other scientist would go on to win a Nobel Prize for the discovery of a natural product antibiotic. Selman Waksman won the Nobel Prize for Medicine in 1952 for discovering streptomycin and coined the word antibiotic to mean 'a chemical substance, produced by microorganisms, which has the capacity to inhibit the growth of and even to destroy bacteria and other microorganisms'. His graduate student, Albert Schatz, who discovered that streptomycin inhibits the growth of the tuberculosis (TB) bacillus *Mycobacterium tuberculosis*, famously missed out on the Nobel Prize, and later successfully sued for a share of the patent royalties and recognition for co-discovery of this antibiotic. Streptomycin is still one of the first-line antibiotics used to treat people that are reinfected with TB and is made by a soil bacterium called *Streptomyces griseus*. As a genus, *Streptomyces* are particularly talented antibiotic producers. These Gram-positive, filamentous bacteria are responsible for a large proportion of the antibiotics currently used in the clinic and their ability to produce such an array of molecules makes them particularly adept at surviving in a variety of competitive environments, from soils to deserts and oceans.

The use of antimicrobials in the clinic stretches back just over 100 years, to the introduction of the synthetic antimicrobial Salvarsan to treat syphilis in 1909 and then the synthetic sulfa drugs in the 1920s, the latter of which had a huge impact on infectious disease. Although sulfa drugs are still in clinical use, they were largely superseded by the introduction of penicillin in 1942. Thus, humans have a relatively short history of antimicrobial use and although the first antimicrobials were synthetic, most are now based on the natural products of bacteria and fungi. Unfortunately, they have been widely, and in many cases

Above: *Tetraponera penzigi ants on their host Acacia tree in Kenya. © Dr Dino Martins, Director of the Mpala Research Centre in Kenya.*

Right: *Top view of a fungus garden chamber in a captive colony of Acromyrmex octospinosus leafcutter ants. © Matt Hutchings, John Innes Centre Visit* **https://antcam.nbi.ac.uk/** *for a live-feed ant cam.*

carelessly, used in medicine and in agriculture such that the planet is 'awash in a dilute solution of antibiotics'. The inevitable result is that many disease-causing bacteria have become resistant to these drugs and this antimicrobial resistance is an increasing problem that already accounts for 1.3 million deaths a year. We desperately need to develop a new generation of antibiotics and use them more wisely to slow the inevitable evolution of resistance. The Golden Age of discovery ground to a halt in the 1960s largely because of the rediscovery problem, that is, the repeated rediscovery of known antibiotics from soil microbes. Pharmaceutical companies concluded that all the useful natural product antibiotics had been discovered and switched their efforts to making antimicrobials using synthetic chemistry. With a few notable exceptions (e.g. the sulfa drugs), this has been largely unsuccessful and big pharma gave up on antimicrobial discovery, because antibiotics are not profitable. The advent of genome sequencing in the late 1990s and early 2000s, however, revealed that soil microbes encode many more natural products than they make in the laboratory, leading to renewed efforts by scientists to discover new microbes from soil and other underexplored niches, and to activate the biosynthesis of all their natural products under laboratory conditions.

So where should we look for new strains of bacteria and fungi with novel chemistry? Well, genome and metagenome sequencing tell us that even the soil is underexplored, with many molecules not made by cultured bacteria and many bacteria not even cultured from soil. However, there are also environmental niches that we either could not explore easily in the 1950s, such as deep-sea marine sediments, or that we just did not know about. The latter includes symbiotic niches in which higher organisms such as plants and invertebrates form mutually beneficial symbioses (mutualisms) with antibiotic-producing bacteria and exchange food and housing for defence against disease.

Perhaps the best studied example of a defensive symbiosis is that of tropical leafcutter ants in the genus *Acromyrmex* and tribe Attini, which are endemic to South and Central America and the Southern USA. As the name implies, leafcutter ants collect leaf material to carry back to their nests; however, the ants do not eat these leaves as they do not possess the digestive enzymes to break them down. Instead, they use this leaf material to farm a symbiotic fungus, *Leucoagaricus*, that becomes both the home and the food source for the ants as it provides fruiting bodies filled with fats and sugars that the ants can digest. The ants are entirely dependent on the *Leucoagaricus* and the immature worker ants are responsible for maintaining and grooming the fungal cultivar. However, in creating the optimal environment for their fungus garden to flourish, the ants also create the perfect environment for opportunistic pathogens like fungal *Escovopsis* species that can infect the fungus garden and cause entire colonies to collapse. To provide additional protection for their fungal cultivar, *Acromyrmex* ants have developed another symbiosis with antibiotic-producing bacteria, particularly *Streptomyces* and the related *Pseudonocardia* species, that produce natural products to protect the nest from infection. This protective microbiome is maintained on the surface of the ants so that when signs of infection are identified within their nest, the ants can remove it and rub their bodies against it to coat it in the microbial natural products. Specialist glands on the ants support this dynamic microbial community and ensure diversity in both species and natural products, so that a cocktail of compounds is available to protect the fungus garden. By using this 'multi-drug' approach, the ants have circumvented the antimicrobial resistance problems that humans have encountered, even though they are thought to have been using antibiotics for millions of years.

We have been searching the nests of these leafcutters and other tropical fungus-growing ants for new microorganisms making new antibiotics. The most promising niche we have found is that of the African plant ant *Tetraponera penzigi*, which nests in the domatia of its host Acacia tree and protects these trees against large herbivores such as elephants. These ants also grow a fungus inside their domatia as food for their larvae and queen and we have cultured new species of *Streptomyces* and *Saccharopolyspora* from these domatia, suggesting they may use antibiotics to protect this fungus and themselves against disease. One of these species, which we named *Streptomyces formicae* (formica being Latin for ant) makes a new structural class of antibiotics called the formicamycins.

The formicamycins and their previously identified intermediates, fasamycins, are polyketide antibiotics that are decorated with differing numbers of chlorine atoms. These compounds are potent inhibitors of Gram-positive pathogens such as methicillin-resistant *Staphylococcus aureus* (MRSA) and vancomycin-resistant enterococci (VRE). In addition, formicamycins display an incredibly high barrier to resistance, a feature which makes them promising candidates for clinical development. This work shows that many more new compounds remain to be identified from microbial natural products, including those that may prove more effective against drug-resistant infections than existing antibiotics. Furthermore, searching underexplored niches, including the symbiotic relationships between fungus-growing ants, fungi and bacteria is a promising route towards antibiotic discovery.

Can organic soil management practices limit the survival of foodborne pathogens?

Naresh Devarajan and **Daniel S. Karp**
Department of Wildlife, Fish, and Conservation Biology, University of California, USA

Outbreaks of foodborne diseases are often associated with contaminated produce. Responding to recent food safety regulations and pressure from the produce industry, fresh-produce growers have altered their farming practices to mitigate the risks associated with foodborne pathogens. In particular, many individuals within the fresh-produce industry aspire to create sterile, hospital-like growing conditions that limit the risk of pathogens being introduced to farm fields. For example, recent surveys suggest growers have begun to refrain from applying animal-based soil amendments to produce fields, citing food safety concerns.

While raw manures are known to represent a significant source of foodborne pathogens, proper composting techniques (e.g. heat treatments) are known to be quite effective in reducing foodborne pathogen concentrations. They play well-known roles in improving soil health. Finally, recent studies suggest that adding organic matter to the soil may increase the diversity of indigenous soil bacterial communities and, in doing, promote bacterial species that are effective at suppressing foodborne pathogens. Thus, rather than increasing food safety risks, it is possible that animal-based composts could protect soils from foodborne pathogens by bolstering bacterial antagonists. That is, soil bacteria could act as natural biological control agents against foodborne pathogens. However, it remains unclear who the most vital members of the community are and how farmers can recruit/promote them on their farm fields.

To study the cascading effects of soil management on foodborne pathogen suppression in soils, we leveraged the long-term (27-year) 'Century Experiment' at the Russell Ranch Sustainable Agriculture Facility, operated by the University of California at Davis. We compared four soil treatments: (1) organic fields with composted poultry litter and winter cover crops; (2) conventional fields with synthetic fertilisers but no composts or cover crops; (3) fields that included winter cover crops and fertilisers but no composts; and (4) a more recent, three-year-old treatment with composts and fertilisers but no cover crops. In 2019, we acquired soil samples throughout the growing season, when all the one-acre plots were growing corn. We measured the physicochemical properties of each soil sample and used high-throughput sequencing to characterise the bacterial communities. Finally, we conducted pathogen 'bioassays' in the lab, where we inoculated soils with known concentrations of *Salmonella enterica* and *Listeria monocytogenes* and then quantified pathogen concentrations 10 and 30 days later.

Left: *Soil sampling at the Russell Ranch Sustainable Agricultural Facility, UC Davis, CA, USA.*

Right inset: *A field within the 'Century Experiment' at the Russell Ranch Sustainable Agricultural Facility, UC Davis, CA, USA.*

Composts may promote soil bacteria that are especially adept at suppressing foodborne pathogens

As expected, we found that organically managed soils (i.e. soils with composts and cover crops) had more soil nutrients, organic matter and soil moisture compared with conventionally managed soils. Similarly, bacterial communities were more diverse and compositionally distinct from conventionally managed soils. But what about pathogen survival? We found that both *Listeria* and *Salmonella* persistence strongly depended on soil chemical and microbial properties. Most critically, persistence was much higher in soils with bacterial communities more similar to those found in conventional soils. As a result, the survival of both pathogens was lower in organic soils with compost additions, relative to conventional soils. This exciting result suggests that composts may promote soil bacteria that are especially adept at suppressing foodborne pathogens. However, we also found that the differences in bacterial communities between soil management treatments dissipated over the growing season. Correspondingly, we did not observe any difference in pathogen suppression between treatments by harvest.

Looking forward, our findings suggest promising new research directions. First, how long does it take to develop pathogen-suppressive soils? While we expected the more recent 'compost-only fields', to be quite distinct from the long-term 'organic fields', our models did not suggest that bacterial survival differed between the treatments. Thus, it is possible that farmers could enhance the 'pathogen suppressiveness' of their soils over relatively short periods. Second, which bacteria are most important in regulating pathogen survival? Currently, we are attempting to identify the 'key players' through pathogen challenge experiments, in which pathogens are iteratively grown alongside one of >13,000 different bacterial isolates from the most suppressive soils in our study.

Regardless of outcome, our study suggests that properly treated composts may not increase food safety risks and thus can represent a safe, sustainable alternative to conventional fertilisers. Indeed, by enhancing soil quality, building organic matter and adding soil nutrients, composts may promote a shift of bacterial communities and create a less hospitable environment for the foodborne pathogens. Growers could thus consider reassessing the practice of entirely abandoning properly treated animal-based soil amendments, not only for the soil-health benefits but also for the potential improvements to food safety.

FURTHER READING

Devarajan N, McGarvey JA, Scow K, Jones MS, Lee S, Samaddar S *et al*. Cascading effects of composts and cover crops on soil chemistry, bacterial communities and the survival of foodborne pathogens. *Journal of Applied Microbiology* 2021; 131, 1564–1577

Olimpi EM, Baur P, Echeverri A, Gonthier D, Karp DS, Cremen C *et al*. Evolving food safety pressures in California's Central Coast region. *Frontiers in Sustainable Food Systems* 2019; 3, 102

Baur P, Driscoll L, Gennet S, Karp D. Inconsistent food safety pressures complicate environmental conservation for California produce growers. *California Agriculture* 2016; 70, 142–151

Jones MS, Fu Z, Reganold JP, Karp DS, Besser TE, Tylianakis JM *et al*. Organic farming promotes biotic resistance to food-borne human pathogens. *Journal of Applied Ecology* 2019; 56, 1117–1127

Karp DS, Moses R, Gennet S, Jones MS, Joseph S, M'Gonigle LK *et al*. Agricultural practices for food safety threaten pest-control services to fresh produce. *Journal of Applied Ecology* 2016; 53, 1402–1412

Karp DS, Baur P, Atwill ER, De Master K, Gennet S, Iles A *et al*. Unintended ecological and social impacts of food safety regulations in the California Central Coast. *BioScience* 2015; 65, 1173–1183

Karp DS, Gennet S, Kilonzo C, Partyka M, Chaumont N, Atwill ER *et al*. Comanaging agriculture for nature conservation and food safety. *PNAS* 2015; 112, 11126–11131

Microbiome-related aspects of locust density-dependent phase transition

Lavy O, Lewin-Epstein O, Bendett Y, Gophna U, Gefen E, Hadany L, Ayali A *et al*. Microbiome-related aspects of locust density-dependent phase transition. *Environmental Microbiology* 2022; 24(1), 507–516

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https://bit.ly/SfAMEMILocusts

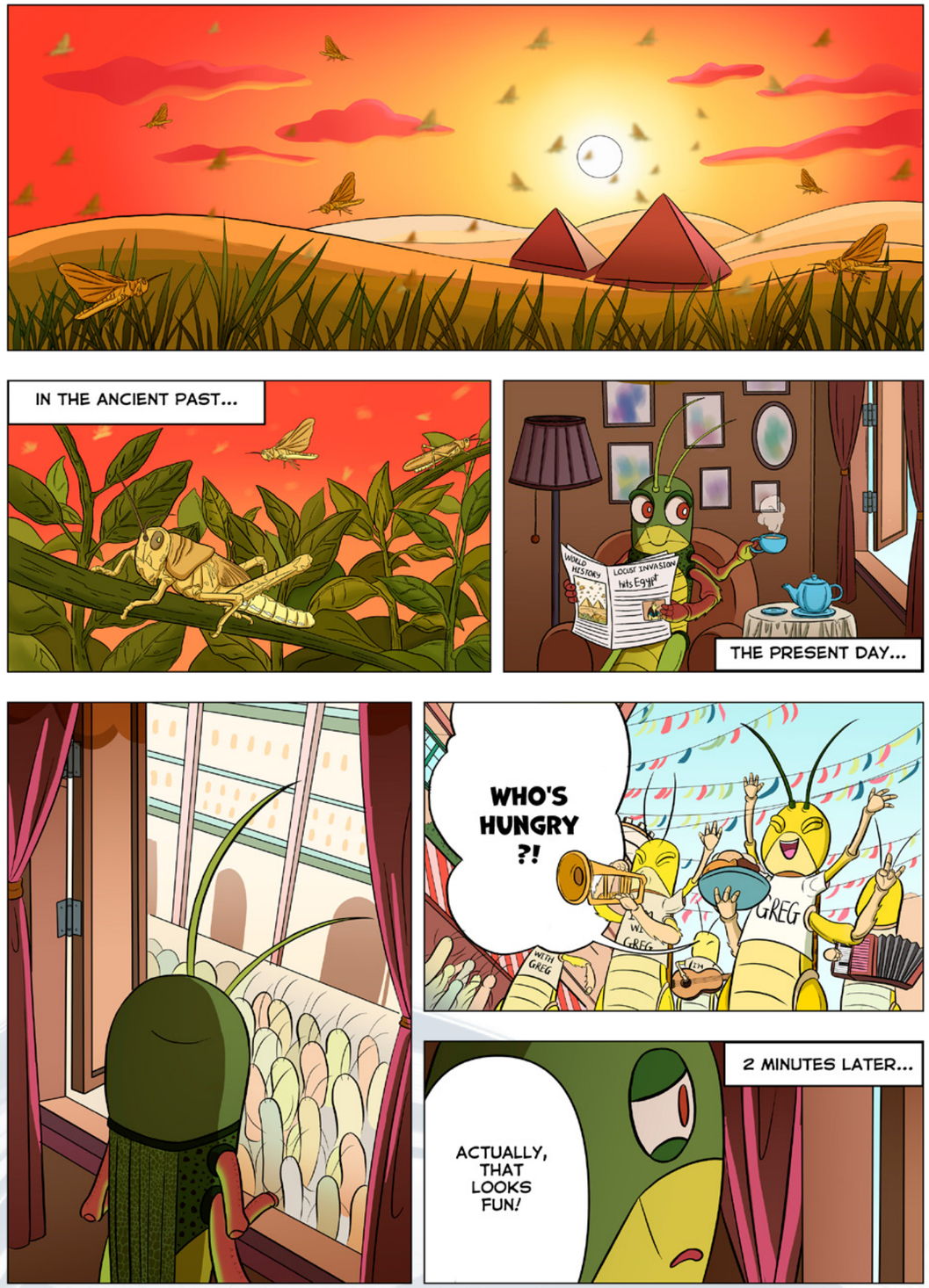
Recent years have seen major parts of the world hit by devastating swarms of the desert locust (*Schistocerca gregaria*). Locusts are known to express two extreme phenotypes. High-density swarms migrate while consuming vast amounts of vegetation and are thus considered a major agricultural pest. At low density, however, locusts tend to be repelled by conspecifics, be relatively sedentary and thus not pose any threat. Ample knowledge has accumulated regarding the multitude of ecological, physiological and molecular density-dependent phase characteristics. Recent reports have addressed microbiome-related differences between gregarious and solitarious locusts. We are, however, at a relatively early stage on our journey towards a complete understanding of this important topic.

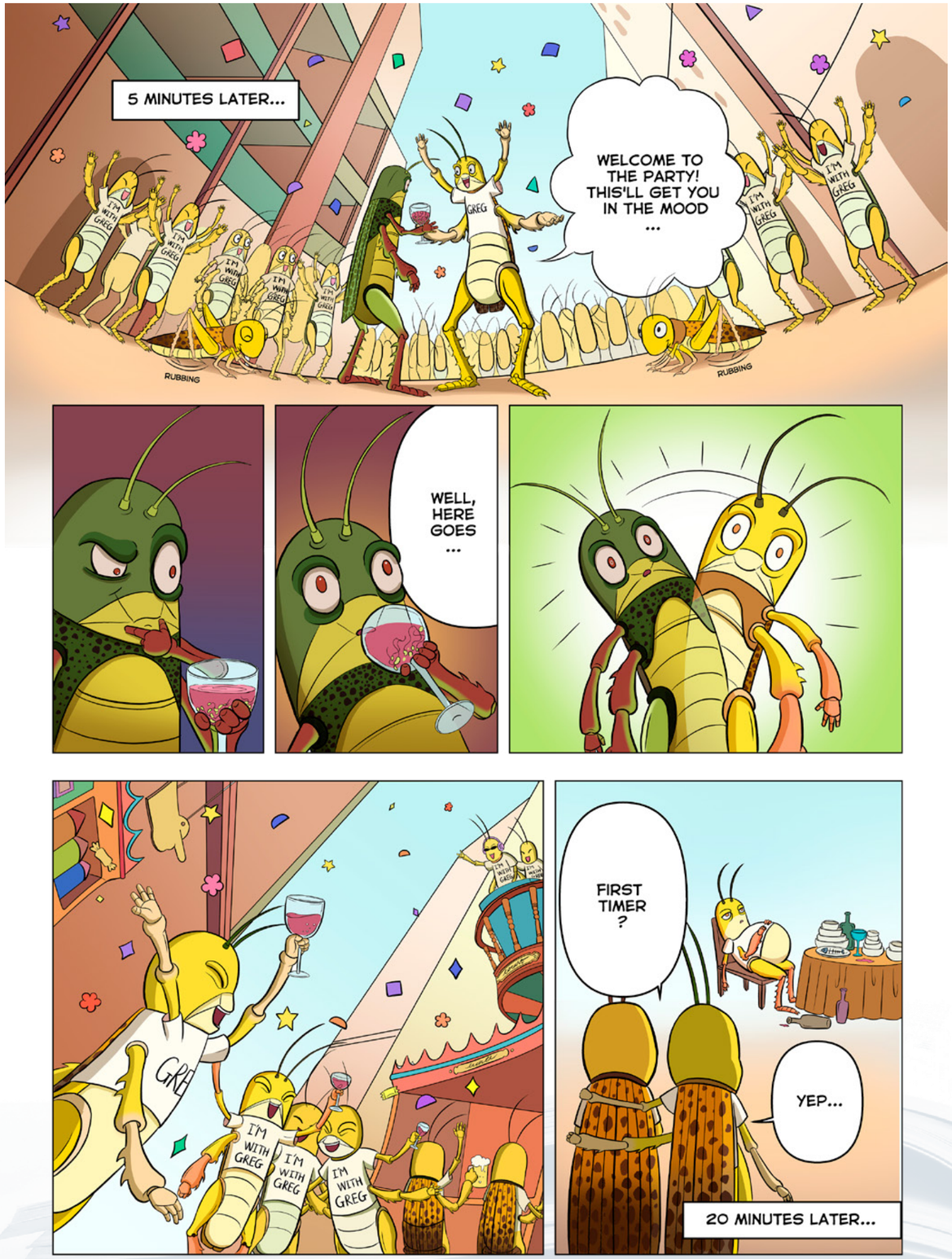
Lavy *et al*. offer new data on the impact of a density-dependent phase shift in the gut and integument microbiota, indicating that upon joining a gregarious population, the gut bacterial composition of solitary-reared desert locusts becomes similar to that of the gregarious phenotype. The most significant change observed was a shift towards a *Weissella cibaria*-dominated composition; *Weissella*, almost completely absent from the microbiome of solitary locusts, became dominant soon after their hosts joined the group. This is in accord with previous reports by Lavy *et al*. regarding temporal dynamics of the bacterial composition of gregarious lab populations of desert locusts. *Weissella* is also widely abundant in the gut of gregarious migratory locusts and was also found to induce aggregation in nymphs of the German cockroach. This raises the possibility that *Weissella* acts as a crowd-promoting bacterium, contributing to the swarm's integrity.

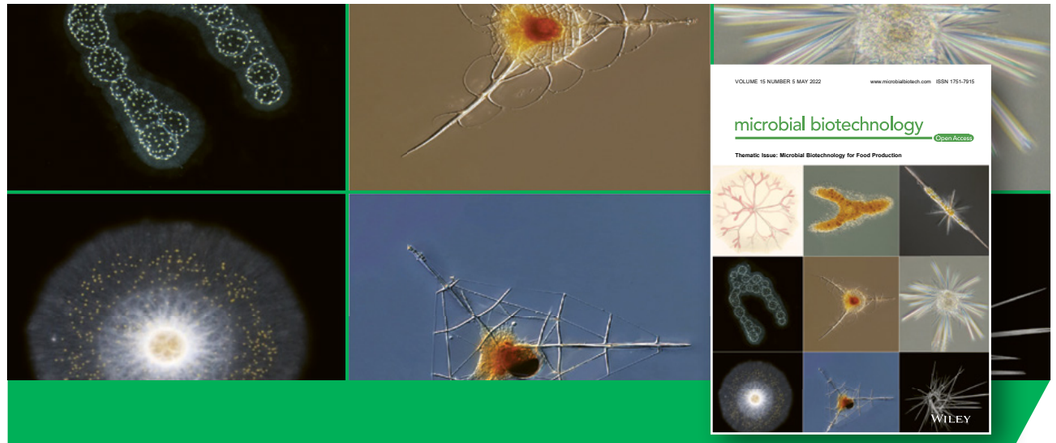
A mathematical model was devised for analysing the conditions that may favour the evolution of microbial species that induce aggregation behaviour in their host. It was found that microbes such as *Weissella*, with an advantage in horizontal transmission, would benefit from inducing increased interaction rates and aggregation in their hosts. This, in turn, would promote locust crowding and could facilitate the locust swarming behaviour.

This is the first report of a previously unknown aspect of locust phase transition, demonstrating that the phase-shift includes a change in the gut and integument bacterial composition. While many questions remain unanswered, the results do suggest that bacteria may play an important role in affecting locust behaviour. This new understanding may open the way to novel directions in the ongoing efforts to battle this ancient and devastating pest.

Amir Ayali
Tel Aviv University, Israel







Microbial Biotechnology

Grapevine virome and production of healthy plants by somatic embryogenesis

Nuzzo F, Moine A, Nerva L, Pagliarani C, Perrone I, Boccacci P *et al*. Grapevine virome and production of healthy plants by somatic embryogenesis. *Microbial Biotechnology* 2022

Available from

https://sfamjournals.onlinelibrary.wiley.com/doi/10.1111/1751-7915.14011

Grapevine is one of the world's most important fruit crops, with 7 million hectares cultivated worldwide in 2020. It is mainly grown for wine production, for fresh and dry fruit consumption and for several social, touristic and cultural activities linked to its cultivation, which are key for generating a positive impact on the economy.

Grapevine can be infected by several pathogens, including more than 80 viral entities that heavily influence plant vigour, yield and fruit quality leading to large economic losses in the whole grapevine agribusiness. In addition to plant pathogens, mycoviruses are widespread in all taxonomic groups of fungi, and the positive or negative effects that these virus-infected endophytic or epiphytic fungi can induce in host plants should be carefully considered.

Somatic embryogenesis (non-zygotic embryo formation from somatic cells) is the most used method for grapevine regeneration following biotechnological approaches, and for the first time we assessed its effectiveness to produce grapevine plants free of mycoviruses, in addition to plant viruses and viroids.

The production of healthy plants from somatic embryogenesis without any viral entity has a practical value, being crucial for reducing the spread of these pathogens in the vineyard. Furthermore, the absence of mycoviruses suggested that the 'biological vacuum' generated by this regeneration technique also involves fungi, resulting in gnotobiotic or pseudo-gnotobiotic plants, thus representing an extraordinary asset to understand the influence of the microbiome on plant growth and physiology.

Giorgio Gambino
Senior Researcher, Institute for Sustainable Plant Protection, National Research Council of Italy (IPSP-CNR) Torino, Italy

AN INTERVIEW WITH

Duncan Ewing

Duncan is a PhD student at the School of Medicine, University of Leeds and funded by the SfAM Basil Jarvis PhD Studentship.

Applications for the 2023 PhD Studentship will open on 1 July 2022.

You previously worked as a lab technician for the university – what made you want to do a PhD, and why gut dysbiosis?

I enjoyed the challenges that came from the day-to-day running of research projects and the experience and confidence I gained whilst working as a research technician made me want to pursue a greater degree of autonomy with my work.

Doing a PhD seemed like an excellent route to developing and expanding my research skills, as well as an opportunity to conceptualise my own project.

I think what I find most appealing about the gut microbiome and dysbiosis is how little we currently know about it. We are beginning to see how deeply linked our health is to our resident microbiota. We know that antimicrobials have the potential to impact the microbiome beyond their target organisms and that this can cause negative side effects for the patient. I think understanding the functional impacts that antimicrobials have upon a patient's microbiome will be an important step in the personalisation of healthcare.

In terms of the main biomarkers of gut dysbiosis, are these just bacterial or are you looking for specific compounds or other changes?

I am investigating the impacts that antimicrobials can have upon the intestinal microbiome; because the models I'll be using are aimed towards studying the impacts that antimicrobials can have upon the microbiome directly, they will predominantly be bacterial.

We know that there are certain metabolites that are important in the prevention of opportunistic pathogen growth such as the presence of the bile acid cholate in initiating *Clostridioides difficile* infection (CDI).

My initial analysis will involve semi-targeted metabolomics searching for the presence of previously identified markers such as cholate, as well as hopefully identifying additional biomarkers depending on antimicrobial exposure and disruption to the microbiome.

Are there particular antimicrobial treatments or infections that are more strongly linked with gut dysbiosis?

CDI is strongly associated with certain broad-spectrum antimicrobial treatments such as clindamycin. We also see that the treatments used to manage the initial CDI instance can, in turn, damage the gut microbiome further, leading to recurrences. We are also beginning to see links drawn between gut dysbiosis and conditions such as colorectal cancer, Crohn's disease and ulcerative colitis.

The gastrointestinal (GI) tract is a complex system – how do you go about modelling the gut in a lab setting?

Interactions between host and microbiome are complex and bidirectional. Compounds ingested by the host such as foods or pharmaceutical drugs can have direct and indirect impacts on the microbiota.

In my project I am initially screening for biomarkers using *in vitro* models of the human intestine. We can capture and seed the models with bacterial populations from faecal material and examine the effects caused by antimicrobials directly on the microbes. While they cannot model host factors such as immunological or secretory events, they do provide us with a highly microbiologically reflective model of the human gut.

The models I am using consist of a triple-stage chemostat with conditions representative of different points along the human colon with different environmental and nutrient conditions. Our lab has been using and refining these models of the human colon for several years and they have been shown to be clinically reflective of CDI and colonisation and expansion by carbapenemase-producing organisms.

The advantage of modelling the GI tract in this fashion is that it allows for longitudinal studies to take place where we can see how the microbiome changes over time in response to antimicrobial therapy as well as examining how the microbiome changes within the different environments along the GI tract, which are not as easily accessible in other model types.

By studying the microbiota in isolation this removes potential cause-and-effect dilemmas, which may be present in *in vivo* animal models, as well as minimising ethical concerns.

People might be familiar with the concept of gut dysbiosis, yet not so much with all the effects it can have on the body. What are some of these effects, and do you think the consequences of gut dysbiosis are fully understood?

Our resident microbiota act in symbiosis with various systems in our body to maintain homeostasis. We know that when in a healthy state our microbiota acts to provide a level of competitive exclusion to exogenous microorganisms that could be detrimental to our health, as well as preventing the expansion of minority species in the gut, which could potentially cause health issues to the host. Our microbiota also contributes to the conditioning and regulation of our immune systems. During dysbiosis, when the microbiome balance is disrupted, these functions can fail, leading to functional GI disorders.

I think we have started to realise the level at which we rely upon the microbiome for our health; however, due to the uniqueness of the microbiota between individuals we have a way to go when it comes to understanding the mechanisms by which different components of the microbiome come together functionally.

If clinicians had a clear idea of the biomarkers for antibiotic-induced dysbiosis, what effects do you think this would have on clinical practice?

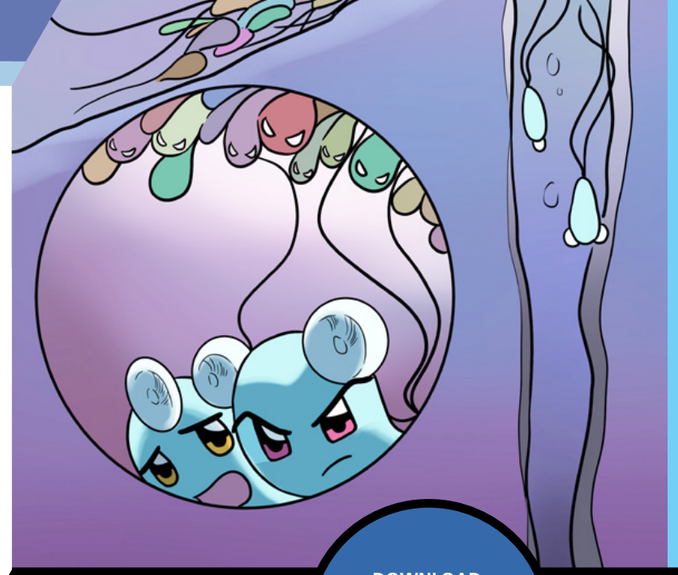
Understanding cause and effect of antimicrobial treatment is important for our intestinal health. I'd like to think that in the future, biomarkers could potentially be used to de-risk the side effects of antimicrobial prescription for patients. If we can identify certain biomarkers as being indicative of a patient's gut microbiome status, this could influence antibiotic prescription choices (e.g. more targeted antibiotics being used, or a different route of delivery) to preserve or spare the microbiome from further assault, whilst the antibiotic is still clinically effective.

Have you made any major findings you can share with us to date?

In our initial observations, clinical antimicrobial prescription practices often involved prescribing combinations of antibiotics or multiple sequential antibiotic treatments. This, unsurprisingly, is correlated with reduced diversity of the microbiota, putting these individuals potentially at increased risk of colonisation or disease with *C. difficile* or other organisms.

With our initial experiments we modelled these prescription practices in our *in vitro* system and noted fundamental changes to the microbiome. Even after 5 weeks without antibiotics and total levels of bacteria returning to levels seen before antimicrobial instillation, the microbiome failed to re-establish effective colonisation resistance when challenged with multiple opportunistic pathogens. I believe this supports the idea that to fully understand the microbiome and its contribution to human health, we need to move beyond describing the microbiome and dysbiosis through the metric of population dynamics and begin to explore it as a collection of potentially functionally distinct pathologies.

Using manga comics to spread microbiology literacy amongst schoolchildren



Sarah Wettstadt [1] and **Nicky Williams** [2]

1 *MicroComms, Berlin*

2 *Alzheimer's Research, UK*

DOWNLOAD
THE FULL COMIC HERE
https://bit.ly/SfAMVibbyandRio

Microbiology affects our daily life, be it the food we eat, how we wash our hands, which means of transport we use, whether or not we get vaccinated, or what the weather might look like. However, as a science communicator, I am awfully aware that these complex interactions are not clear to everyone. Sometimes it seems as if only microbiologists really appreciate microbes and their activities. Yet, our society faces many global crises concerning microbes and microbe-related topics, such as antimicrobial resistance, the COVID-19 pandemic and climate change.

We need to increase microbial literacy in our society

I am convinced that if every world citizen had a basic understanding of microbiology, many solutions would face less resistance, and many experts from the field are of the same opinion. In 2019, Timmis *et al*. wrote that 'microbiology literacy must become part of the job description of adults'. As you can imagine, when Ken Timmis, the lead author of that very study, reached out and asked me whether I wanted to participate in the Microbial Literacy Initiative, I just had to say yes!

The initiative focuses on increasing microbial understanding in society. One way to achieve that would be to make microbiology part of basic education and thus the school curriculum. Currently, school subjects like languages, history, geography, mathematics, physics, chemistry and biology are considered essential pillars of a child's education. However, basic understanding of microbes and their activities should be as essential to the general education as these subjects. This is why the Microbial Literacy Initiative envisions microbiology curricula for kindergarten, primary, secondary and high school as well as adding these curricula to a teacher's training.

Finding engaging ways to create microbiology-literate world citizens

To engage children and teenagers with the exciting microbial world, we need to wrap microbiology knowledge into engaging and exciting stories. This is especially important since we cannot directly see microbes and their activities. Hence, for a child or teenager, it is difficult to imagine that an invisible player would do all these extraordinary things. This is why the Microbial Literacy Initiative focuses on using science art, gamification and hands-on experiments to showcase microbial activities. These materials will support the teacher's task of telling stories about microbial players. Even though there are plenty of educational materials available online, they do not cover enough detail, are inaccessible for certain age groups or convey wrong messages. Hence, one major task of the Microbial Literacy Initiative is to not only mine the web for acceptable microbial art works, but to also create new ones.

Supported by SfAM's Outreach and Engagement Grant, science artist Nicky Williams and I wanted to create

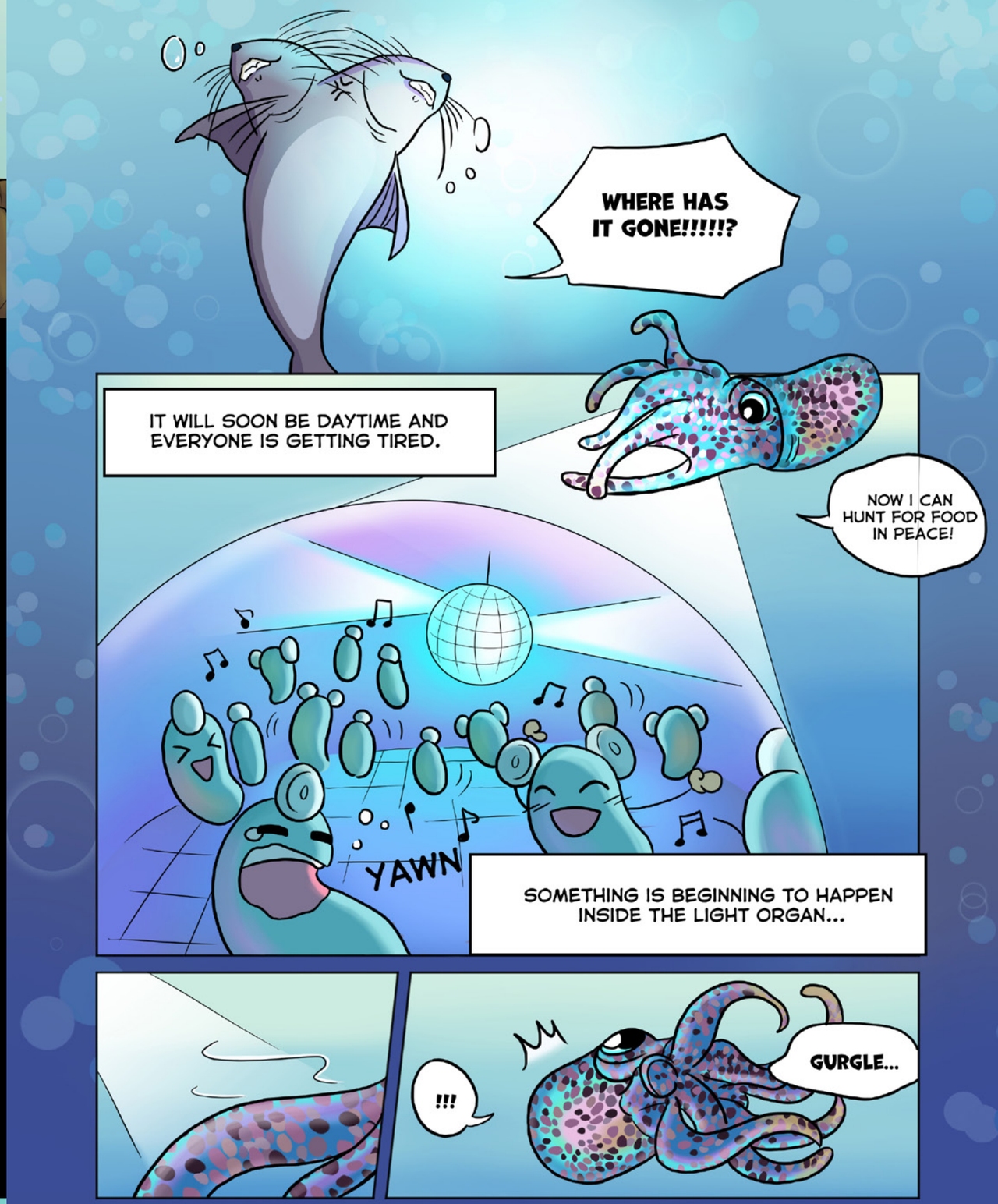
a piece of science art based on a storytelling approach. We decided to pick a topic that would be interesting for children and could be depicted in a fun and engaging story. Using colourful comics to convey scientific information is a widely recognised technique in communications and I have been using it profoundly to explain bacterial topics. Nicky, on the other hand, is a big fan of manga comics, which is why the majority of the illustrations in our comic are strongly influenced by this style. In Japanese, *manga* means 'comics', literally translating as 'whimsical drawings' or 'pictures running wild'. Manga comics are a staple of Japanese pop culture and are taking over shelves in Western bookshops too! Since manga comics are so popular amongst younger teenagers and children above the age of 9, we chose the age group of 9–13 years as our target audience.

Together, we decided to create a comic about how the bacterium *Vibrio fischeri* uses bioluminescence by quorum sensing to help the Hawaiian bobtail squid. The aim was to explain this bacterial concept by presenting bacterial players – yes, we called them Vibby and Rio – with real personalities, wishes and problems. The story would then evolve around how their bacterial superpowers helped to solve their issues.

The storytelling approach we chose consists of a so-called 'hero's journey', so we decided to challenge our bacteria with relatable problems. We show how our two main bacteria have to fight other microbial players to survive, look for a safe place to live and also help the squid find food. After they had overcome their struggles, we wanted to reward our heroes by showing how they enjoy their home within the squid. This triggers the bacteria to grow and reproduce, which further results in quorum sensing and bioluminescence.

All of these concepts were creatively drawn and filled with lots of vivid colours and the expressive manga style really brought our microbial characters to life. The comic, in its manga style, with big eyes, exaggerated expressions and dynamic poses in a complex storytelling approach, is sure to engage children and younger teenagers. Teachers will be able to use this comic in the classroom or in online teaching environments to help convey the beauty of the microbial world. A small step in creating microbiology-literate people!

> The storytelling approach we chose consists of a so-called 'hero's journey'



Every strain has a story

NCIMB's CEO Carol Phillips will be retiring in the summer, and we were keen to find out more about her plans and if she had some career guidance for our members.

The most common question I get asked right now is *You seem very young to be retiring – what was your career path?* I do consider myself very fortunate to be able to retire early, and now that restrictions are lifting, I am going to be travelling with my husband in our expedition vehicle.

I have thoroughly enjoyed my working life – my first job after university was at the Dunstaffnage Marine Laboratory (now SAMS). I was very fortunate to be able to study for my PhD while working there, on impacts of aquaculture in marine sediments. After my PhD I moved to the University of Aberdeen to work with Professor James Prosser on nitrifying bacteria – it was a tough job, which involved field trips to the Mediterranean Sea, my first international conference, which was in Brazil, and a placement at the Centre for Microbial Ecology in Michigan – how lucky was I? At the end of my postdoc I changed path and went into the commercial side of science, as a business development manager with NCIMB. Enjoying the business side of science, but still keen on research, I was delighted to then join the two in a post as a technology broker with Heriot-Watt University, looking for commercialisation opportunities from research. From there, I went back home to Shetland as a business development manager for the North Atlantic Fisheries College. I then came full circle and returned to NCIMB, where I am now the CEO.

I never thought I would be able to travel and explore so much of the world through my work, or meet and work alongside so many amazing people. Looking back, it seems like I had a structured career path – undergraduate, PhD, postdoctoral research, commercial – but I didn't really set out with a plan. At school I knew I wanted a career in science but by the time I finished my undergraduate studies I was overwhelmed with the different paths available. I have been very lucky that when one stage was ending, a new opportunity was waiting. I think having goals is important, but you also need to be flexible and willing to explore new things – you never know where it might take you.

I love being practical, whether that is field work or being at the bench – although I don't get much chance these days, as it is mainly spreadsheets (my next most favourite thing) that occupy my days. Our motto at NCIMB is 'we love bugs' and that sums it up really. I just love how microorganisms are so versatile – they are always adapting and evolving, and we would not be able to function without them. Working at NCIMB, I have never stopped being fascinated by all the locations and sources the strains in our collections have come from – every strain has an amazing story. I also love that while we can delve into the genomes of microorganisms with state-of-the-art next-generation sequencing, there is still a need for traditional bench-based microbiology to really understand how they perform, and to store and protect them for future generations of microbiologists. Sharing my passion for microorganisms with those up-and-coming microbiologists, and seeing how enthusiastic they are, is great fun – I loved delivering the Aberdeen Microbiology Annual Schools Lecture a few years ago.

A wonderful aspect of my career has been all the amazing people I have worked with and been supported by, and I will really miss my work colleagues – not only in NCIMB but in the other organisations I have been fortunate to collaborate with. I am delighted that I have been able to remain connected to SAMS all through my career, whether through working collaborations or participation in its governing boards and audit committees. I have been very lucky to have had the chance to sit on some external committees, which has allowed me to meet, and work alongside, even more inspirational and very talented people. As well as SAMS I have participated in SfAM, IBioIC, One Life Science, North of Scotland KTP Centre and CCAP steering committees.

It is an exciting time right now, not just for me but for NCIMB, as the company is also moving this summer. It's another huge milestone and the new purpose-built laboratory building will open up some amazing opportunities. This year we also celebrate our 40 year anniversary as a private company, with the culture collections themselves celebrating their 70th birthday two years ago. Being a limited company is an unusual status for a culture collection – but this has allowed the expansion of the range of services offered, so NCIMB is no longer dependent on public funding. We have been having fun as we prepare for the move, looking back in the archives and at the photographs of the many microbiologists that have been part of NCIMB's journey over the decades. I am so proud to have been part of that journey. Our new CEO will join us in June and I am really excited to see where NCIMB goes from here.

Above: *Cleaning up after a day collecting sediment cores for my PhD at Dunstaffnage Marine Lab.*

Right: *Our home on wheels for the next few years. After retirement my husband and I plan to travel the world in our expedition vehicle.*

Carol Phillips
CEO NCIMB

LONDON'S MICROBIOTA

In 1594, Gray's Inn Hall hosted the first performance of Shakespeare's *Comedy of Errors*. The Hall (rebuilt after wartime bombing) can still be found in South Square, Gray's Inn, a peaceful and secluded space it shares with a statue of Sir Francis Bacon (1561–1626). I assume the juxtaposition is coincidental since the theory that Bacon was the true author of Shakespeare's plays is now largely discredited. He was in fact an eminent lawyer, statesman and pioneer of scientific thought who had lived and studied in Gray's Inn. It does appear, however, that at the very end of his life he became an unacknowledged martyr in the cause of food microbiology.

FROZEN BACON

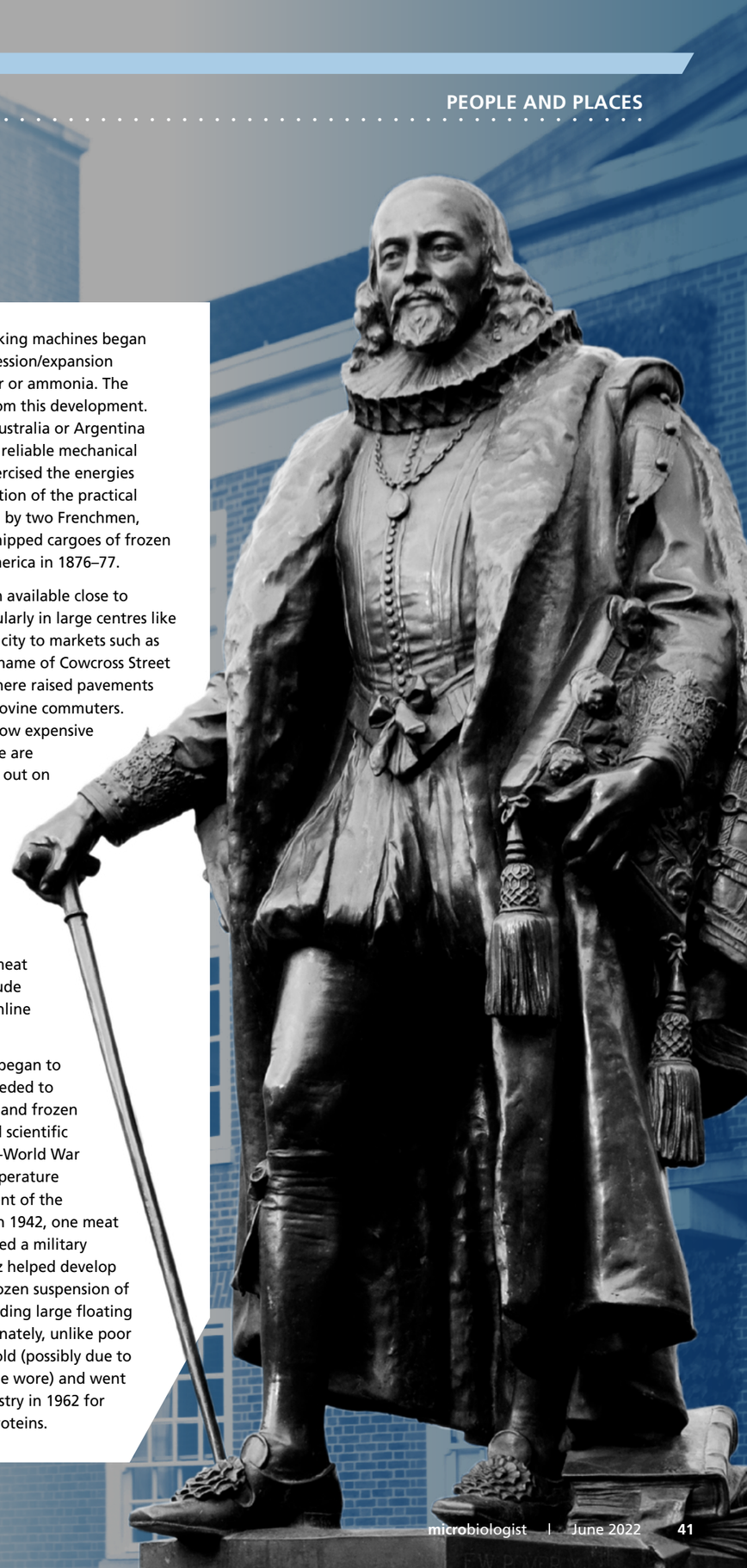
At the time of his death in 1626, Bacon was five years into an enforced retirement following charges of taking bribes from litigants, an accusation he admitted though he defended himself by denying that the bribes had ever influenced his decisions. On a cold April day he was near Highgate Hill on a coach ride with the King's physician, Dr Witherborne, there was snow on the ground and, according to John Aubrey, writing in *Brief Lives* 50 years later, Bacon wondered 'why flesh might not be preserved in snow as in salt. They were resolved they would try the experiment…'

To this end, they bought a hen from a woman living nearby, who killed and gutted it and Bacon helped stuff the carcass with snow. According to Aubrey, 'The snow so chilled him that he immediately fell so extremely ill, that he could not return to his lodgings' and he was taken to the Earl of Arundel's house nearby where he was put in a damp, unaired bed in which he died of pneumonia 2–3 days later.

Understandably in view of this turn of events, there seems to be no record of how the experiment turned out, but what is perhaps surprising is that they considered it necessary to perform in the first place. It seems that in this country we may have been a little late to the party; the beneficial effect of low temperature on the keeping quality of perishable foods had been widely known and used since antiquity by inhabitants of colder climes – two of many examples being the transportation of fish from northern Europe to Rome, packed in ice and wrapped in insulating furs, and the traditional production of freeze-dried potatoes, *chuño*, in Peru. These practices were based on empirical observations; we now know that low-temperature preservation operates largely through its effect on a product's microflora – slowing or arresting its growth. Chill conditions allow only the relatively slow growth of psychrotrophic and psychrophilic microorganisms, which eventually dominate and determine the type of spoilage seen. Freezing stops all microbial growth by a combination of temperature and reduced water activity.

The main obstacle to wider use of low-temperature preservation was its dependence on natural ice. In areas where it was sparingly available the benefits were largely enjoyed by the wealthy who could store ice throughout the year in the must-have accessory of the time, a subterranean ice house. In England these were introduced from around 1660 and by the 18th century had become a common feature of grand country houses. An early commercial ice store in London was rediscovered in 2018 under Park Crescent, a Nash terrace south of Regent's Park. Built around 1780, this brick-lined, egg-shaped excavation, 7.5 metres wide and 9.5 metres deep, was found just 8 metres from the tunnels of the Jubilee Line. Initially it stocked locally sourced ice but following a mild winter in 1822 the owner, William Leftwich, began to import ice from the frozen lakes of Norway, part of a profitable international trade in natural ice that reached its peak in the 19th century.

Martin Adams
SfAM President 2011–2014



It wasn't until the 1830s that ice-making machines began to be patented based on the compression/expansion of air or volatile liquids such as ether or ammonia. The trade in fresh meat stood to gain from this development. Meat was considerably cheaper in Australia or Argentina but its transport to Europe required reliable mechanical refrigeration plant on ships. This exercised the energies of a number of engineers but a solution of the practical difficulties was finally demonstrated by two Frenchmen, Tellier and Carré, who successfully shipped cargoes of frozen meat between France and South America in 1876–77.

Previously, fresh meat had only been available close to slaughter and was expensive, particularly in large centres like London. Cattle were driven into the city to markets such as Smithfield and traces remain in the name of Cowcross Street and on Liverpool Road, Islington, where raised pavements were built to separate human and bovine commuters. But I imagine that the denizens of now expensive residences in nearby Lonsdale Square are pleased they no longer have to look out on to cattle-holding pens.

The disagreeable sights, sounds and smells associated with the driving, slaughter and butchering of large numbers of animals in the close confines of Smithfield made for a particularly unpleasant ambience. In 1855 it became a market for cut meat only, and was rebuilt in 1868 to include an underground railway link to mainline railway stations.

In the following decade, Smithfield began to acquire the cold storage facilities needed to handle increasing imports of chilled and frozen meat. The cold stores also supported scientific research in the form of a small, post-World War II branch laboratory of the Low Temperature Research Station (a distant antecedent of the Quadram Institute). A little earlier, in 1942, one meat store 'five floors underground' housed a military project in which a young Max Perutz helped develop a secret new material 'pykrete', a frozen suspension of wood pulp in water suitable for building large floating airstrips. It was never used but fortunately, unlike poor Francis Bacon, Perutz survived the cold (possibly due to an electrically heated aviator's suit he wore) and went on to win the Nobel Prize for Chemistry in 1962 for work on the structure of globular proteins.

BioFocus

Halfway to normal

We're now halfway into 2022 and hopefully all looking forward to a semblance of normality this summer for the first time in two years. The biosciences sector has been remarkably resilient, and as we turn a page in the pandemic, we can hope to increase focus on the many other global challenges we face.

With this in mind, the theme of this year's Links Day is Science and International Collaboration. Politicians, policymakers, scientists and sector leaders will come together to discuss the latest opportunities for networking and partnerships within STEM, as well as the challenges and barriers that still need to be addressed.

Taking place at the end of June, this year's Links Day will be returning as an in-person event at Portcullis House and we are excited to see familiar faces as well as those joining us for the first time. The event has been one of the biggest pan-science events in the Parliamentary calendar over many years, and we remain grateful for all of the support and participation of SfAM in making the event a success.

We're also gearing up our support for the plant health community by building on the successes of our previous meetings and conferences. This year we have received support from DEFRA to run a three-year series of plant health events aiming to develop the diverse community involved in UK plant health capability, capacity and resilience who are drawn from across academia, business and regulatory agencies.

Our first event in March covered the new GB Plant Biosecurity Strategy, and attracted an online audience of nearly 200 people. The event featured a presentation by UK Chief Plant Health Officer Professor Nicola Spence CBE FRSB, who delivered a whistle-stop tour of previous successes in promoting and defending plant health as well as future challenges the new strategy will aim to address.

More events will be taking place throughout the year, and I invite any microbiologists with an interest or expertise within plant science to join the conversation.

Mark Downs CSci FRSB
Chief Executive of the Royal Society of Biology

In May, we held our AGM – again the first in-person event of its kind since 2019. We had an opportunity to thank our previous president, Professor Dame Julia Goodfellow FRSB for her great dedication, commitment and inspiration during her time leading the Society.

Our new president will be Professor Sir Ian Boyd FRS FRSB, and we look forward to working closely with him and with member organisations during his four-year term. Sir Ian is a marine and polar scientist and was previously Chief Scientific Adviser to the UK government on food and the environment. He is the current chair of the UK Research Integrity Office, a professor at the University of St Andrews and his breadth of expertise and interests signal many areas we know are of importance for our members and where we can aim for impact.

In May, we also created an opportunity to celebrate higher education institutions and students at our Degree Accreditation Awards Ceremony, alongside our 2022 Accreditation conference.

The ceremony provided the moment to congratulate students who had been recognised as top in their cohort from 2020 through to 2022. Those attending the conference found it informative and as interesting as ever, and the awards evening was a welcome celebration and a chance to look forward as well as remember the recent challenges.

Reflecting the mixture of in-person and online formats we can now adopt, we will be back online for our next Policy Lates event, taking place on the 19 July 2022.

Our Policy Lates continue to showcase relevant and timely discussions led by experts in the field, and this topic definitely draws thinking at scales from micro to macro. A panel of experts will be discussing how One Health could help prevent pandemics, and I invite all those interested to register to join via our website.

Our new president will be Professor Sir Ian Boyd FRS FRSB, and we look forward to working closely with him

SfAM sponsor their first Daphne Jackson Fellowship

When the Policy Team attended their first Daphne Jackson Trust Research Conference in 2019, we were overwhelmed by the countless stories of struggles faced by researchers who had undertaken career breaks when trying to return to their profession.

Despite persevering through personal obstacles to be able to work in research again, they faced numerous barriers to entry, such as needing to obtain experience in new techniques in their field or finding flexible employers willing to hire someone with a gap in their CV.

We couldn't anticipate all the obstacles that returners faced, but the Daphne Jackson Trust could and did. The Daphne Jackson Trust, founded by Professor Daphne Jackson – the UK's first female Professor of Physics based at the University of Surrey, was designed to provide fellowships, mentoring and support for researchers who want to return to research following a career break.

During her career, Daphne realised that women who took career breaks to have a family were lost from academic research, with no way to return, so she started a fellowship scheme to address that. Since then, over 450 fellowships have been awarded and the scheme is open to anyone who has taken a career break from research for family, health or caring reasons.

A career break can have huge implications for a researcher's career. When looking for new positions after a break, many find themselves lacking confidence and are often in competition with applicants who have recent publications and more up-to-date technical skills. Daphne Jackson Fellowships provide a unique opportunity to address that by offering a route back into research, providing personalised support, part-time hours and 100 hours dedicated to retraining during the fellowship. All fellowships are part-time (0.5 FTE) and range from two to three years in length. At the end of a Daphne Jackson Fellowship, fellows have regained confidence in themselves, gained up-to-date experience and retrained in their own field. Seven out of ten Daphne Jackson Fellows work in their first-choice job or career after their fellowship, and 9 out of 10 stay in research or teaching for at least five years after finishing.

Applicants to the Daphne Jackson Trust typically have a PhD or equivalent research experience with some postdoctoral training; however, this varies significantly. Some applicants have very little, if any, postdoctoral experience, whereas others have many years' experience leading research groups or laboratories. Each applicant is supported by a dedicated Fellowship Advisor who guides them through the process. All proposals undergo rigorous technical review before being assessed by an independent Daphne Jackson Trust Awards Panel. The Daphne Jackson Trust works with sponsors such as UKRI, universities, charities and learned societies, who provide funding for each fellowship. The Trust currently has over 60 fellows in place around the UK.

After hearing the myriad of ways that the Trust supported and encouraged returners, we knew that we wanted to collaborate with them, and the Executive Committee subsequently agreed to support a fellowship. In adherence with SfAM's values in equality, diversity and inclusion (ED&I), a panel of SfAM committee and staff members sifted through anonymous applications to agree on the candidate who we felt could benefit the most from our support and who proposed the most relevant microbiology research topic. In addition, we also researched the potential candidates' host institutions to ensure that the host university upheld SfAM's ED&I values. After all, the host institution's values play a significant role in the success of the fellow and their research.

This year, SfAM is proud to have collaborated with the Trust to sponsor their first Daphne Jackson Fellowship, which was awarded to **Dr Banaz Star-Shirko**. Prior to her career break, Banaz completed an MSc in genetics and a PhD in microbiology in Iraq, where she also worked as a lecturer before moving to the UK. Banaz completed an MSc in microbiology in the UK before extending her career break to care for her family.

Banaz's fellowship is hosted by the London School of Hygiene and Tropical Medicine (LSHTM) under the supervision of Dr Ozan Gundogdu. During her fellowship, Banaz will apply next-generation sequencing and bioinformatics to investigate the impact of *Campylobacter* on the chicken gut microbiome. She will also explore the use of natural antimicrobials on *Campylobacter* and mechanisms of inhibition. Banaz will be working closely with the Agri-Food & Biosciences Institute (AFBI) and Moy Park during her fellowship to ensure the results of her research are used as widely as possible.

Wanting to ensure her research is widely available is already a testament to the value that Banaz and her fellowship bring to microbiology. SfAM will be continually looking for ways to support and involve Banaz in the Society throughout her fellowship and we can't wait to see the outcome of her research. We also hope this fellowship encourages our members who have been on a career break, or faced adversity in pursuit of microbiological research, to keep pursuing their passion and take advantage of all the resources SfAM offers to all members, regardless of their personal characteristics or stage in their career. More information about the Daphne Jackson Trust and their fellowships can be found at **https://daphnejackson.org/**.

Lisa Rivera
Policy and Public Affairs Manager

POLICY AND PUBLIC AFFAIRS

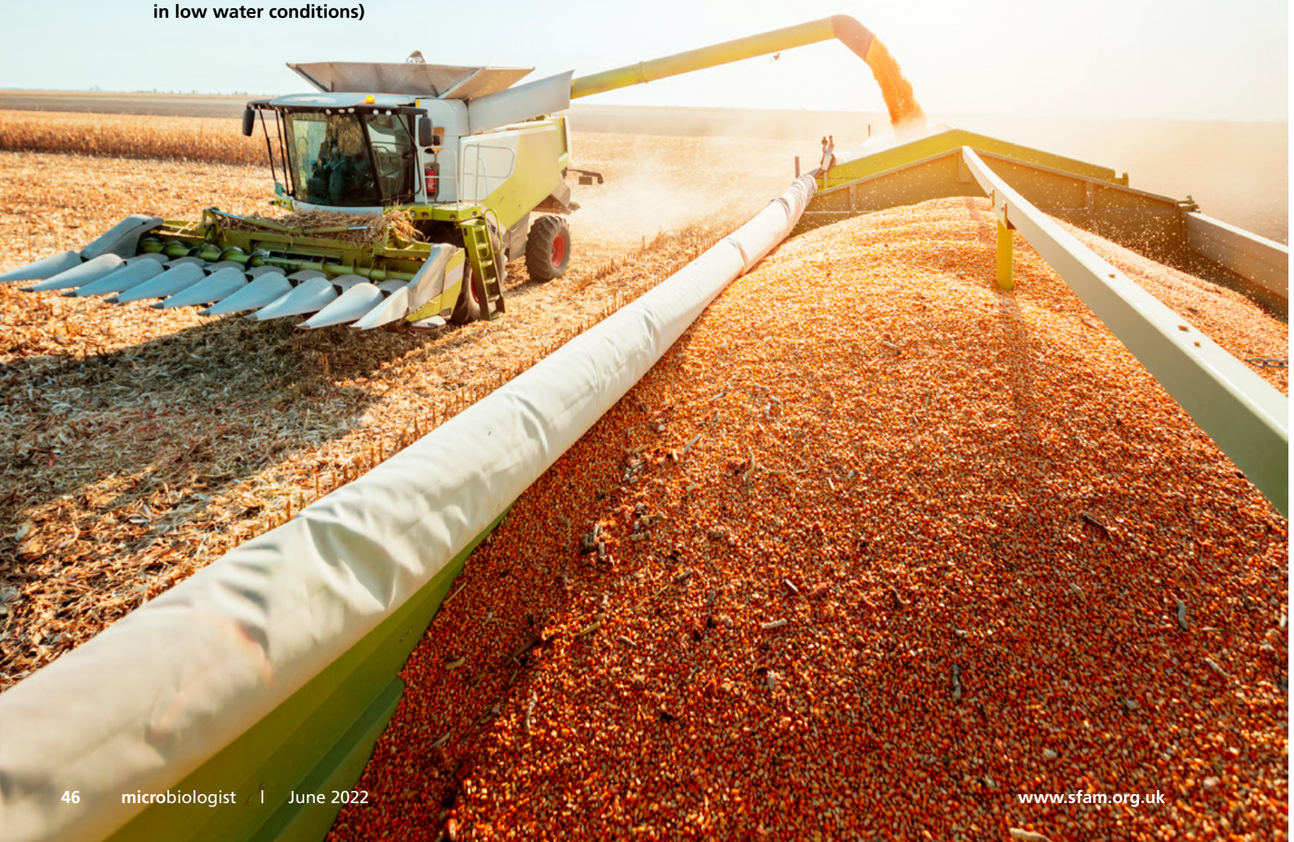
INTERNATIONAL FOOD SECURITY EXPERTS NEEDED

SfAM's Policy Team are initiating the next policy brief in their Food Security series focusing on primary food production. As the brief will be a global comparison, we're particularly keen to hear from experts on food production in Nigeria, America and India.

Suggested areas have included, but are not limited to:

- **New methods (e.g. aquaponics, controlled environments, urban farming)**
- **Alternative systems (organic, antibiotic-free)**
- **Plant and soil microbiomes: impact on food safety risk and as a target for intervention**
- **Effect of climate change (e.g. zoonoses, agriculture in low water conditions)**

If you or someone you know are interested in contributing, please contact the Policy Team at **Policy@sfam.org.uk**. This will be an opportunity to contribute to the Society's policy work and your name will be listed as a contributor in the final brief and any subsequent engagement.



NEW MEMBERS OF THE SOCIETY JUNE 2022

China
S Wang

Egypt
D Raie

Ireland
R Rattigan

India
R Jobby

Nepal
T Ghimire
R Parajuli

Nigeria
O Aina
K Arowolo
J Idomeh
E Ngbede
I Okonko
I Olorunshola
A Oyedele

Peru
J Ramos Gorbeña

Poland
J Kwiecinski

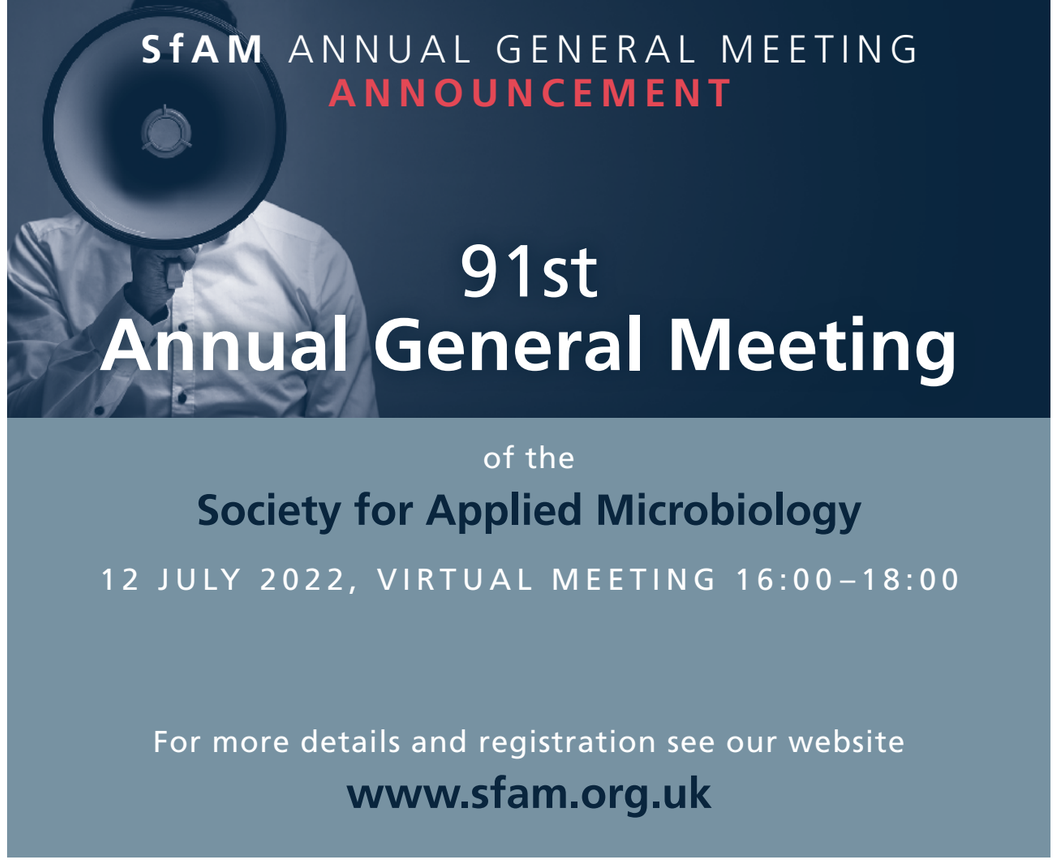
Sweden
P Lindblad

South Africa
A Amoo

Uganda
T Kayondo

United Kingdom
A Adelugba
B Arakal
R Bashiri
K Baxter
R Bayliss
A Beaton
B Bottura
J Bowman
A Campey
L Chatterley
M Clapperton
G Cooper
J Croxford
C Dane
W Davis Birch
R Devine
K Ebrahimi
M Enright
E Ezra
C Falagan
K Fung
P Garofalo
E Giotis
H Goldswain
B Grey
R Harper
T Heaver
S Hegde
C Heys
K Jones
L Langridge
K Lavender
A McBain
Y Meeda
S Naseeb
A O'Riain
B Pander
K Ralebitso-Senior
A Rikly
E Roberts
K Rodgers
R Shears
A Singer
H Suresh
S Trendell
S Umoren
K Wasmund
A Welgamage Don
R Wilkinson
D Wilkinson
M Xiromeriti
M Yilmaz
W Zhou
M Holtz
M Seto

USA
M Junkel
C Su-Morrill



The latest news, views and microbiological developments

The clearcut standard in serotyping

Distributed in the UK by BioConnections the SIFIN range of slide agglutination sera is the only commercially available range of antisera manufactured using monoclonal antibodies (MAbs).

Using MAbs provides a number of advantages over traditionally produced polyclonal sera:

- Each MAb consists of a homogenous antibody population with regard to immunoglobulin class, specificity, avidity and stability. These key features are preserved at all stages of the manufacturing process.
- MAbs can be standardised to give reproducible antibody concentrations and thus minimise batch to batch variation.
- MAbs are free of accompanying antibodies preventing unspecific agglutination.
- In view of animal welfare considerations the production of MAbs does not depend on immunoserum donor animals.

Using SIFIN for your slide agglutination sera gives clearcut results in the laboratory:

- Fast and strong agglutination.
- 100% specificity.
- No accompanying antibodies to cause cross reactions.
- Long product shelf life.
- Sera for *Salmonell*a, *Shigell*a, *Yersinia* and pathogenic *E.coli*.

To find out more about the growing range of SIFIN sera and how they can help in your laboratory testing please visit the BioConnections website, alternatively contact us by email or by telephone.

Further information

Visit: www.bioconnections.net
Tel: **+44 (0)1782 516010**
Email: **welcome@bioconnections.co.uk**

Media preparation range to be enhanced

Don Whitley Scientific (DWS) announce the launch of a new, larger volume media preparator for the second half of 2022. This expansion to the existing range of ABE preparators provides a 50 litre model with the same safety and connectivity features as the other MEDIAWELs.

Preparing culture media manually can be labour intensive and very time consuming. Additionally, each step, from boiling up the media and water on a hotplate to autoclaving, cooling and pouring, has the potential to introduce contamination. Automated media preparators allow preparation and sterilisation to be performed using a single piece of equipment. Using a media preparator rather than a standard autoclave provides clear advantages in terms of standardisation, repeatability, and a consistent quality.

DWS supplies a range of automatic media preparators that are purpose-designed for the preparation of sterile liquid media, currently available in two sizes for the preparation of between 1 and 30 litres of media.

Reducing labour costs is one reason to implement an automated media preparation process but there are other factors to be considered, not least that an in-house preparation system can provide an on-demand supply of media for such things as special projects or to cope with increased demand.

Further information

Visit: www.dwscientific.com
Tel: **+44 (0)1274 595728**
Email: **sales@dwscientific.co.uk**

The company Genetic PCR Solutions™ will soon launch a qPCR kit to detect monkeypox

Friday, 20 May 2022. The Spanish company, branded Genetic PCR Solutions™ (GPS™; www.geneticpcr.com), has already designed a kit of qPCR reagents for the rapid genetic detection of the monkeypox virus, which has been detected in Spain and other countries such as the United Kingdom, Portugal, Italy, Sweden, France, Belgium, Germany, Canada and USA.

The GPS™ technical team has completed the design and development work on this kit, which began as a priority when it received confirmation of the news from the Instituto de Salud Carlos III (Madrid). Although reference laboratories have techniques for detecting this virus, the Center for Disease Control (CDC), Atlanta, USA, has indicated that there is currently no commercial qPCR kit available to facilitate surveillance if required. For the design of this qPCR, GPS™ has been based on a genetic marker used by the group of Dr I.K. Damon (CDC-Atlanta) but taking another fragment that is inclusive of the 76 sequences of MPXV available at the NCBI (National Center for Biotechnology Information). To verify in silico exclusivity, they have been compared with all data available focussing the most phylogenetically related viruses according to the current taxonomy of Orthopoxviruses (International Committee on Taxonomy of Viruses, ICTV), specifically cowpox virus (90 sequences), vaccinia virus (132 sequences) and smallpox virus (73 sequences).

GPS™ laboratories are validating its development following strict recommendations of international standards and, later, it will be tested in hospitals with real and reference samples. The company has planned that the kit may be available at the end of next week, which will allow any laboratory to carry out specific tests to detect the monkeypox virus. At the present time GPS™ has already received the interest of several hospital centres for the use of this qPCR currently under validation.

With this new diagnostic kit GPS™, once again, shows the innovative character and the agility to develop precision PCR assays for the control of epidemic outbreaks that threaten global health. In 2016, generated the first genetic kit for the detection of the Zika virus and in January 2020 it was one of the first companies worldwide to develop efficiently the kit for the detection of SARS-CoV-2, which causes CoVID-19.

Further information

Visit: www.geneticpcr.com
Tel: **+34 96 542 9901**
Email: **info@geneticpcr.com**

Did you know that NCIMB offers a 16S metagenomics service?

Metagenomics based on PCR amplification of marker genes such as 16S rDNA offers a cost-effective and rapid way to understand the makeup of a bacterial community. At NCIMB we offer a 16S metagenomics service and can accept samples from a diverse range of sources including human, animal, industrial effluents and bioreactor slimes as well as settings within the natural environment. We also undertake analysis of fungal communities by ITS metagenomics, and our services are used by both industry and research organisations.

NCIMB Ltd. curates the National Collection of Industrial, Food and Marine Bacteria, and offers a range of microbiology, biological material storage and analytical services. Our culture collection is comprised of ACDP hazard group 1 and 2 microorganisms isolated from all kinds of environments.

Further information

Visit: www.ncimb.com
Tel: **+44 (0)1224 009333**
Email: **enquiries@ncimb.com**

NCPV continuing to support pandemic research

NCPV has added two strains of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) to the collection to assist the scientific community with pandemic research.

SARS-CoV-2 strain B.1.1.7/N501Y/V1, clade 20I (Kent/Alpha lineage, cat no. 2111223v) is NCPV's first commercially available virus inactivated through X-ray irradiation. X-ray irradiated products are non-infectious whilst maintaining genome integrity and antigenic structures. Additionally, no residual toxic inactivation chemicals are present in the preparation.

SARS-CoV-2 strain B.1.1.529, clade 21K (Omicron lineage, GenBank reference: OM003685.1, cat no. 2112101v) is also now available to order.

These strains were identified through whole-genome sequencing, Nextclade (clades.nextstrain.org), and the Phylogenetic Assignment of Named Global Outbreak Lineages (PANGO Lineages, cov-lineages.org).

Further information

Visit: www.culturecollections.org.uk/ncpv
Tel: **+44 (0)1980 612512**
Email: **culturecollections.org.uk/contactus**
Twitter: **@NCPV**

Society for Applied Microbiology

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