microbiologist

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Society *for* Applied Microbiology

INSIDE

Up close and personal

What's under the sheets?

Mental illness under the microscope

The domestic microbiome

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Paul Sainsbury reviews the content of this issue

microbiologist

People are finally recognizing the crucial role played by microbes in sustaining life on Earth

As we know, bacteria are far older than most people realize. Although exact dates are hard to pin down, scientists have found cyanobacteria-like fossils that are nearly 3.5 billion years old, which are among the oldest fossils currently known. Certainly our understanding of the microscopic world over the last 100 years has drastically improved our health and increased our lifespans. However, for all that we know, it is apparent we are only scratching the tip of the iceberg and humans still have so much to learn about our tiny friends.

For example, researchers are just now determining how climate change is affecting fungi. Aileen Bard details in this issue a project which aims to understand the role fungi play in forest networks and how the whole ecosystem will respond to potential major global changes. Brendan Gilmore's article about whom we are sharing our bed with may encourage you to change the sheets more often and Jennifer Wallis looks back in history at how bacteria were assumed to be involved in mental illness.

Mark Webber informs us that we may not be getting the protection we think from antibacterial products, and that we might even be contributing to the problems we are trying to avoid. This issue also sees London's Microbiota take us to the former site of the Brown Animal Sanatory Institution in Vauxhall, South London.

The Society *for* Applied Microbiology has also published a new strategy for the next three years and an abridged version is presented by the President and Chief Executive on pages 6 & 7. This will have a huge impact on the output of the Society and will rely to a greater degree on the input of Members and the wider microbiology community. So please look out for any calls to action, working groups, meetings, workshops or any other key communications or events that may be relevant to you.

We are also pleased that a date has been finalized for what has become our most popular event; the S*f*AM Antimicrobial Resistance Meeting. The date is confirmed for Wednesday 14 November and you can book online and gain further details of the agenda via the S*f*AM website. There are also a few days left to book for the Annual Conference. The 3-day event will be packed full of the latest research on infectious diseases, given by expert microbiologists and clinicians covering a wide range of topics that include migration, medical tourism and unusual infections.

I hope you find this issue enjoyable as all the extra features we've crammed in are a celebration of the work that many of you are doing to further the human–microbe relationship – so that we might enjoy many more years here on our planet living together in harmony.

NEWS IN BRIEF

Lord Jim O'Neill, former Chair of the AMR Review has been awarded the Society *for* Applied Microbiology's first honorary fellowship.

Health officials have reported cases of gonorrhoea found in Australia and the UK resistant to ALL of the antibiotics that have been in routine use against the infection.

Groups of researchers now believe they are on the cusp of a revolution that uses "*mood microbes*" or "*psychobiotics*" to improve mental health. The initial study that started the whole concept began at Kyushu University in Japan.

Paul Sainsbury, *Editor*

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Strategy Review: 2018–2021

We are delighted to present here the Society's new strategy for 2018–2021. Trustees of the Society met for a strategy day in September 2017 and, together with the team, we've produced the following strategic themes, aims and priority areas to shape the direction of the Society's work:

Vision

SfAM envisages a future where applied microbiology research and development is strong in the UK and beyond, and the applications of microbiology contribute to addressing significant challenges facing humanity, including infectious diseases; the changing environment; sustainability of energy, food, water and land resources; and economic growth.

Mission

SfAM will achieve this by being the voice of microbiology and advancing, for the benefit of the public, the science of microbiology in its **application** to the environment, human and animal health, agriculture and industry.

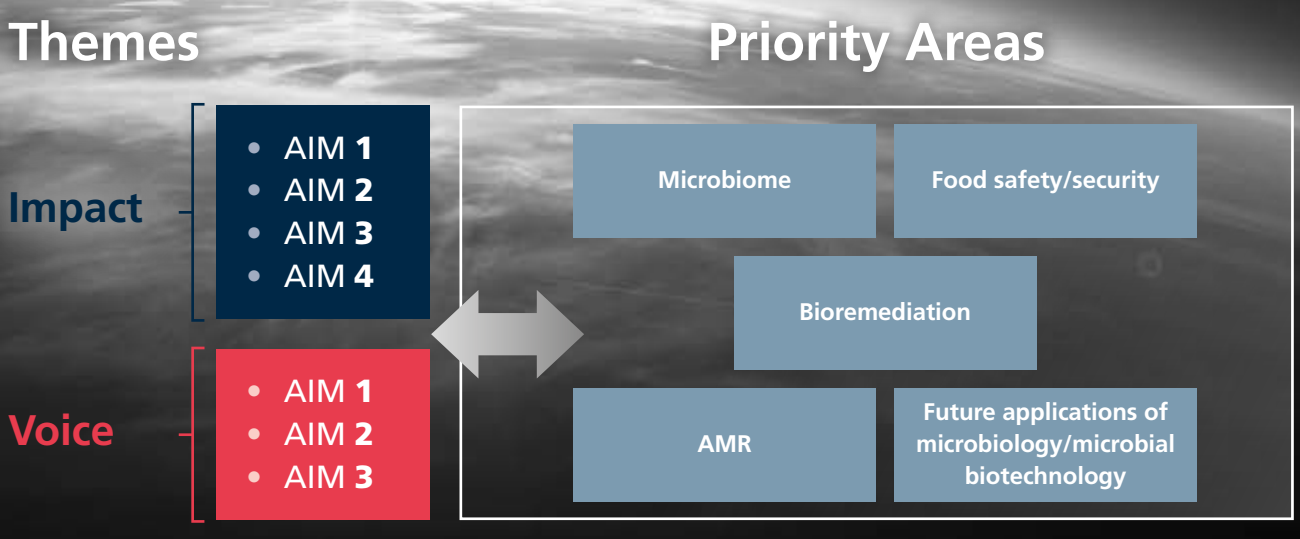
Values

Our values include equality, diversity and inclusivity, collaboration to amplify impact, scientific integrity, evidence-based decision-making and political neutrality – recognizing that microbiology doesn't observe geographical borders. All of these are fundamental values which will run through all future activity.

The following were identified as strong strategic themes:

Impact **Voice**

The organizational aims are listed under each theme. To demonstrate we're having an impact we will organize our output in the form of self-contained **projects/campaigns**, each with their own aims, objectives, events, scientific meetings and communications output. These will focus on our priority areas and the following strategy will underpin each campaign.



Theme 1: Impact

In an environment where it is becoming increasingly important for scientists to have an impact we will continually support our Members throughout their career. Our current strengths, such as the work we do to support early career researchers will enable us to negate future threats such as skills gaps, to ensure the Society provides relevant career support to academic and non-academic microbiologists and scientists.

Aim 1: ECS Support

Early career scientists represent the future of applied microbiology. Building on the Society's strong Early Career Scientist (ECS) membership and the exemplar work of our ECS Committee, the Society will develop this support and, using our inherent agility, continually adapt and change to reflect current needs.

Aim 2: Community

We will listen to our entire membership wherever they are and whichever sector they work in, to ensure membership offers them tangible, useful and relevant benefits.

Aim 3: Interdisciplinarity

We are **applied microbiologists**, so to aid researchers' interdisciplinary collaborations, as is increasingly necessary in the current research environment, we will provide support for innovation and fostering interdisciplinary and inter-sector collaborations. Over time this will position the Society as the go-to organization for academic scientists who are looking to find other academic and corporate/industry connections.

Aim 4: Microbiology in the UK

We will undertake thorough market research into the applied microbiology landscape to assess which institutions, institutes and industry laboratories are researching applied microbiology, whether there are skills gaps and areas which the Society can help to fill. In time this will enable us to position ourselves as the go-to organization for education and training in applied microbiology techniques, QC and routine laboratory work, and relevant non-microbiological areas.

Theme 2: Voice

The Society has previously had the strapline: *the voice of applied microbiology*. With our increasing participation in policy-relevant work, and our strong communications team, this holds true. We are creating a voice for our membership in Government and Parliament. We also have strong engagement with people via traditional and social media to illustrate just how relevant applied microbiology is to us all. This strategic theme will build on our strengths in these areas and provide focus for our external communications.

Aim 1: Policy

We will place S*f*AM, and its membership, as a key conduit for policymakers to access high-quality microbiology advice and evidence on topics aligned with our vision.

Aim 2: Collaboration

We shall continue to collaborate with partner organizations and societies as part of a broader representation on behalf of the science and engineering sector.

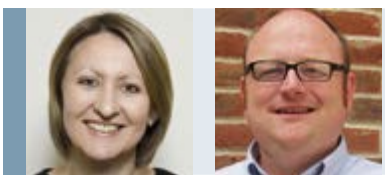
Aim 3: Communication

We will promote the application of microbiology in all relevant areas – with a particular focus on our priority areas – and its impact on all people in everyday life, in an informed, accessible way.

Priority areas/campaigns

Our focus will be on a number of priority areas over the period of this strategy (2018–2021), to which our themes (Aims, Objectives and KPIs) can be applied. Each one is linked to a significant challenge, as described in the Society's vision.

Significant challenge	Priority area
Infectious disease	Antimicrobial resistance (AMR)
Food security	Food safety and security
Health	Microbiome
Changing environment	Bioremediation and biodegradation
Microbiology skills	Teaching of applied microbiology at undergraduate level



Lucy Harper (left)
S*f*AM *Chief Executive*
Mark Fielder (right)
S*f*AM *President*

Infected with symposium success

Walking up to the University of Birmingham's Aston Webb Great Hall, a piece of architecture that would fit comfortably on the set of Harry Potter, I knew that the inside was going to be just as impressive. I wasn't wrong; the vast space has high ceilings, a stage and plenty of room to fit our record number of delegates. There was a lot to fit into one day including oral presentations, posters, exhibitors, two keynote speakers on epidemiology and infection control and a science communication workshop. This year, 111 early career scientists from far and wide registered for the 7th Annual ECS Research Symposium with 27 posters and six oral presentations!

The first to talk about their research in our oral presentation session was Paz Aranega Bou from the Biosafety, Air and Water Microbiology Group at Public Health England. Her research covered how the waste traps in hospital sinks can act as reservoirs for carbapenemase-producing Enterobacteriaceae (CPE). The second presenter, Ali Alsudani from the Nottingham Trent University gave an interesting talk about pre-, pro- and symbiotic manipulation of broiler gut microbiota. Following on from this was Maria Masoura from the University of Birmingham who delved into the antimicrobial effects of honey and how hydrogen peroxide, one of over 150 compounds found in honey, causes oxidative stress in bacteria. The fourth talk, by Joseph Ingram from the University of Nottingham, explained his research into tuneable zinc-responsive bacterial promoters for controlled gene expression. Continuing with the theme of making research efficient and cost-effective was Ruth Reid from De Montfort University explaining her development of a rapid multiplex real-time PCR assay for the detection of Extended Spectrum Beta Lactamase (ESBL) genes. The final oral presenter was Joshua Burns from Robert Gordon University. Joshua showed how exploiting the unexplored chemical diversity of *Streptomyces* species could produce new antibiotics.

Aston Webb Great Hall

This year our ECS Undergraduate Representative, Jake Bell, worked hard to ensure that undergraduate students felt included in our events and we were thrilled to see a much larger number than usual attending the symposium. We hope this continues. and that it encourages them to attend other *Sf*AM events in the future.

We were very fortunate to have at the symposium two high-profile keynote speakers; Fin Twomey – the Head of Animal Public Health at DEFRA and Jonathan Van-Tam – the Deputy Chief Medical Officer for the UK. Both speakers gave impressive talks and looking at the feedback from the event they were the highlight of the day.

The day was rounded off by a workshop run by Voice of Young Science, part of the Sense about Science organization who campaign for scientists to be open and honest about their research and encourage the public to recognize the value of accurate scientific evidence when making decisions. The workshop began with getting delegates to 'zoom out' of their research and recognize the main themes to make what they were doing more relevant to everyday life.

The workshop concluded with three main messages for our delegates: trust people, share goals and speak human. It was a fitting end to such a great day!

Jennie French
ECS Publications Officer
University of Nottingham

ANTIMICROBIAL RESISTANCE

Looking beyond the microbiological

Wednesday 14 November 2018 | 10:00 – 17:00 | Roger Street | London

Many factors contribute to antimicrobial resistance beyond the biological processes we are familiar with, such as political, economic, socio-cultural, environmental and other external influences.

The Society *for* Applied Microbiology will this year host its fourth Annual AMR Meeting with the aim of updating professionals involved in the healthcare of humans and animals in relation to infection and use of antimicrobials.

The most effective actions to reduce and control AMR will likely involve changes in social practices and the use of social science as a tool to fight it. This may include a closer look at how farmers and vets manage livestock production for human consumption. It must also remain a priority to incentivize the next generation of scientists in the search for novel antimicrobial compounds.

This AMR meeting will discuss international strategies and their application to a *one health* model, reduction targets in agriculture, communicating vital messages, the harmonization of antibiotic prescriptions and how farmers can play a vital role in improving public health.

Fees before 01 November 2018

MEMBER	**£90**
ECS MEMBER	**£45**
NON-MEMBER	**£180**

The conference will also offer a light lunch and refreshments for all participants and attendees. Please help us ensure the event's success by registering as soon as possible.

sfam society for applied microbiology

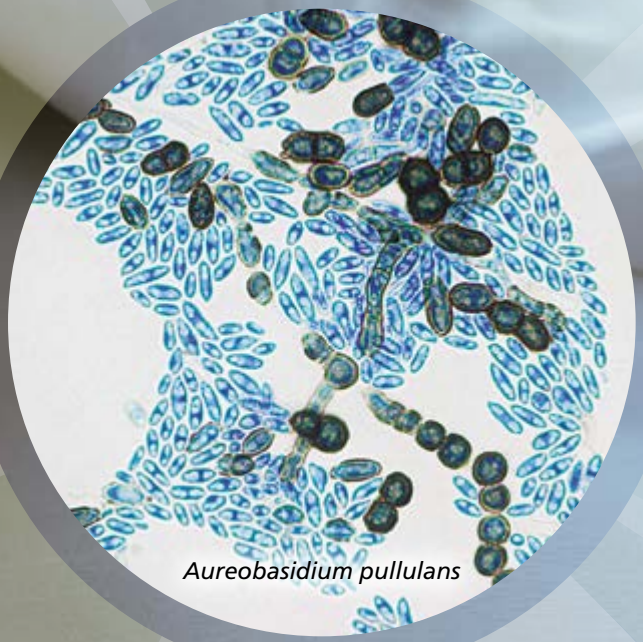
What's between the sheets?

The microbiome of the built environment – our homes, hospitals and places of work and recreation – may play a significant role in our health and well-being. The numbers of studies investigating the interplay between our microbiome and that of our immediate environment have steadily increased over the past 10 years, shedding new light on our interactions and our most intimate microbial associations. But what do we know about what goes on between or beneath the sheets? Given that we spend up to one-third of our lives in bed, we know surprisingly little regarding with what or whom we share our slumbers.

It has been noted in the scientific literature for some time that, in the context of the healthcare environment, bedding and bedroom furniture constitute important fomites for the transmission of pathogens. Pillows have been described as the 'forgotten fomite', since they provide an ideal reservoir for microorganisms. The high surface area and moisture retention capacity of filling material combined with the inoculating head of the sleeper introducing microorganisms from the sebum, sweat and direct contact with the skin of the face, neck and the hair makes for the perfect incubator. The sleeper provides ideal temperatures and humidity and provides nutrients from bodily secretions and shedding skin. The perfect storm? A 2014 study suggests so – 38% of hospital pillows were found to be colonized by MRSA and coliforms (see Lange *et al*.). Standard coated pillows with stitched seams may also act as bellows, spreading pathogenic microorganisms around the bedroom. A colonized pillow, like the coughing and sneezing of an infected patient, belches up to two litres of humid, contaminated air every time the patient's head is placed on it. This has the capacity to recolonize the immediate environs and undo the best efforts to sanitize the surrounding surfaces. Similarly, outbreaks of multiresistant *Enterobacter cloacae* in intensive care units has been associated with therapeutic beds which had been covered with antibacterial-treated, vapour-permeable polyurethane mattress covers (designed to reduce bacterial and fungal colonization of mattresses).

It has been established that during a patient's stay in hospital the patient's skin and room surfaces become 'microbially similar', with marked differences between ambulatory and non-ambulatory patients with respect to microbial diversity. Despite (and perhaps due to) regular cleaning and sanitation, the longer patients remained in the hospital room, the greater the acquisition of antibiotic resistance genes in the environment. Similarly, a recent study published in *Science* by S*f*AM's 2016 W H Pierce Prize winner, Jack Gilbert, demonstrates that not only are the microbiota of the home identifiable to individual families (like a microbiome fingerprint), they move around with us such that when we move from one house to another we rapidly disseminate our microbiome to the environment. Interestingly, when a young couple moved into a hotel room, it was microbiologically identical to their home within 24 hours. Staying on the couple theme, microbial ecologists at the University of Waterloo reported that cohabiting couples significantly affect the microbial profile of each other's skin, particularly the feet. Oh, and if your partner breaks wind in bed, then Karl Kruszelnicki (winner of the Ig Nobel Prize for his work on belly button lint) may have some insights to offer from a 2001 study his group

Given that we spend up to one-third of our lives in bed, we know surprisingly little regarding with what or whom we share our slumbers



Aureobasidium pullulans

conducted on the potential of operating theatres to become contaminated by the flatus of theatre staff (by asking staff to break wind close to the agar surface of a Petri dish, both naked and when gowned). His conclusion (published in BMJ) was as follows: "*Our deduction is that the enteric zone in the second Petri dish was caused by the flatus itself, and the splatter ring around that was caused by the sheer velocity of the fart, which blew skin bacteria from the cheeks and blasted it onto the dish. It seems, therefore, that flatus can cause infection if the emitter is naked, but not if he or she is clothed. But the results of the experiment should not be considered alarming, because neither type of bacterium is harmful. In fact, they're similar to the 'friendly' bacteria found in yoghurt.*" Underwear recommended it would seem.

Although no similar studies exist for the domestic bedroom a number of strands of evidence do suggest similar trends in the home versus temporary sleep environments (hotels, hospitals etc.). Pillows (both synthetic fibre- and feather-filled) from UK homes between 1.5 and 20 years old in regular use were examined for the presence of fungi. Over 47 different fungal species were isolated from 10 pillows, with the number of species isolated from each pillow varying from 4 to 16. Interestingly, pillows with synthetic fillers harboured higher numbers of species, including the allergenic *Aspergillus fumigatus*, compared with feather pillows. The most common species isolated included *A. fumigatus*, *Aureobasidium pullulans* and

Rhodotorula mucilaginosa, alongside a number of other fungi identified as allergenic in humans. The authors of this study (Woodcock *et al*., 2006) suggest that due to the duration of sleep and proximity of the pillows to the airway, pillows could be the primary source of exposure of fungi and fungal products (such as volatile secondary metabolites). To quote the authors, "*It is extraordinary that such a major unidentified source of fungal exposure has literally been staring us in the face*."

Beyond that, a great deal of information regarding the colonization and accumulation of microbial diversity on and within our bedding is either anecdotal or comes from commercially sponsored studies which encourage us to wash and/or change our linens, pillows and mattresses more often than we currently do. A recent study commissioned by mattress manufacturer AmeriSleep makes for foetal position-inducing reading. Week-old pillowcases had 17,442 times more bacteria (3 million CFU per square inch) than the average toilet seat; by four weeks that number had risen to 11.96 million CFU per square inch, around 39 times more bacteria than you'd find in a pet feeding bowl. Sheets were similarly contaminated over the same time period. Mattresses less than one year old had a population of bacteria of around 3 million CFU per square inch, which increased with age up to 7 years (16 million CFU per square inch). A recommendation to wash sheets and pillowcases once a week based on these data seems more than reasonable.

Aspergillus fumigatus

One of the leading experts in this area, Philip Tierno of New York University's Langone Medical Center, offered the following statistics to S*f*AM readers: an average couple sleeping in bed can slough off an estimated 4.3 to 14 lbs of skin cells in 10 years; average perspiration loss is 1 litre (2 lbs) plus per day; over a 3–4 month lifetime, a dust mite can produce 200× its body weight in faeces and the average 1,500 square ft house can accumulate 40 lbs of dust (40,000 dust mites per ounce). Small wonder protective pillow and mattress covers form part of his recommendation for a sound night's sleep.

Finally, if you like to keep plants in your bedroom, that might also affect the microbiome of your sleeping environment too. That horticultural staple of the 1970's home, the spider plant *Chlorophytum comosum*, has been shown to alter the microbiome of the built environment too. A microbiome shift was observed in the immediate surroundings of the plant, such that the abundance of archaea, bacteria and fungi increased on the surrounding floor and wall surfaces within six months. This included potentially allergenic spore-forming fungi and potentially beneficial genera such as *Paenibacillus*.

Sleep tight, don't let the bed bugs bite...

The old saying 'don't let the bed bugs bite' seems to have its origins in the late 1800s and was famously quoted in F. Scott Fitzgerald's 1923 play 'The Vegetable'. The common bed bug (*Cimex lectularis*) has entered the public psyche as the hotel guest's roommate from hell. And for good reason too. These parasitic insects have a preference for human blood, defaecate and shed their skin on mattresses and their bites (though painless) often leave nasty, itchy bumps on the skin, which may become infected either directly or by secondary infections if scratched. Nowadays, for many people, the common bed bug is perhaps considered an extreme or archaic example of a potential bedfellow; thought to be more-or-less eradicated by the end of the 1940s, the past two decades have seen bed bugs make something of a resurgence (CBS News declared 2010 the 'Year of the Bed Bug'). Globally, populations have rallied and have been spiking since the turn of the century. One study estimated the increase in the Australian bed bug populations from 2000 to be ~5,000%. Contrast that with recent findings that crab lice (*Pthirus pubis*) populations are declining worldwide due to a trend towards waxing and pubic hair removal (presumably something akin to the effect of deforestation on indigenous species?). Digression aside, bed bugs pose a threat beyond formication (that's the sensation of insects crawling over the skin, often brought on by reading articles like this one) as they may be vectors for other pathogens. Bed bugs harbour over 40 potentially pathogenic microorganisms and their bites may be capable of transmitting drug-resistant pathogens, including MRSA and vancomycin-resistant *Enterococcus*

Cimex lectularis

The common bed bug (*Cimex lectularis*) has entered the public psyche as the hotel guest's roommate from hell

faecium (VRE). Worryingly, a number of recent studies have indicated that bed bugs may be able to host and transmit *Trypanosoma cruzi*, the protozoan responsible for Chagas disease. Salazar and colleagues demonstrated efficient and bidirectional transfer of *T. cruzi* between mice and bed bugs, with bed bug faeces capable of transferring the protozoan when applied to broken skin. Whilst the feeding patterns of 'Kissing bugs' (the traditional vector of *T. cruzi*) are different to those of bed bugs, reducing the likelihood that bed bugs are an efficient potential vector, a 2018 study by Romero and colleagues demonstrated that the protozoan survived within bed bugs for as long as 97 days and exhibited transstadial persistence (the ability to survive across nymphal stages). These findings appear to support the potential role of bed bugs as vectors of Chagas disease.

Current studies into our interaction with our domestic environment seem to suggest that, generally speaking, increased microbial diversity in the home appears to have favourable effects on long-term health. Human society has evolved through environments where microbial exposure has been varied and ubiquitous. Although we do not have a clear picture of what constitutes a 'healthy' bedroom microbiome, and whilst we cannot draw firm conclusions about the precise role (harmful or otherwise) of the microbiota of our intimate home environment, one thing is for sure; whatever our reason for being in bed, whether enjoying a refreshing snooze or languishing in the detritus of our sojourn, we are not alone.

FURTHER READING

Bain D and Woolfson D (2017) Pillows: The forgotten fomite. InfectionControl.tips (**https://infectioncontrol.tips**)

Hot Air? (2001) *BMJ* 323, 1449

Lange V (2014) American reusable pillows – a reservoir for hospital acquired pathogens. *J Infect Control* 42, S34-S3

Lax S *et al*. (2014) Longitudinal analysis of microbial interaction between humans and the indoor environment. *Science* 345, 1048–52

Woodcock AA *et al*. (2006) Fungal contamination of bedding. *Allergy* 61, 140–142

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Queen's University Belfast

To clean or not to clean?

Should we be worried about household usage of antimicrobial products?

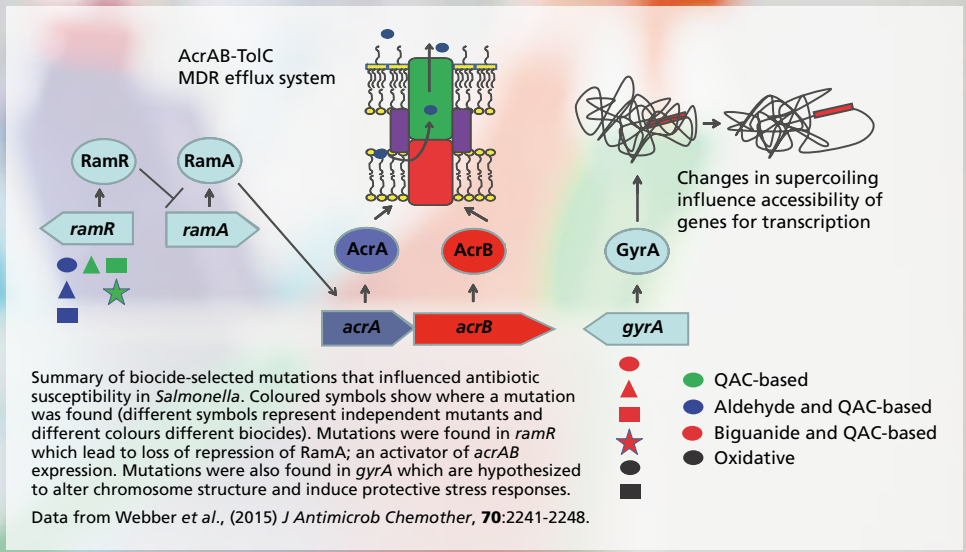
Readers of *Microbiologist* will be aware of current concerns regarding the emergence of antimicrobial-resistant (AMR) bacteria and the increased challenges we face in treating antibiotic-resistant infections caused by many common human pathogens. The term 'antimicrobial' is used to include antibiotics but also antiseptics, disinfectants and preservatives; in fact, a range of biocides we use to not only treat infection but also to prevent contamination of foodstuffs, domestic products and important surfaces.

Over the last 15 years, there has been an increase in domestic products marketed as being 'antibacterial' or 'antimicrobial'; perhaps on the face of it a logical response to worries about the increasing difficulties in treating some infections – prevention is better than cure. Perhaps though, this is not as straightforward as it seems and we may not be getting the protection we think from these products, and might even be contributing to the problems we are trying to avoid.

One of the major groups of antibacterial products on sale for domestic use is antibacterial soaps and body washes. However, the FDA in America made headlines at the end of 2016 by issuing a ban on 19 of the active ingredients found in these products. This ban included triclosan; an antibacterial which had been in such common usage in the early 2000s it was detectable in the urine and blood of most people. So, why did the FDA (and the EU) ban triclosan as an active ingredient in hand soaps etc. given the backdrop of worries about AMR? Well, there are multiple reasons including environmental concerns, possible hormone-disrupting activity and a lack of benefit above simple soap and water but there has also been a lot of concern about triclosan potentially making the AMR problem worse. This is because of evidence that bacteria can evolve resistance to triclosan and some of the mechanisms are common to those that can cause resistance to clinically important antibiotics.

Bacteria do not distinguish between a chemical we employ as an antibiotic and those we use as a biocide, and evolution will select for any mutants that are able to survive and grow in the presence of a chemical that inhibits growth of most of a population. One common mechanism of resistance is efflux, where transport pump proteins known as multidrug resistance (MDR) efflux systems are overproduced. These MDR pumps have very wide substrate ranges and we (and others) have found that many biocides are recognized by these

pumps and exposure to biocides can select for mutants that overexpress them. These mutants also then display a reduction in their susceptibility to multiple antibiotics which are also substrates for the pump.



Summary of biocide-selected mutations that influenced antibiotic susceptibility in *Salmonella*. Coloured symbols show where a mutation was found (different symbols represent independent mutants and different colours different biocides). Mutations were found in *ramR* which lead to loss of repression of RamA; an activator of *acrAB* expression. Mutations were also found in *gyrA* which are hypothesized to alter chromosome structure and induce protective stress responses.

Data from Webber *et al.*, (2015) *J Antimicrob Chemother*, **70**:2241-2248.

Less obvious links have also been observed. Another recent example from our group showed a link between mutants of *E. coli* and *Salmonella* resistant to fluoroquinolones (powerful antibiotics) and susceptibility to triclosan. Fluoroquinolone-resistant mutants evade the action of the antibiotics by altering the structure of the drug target; DNA gyrase. This is an enzyme involved in DNA housekeeping and we found mutating gyrase altered the state of DNA in the cell which in turn affects the expression of many genes including stress response pathways which are triggered and then help the bug survive exposure to other agents, including triclosan. When we tested what happened when a mixture of gyrase mutants and normal *E. coli* were exposed to a low amount of triclosan the mutants had an advantage over wild-type strains and dominated the population, raising the possibility that triclosan and related compounds could favour expansion of antibiotic-resistant mutants.

Whilst the genetic framework linking susceptibility to various biocides and antibiotic resistance has been demonstrated, the practical, real-world risk of biocides as drivers of antibiotic resistance is controversial and very hard to test. So, what should we do in our homes? One thing that must not be forgotten is the need for cleaning and disinfection to maintain hygiene and stop people getting ill but it's also not practical, realistic or necessary in normal circumstances to aim to live in a sterile environment. Washing hands and cleaning and disinfecting toilets and food preparation surfaces is common sense, although which products to use is probably not something the average member of the public spends a lot of time agonizing over. One important way forward is to work with industry to make sure products are effective and safe, and avoid use of active agents that persist in the environment and for which there is plausible evidence that they can select for resistant mutants. As triclosan is phased out, a hope is that its legacy will be a new approach to designing and testing better and safer antimicrobial products for domestic use.

Bacteria do not distinguish between a chemical we employ as an antibiotic and those we use as a biocide

FURTHER READING

Giuliano CA and Rybak MJ (2015). Efficacy of triclosan as an antimicrobial hand soap and its potential impact on antimicrobial resistance: a focused review. *Pharmacotherapy* 35, 328–336

Webber MA, Buckner MMC, Redgrave LS, Ifill G, Mitchenall LA, Webb C, Iddles R, Maxwell A, and Piddock LJV (2017). Quinolone-resistant gyrase mutants demonstrate decreased susceptibility to triclosan. *J Antimicrob Chemother*, 72, 2755–2763

Webber MA, Whitehead RN, Mount M, Loman NJ, Pallen MJ and Piddock LJV (2015). Parallel evolutionary pathways to antibiotic resistance selected by biocide exposure. *J Antimicrob Chemother*, 70, 2241–2248

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Zoonotic transmission of *Staphylococcus pseudintermedius:* where bite is worse than bark?

Nosocomial infection

Nosocomial infections are a major topic of concern in both human and veterinary medicine. The most commonly occurring nosocomial infections include urinary, blood and surgical site infections, and common sources include a patient's own flora, medical staff and the medical environment. With the prevalence of multidrug-resistant pathogens increasing, nosocomial infections are becoming more difficult to treat, resulting in increased morbidity and mortality. Effective infection prevention and control methods such as hand hygiene and environmental cleaning and disinfection are therefore essential to minimize cross-infection.

Staphylococcus pseudintermedius in dogs and cats

In veterinary medicine, *Staphylococcus pseudintermedius*, a commensal bacterium of dogs and cats, has been increasingly associated with nosocomial infection. *S. pseudintermedius* is part of the normal flora of skin, mucosae and hair follicles, and can also be isolated from the nasal cavity, mouth and gastrointestinal tract of healthy dogs and cats. However, as an opportunistic pathogen, it can cause infections of the skin such as pyoderma, otitis externa and post-operative wound infections. Previously, most infections caused by *S. pseudintermedius* were successfully treatable, using a broad range of veterinary-licenced antimicrobial drugs. However, over the last 10 years, meticillin resistant forms of this bacterium – MRSP – have been increasingly isolated, and hence MRSP now poses a significant challenge to successful treatment. Furthermore, evidence suggests that animals that make frequent trips to a vet, or those that have been hospitalized, have a higher risk of carrying MRSP.

Zoonotic transmission

There have been occasional reports of *S. pseudintermedius* and MRSP in humans and it is thought these infections have occurred zoonotically from infected pets. Infection tends to be associated with dog-bite wounds, although other infections have revealed potential associations with this bacterium. These include bacteraemia, pneumonia, ear infections and surgical site infections to name a few. Zoonotic transmission has been shown to be common in household environments, between owners and pets, particularly where said pets suffer from pyoderma. Furthermore, research has shown that this bacterium

is becoming more prevalent in veterinary staff. In one study carried out in Europe, it was found that 5/128 veterinary participants were carriers of MRSP. Considering that the participants were made up of small animal dermatologists, 3.9% may appear insignificant. It should be reiterated, however, that *S. pseudintermedius* is not a commensal organism of human beings and has only emerged as recently as 2007 in Europe. With this information, veterinary staff should take preventative action to avoid the zoonotic transmission of this pathogen.

Prevention of infection

To date, the role of veterinary staff and/or environment in *S. pseudintermedius*/MRSP transmission is unknown. Therefore, to prevent nosocomial infection by *S. pseudintermedius* or MRSP, both hand and environmental hygiene are considered to be vital. Based on practice within NHS clinical settings which have reduced MRSA prevalence, the British Small Animal Veterinary Association (BSAVA) have produced practice guidelines to reduce the spread of MRSA and MRSP. However, it is clear that further research is needed to better understand the potential for transmission of *S. pseudintermedius*/MRSP from companion pets to the veterinary environment to humans.

Staphylococcus pseudintermedius, a commensal bacterium of dogs and cats, has been increasingly associated with nosocomial infection

FURTHER READING

Frank LA and Loeffler A (2012). Meticillin-resistant *Staphylococcus pseudintermedius*: Clinical challenge and treatment options. *Vet Dermatol* **23**, 283–e56

Kadlec K. and Schwarz S (2012). Antimicrobial resistance of *Staphylococcus pseudintermedius*. *Vet Dermatol* **23**, 276–e55

Lehner G, Linek M, Bond R *et al*. (2014). Case–control risk factor study of methicillin-resistant *Staphylococcus pseudintermedius* (MRSP) infection in dogs and cats in Germany. *Vet Microbiol* **168**, 154–160

Paul NC (2015). MRSP: prevalence in practice. *Vet Rec* **176**(7), 170–171

Paul NC, Moodley A, Ghibaudo G and Guardabassi L (2011). Carriage of methicillin-resistant *Staphylococcus pseudintermedius* in small animal veterinarians: indirect evidence of zoonotic transmission. *Zoonoses Public Health* **58**, 533–539

van Duijkeren E, Catry B, Greko C *et al*. (2011). Review on methicillin-resistant *Staphylococcus pseudintermedius*. *J Antimicrob Chemother* **66**, 2705–2714

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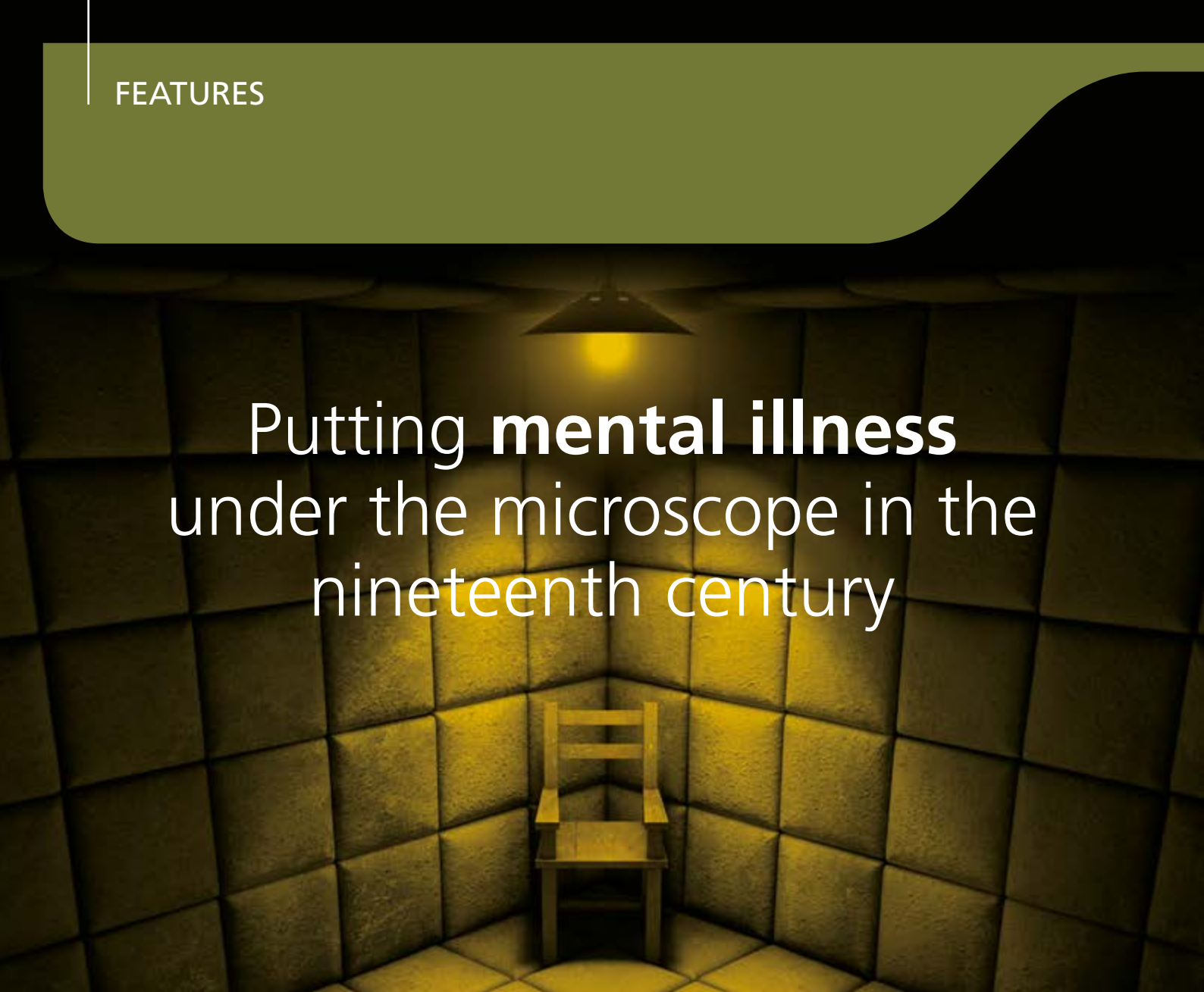
Putting **mental illness** under the microscope in the nineteenth century



A few years ago I went to a seminar about the efforts of an archive to rescue documents from a former London asylum. In the 1980s and 1990s, with community care posited as the panacea that would remove both the stigma of mental illness and the financial burden of inpatient care, many of Britain's last remaining asylums were abandoned. Some were left in rather a hurry; the basement of the asylum in question was strewn with patient files, books of meeting minutes, information leaflets and microscopic slides. The seminar speaker glossed over the slides; they weren't considered as important as the files and they were an ethical and logistical nightmare for any archive in the post-Human Tissue Act landscape. But I was captivated by these discarded scientific objects. The relative lack of concern for the slides reflected a broader trend within the history of psychiatry. As historians we had been (rightly) urged to focus much of our attention on the patient; to recover the personal histories of those who had lacked a voice during their lifetime. In doing so, though, we often overlooked the rich scientific life of these institutions. If nothing else, the seminar renewed my desire to get to grips with the scientific, as well as the social, life of the nineteenth-century asylum.

Science isn't what most people tend to think of when they hear the words 'Victorian asylum', unless it's a kind of horror movie science led by an archetypal 'mad scientist'. Yet many British asylums in the nineteenth century were heavily involved in research, from the physiological to the bacteriological. A recognized leader in this regard was the West Riding Pauper Lunatic Asylum in Wakefield, Yorkshire. Established in 1818, by the 1870s it was viewed as something of a 'Mecca' for asylum researchers, hosting the experiments of neurologist Sir David Ferrier and informing the work of Charles Darwin for his *Expression of the Emotions in Man and Animals* (1872). Staff were encouraged to develop their skills in microscopy; many doctors undertook pathological work as well as making rounds on the wards, with work roles less strictly delineated than in the modern-day hospital. Medical officers from other institutions also visited to hone their technical skills. Many of their findings were recorded in the in-house journal, *West Riding Lunatic Asylum Medical Reports*. As the first British asylum to appoint a pathologist as a paid member of staff in 1872, the West Riding offered staff a well-appointed laboratory, a medical library and a pathological museum. By the

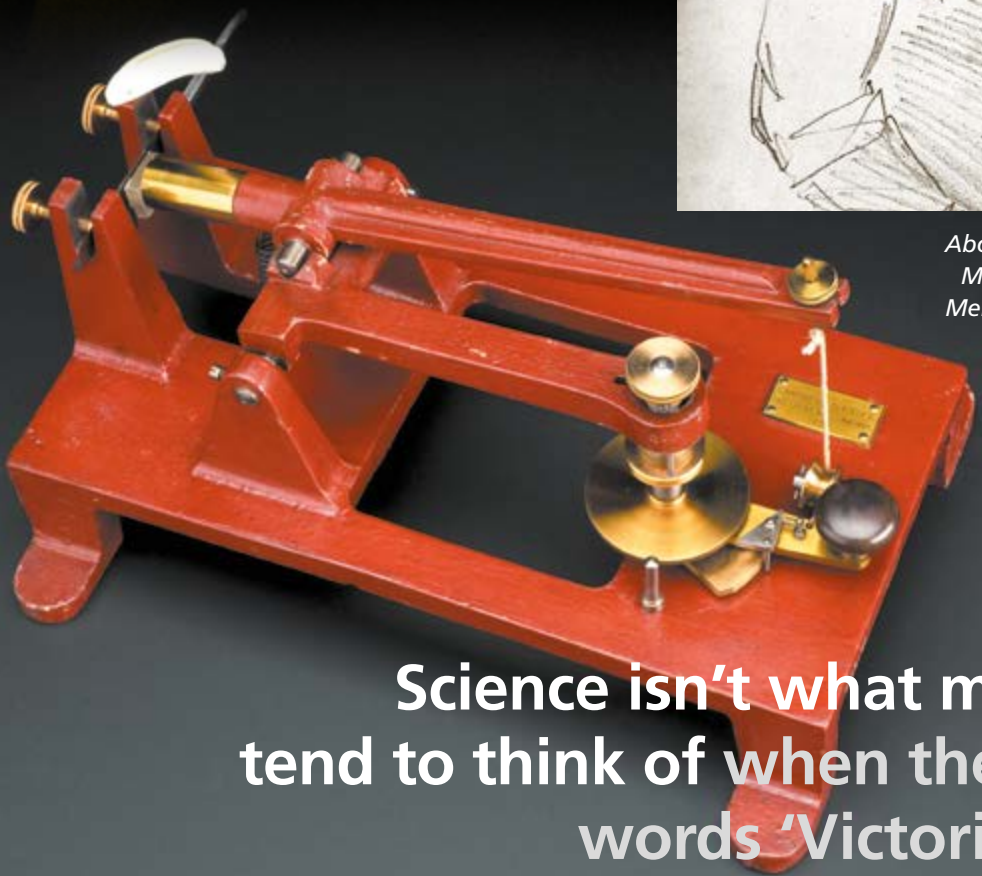
1890s the Asylum was regularly adding to its specialist equipment: a Reichert's microscope, a Rivet–Leyser sliding microtome and a Cambridge rocking microtome were purchased in 1895. Several cabinets for storing the many thousands of slides produced were added in 1898.

This keen interest in microscopy was not mere hobbyism. In the last quarter of the nineteenth century, asylums across Britain were grappling with the problem of General Paralysis of the Insane (GPI). Characterized by a range of physical and mental symptoms – staggering, slurred speech, reflex problems, delusions of grandeur, muscle wastage – many cases of GPI are now believed to have been neurosyphilis. A contemporary estimate reckoned that 18,438 such patients had been admitted to asylums in England and Wales between 1878 and 1892. Suggested causes of GPI ranged from alcoholism to hereditary degeneration to sexual excess. As chronic patients in a pre-Salvarsan and pre-penicillin world, general paralytics put great strain on asylums due to the level of care they required. Thus, much microbiological and bacteriological investigation at the West Riding focused on GPI; eradicating the condition could completely transform the late-Victorian psychiatric landscape.

Almost every part of the general paralytic body was placed under the microscope, from urine to hair to bone. But it was the brain that elicited most attention.

Even before the brain was sectioned and stained, it was clear that general paralysis had a profound effect on the brain substance; the surrounding membranes stuck to the surface and there was a general softening of the whole organ, as well as clots and inflammation. The naked-eye observation of the doctor, and his sense of touch, played an important role here and the introduction of new technologies did not lead to a wholesale shift in practices that eclipsed these older methods. West Riding Superintendent William Bevan Lewis emphasized the importance of touching the brain in order to assess it. There was, he wrote, "*no more exact gauge of consistence of texture than the rough-and-ready methods afforded by the sense of sight and touch*".

Above: A sketch from Alexander Morison's 'The Physiognomy of Mental Diseases' (1838) showing the final stage of GPI
© Wellcome Collection



Left: A rocking microtome produced by the Cambridge Scientific Instrument Company in 1885
© Science Museum, London

Science isn't what most people tend to think of when they hear the words 'Victorian asylum'

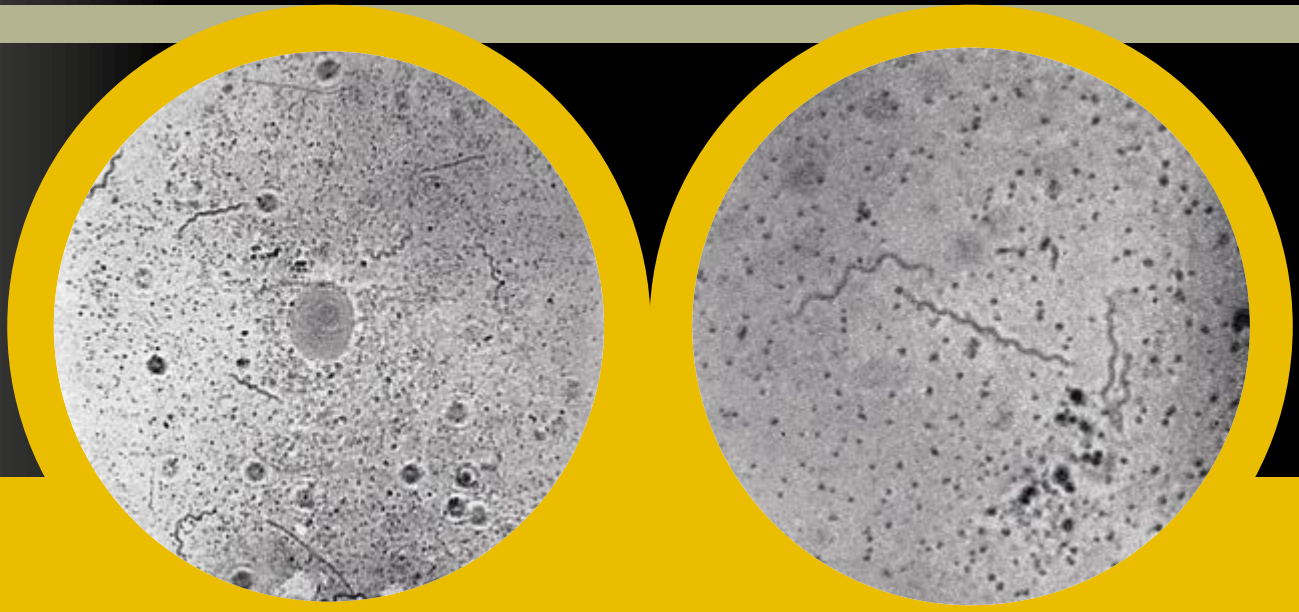
Almost every part of the general paralytic body was placed under the microscope

Adhesions between membrane and brain substance in GPI, from Thomas Smith 'Clouston's Clinical Lectures on Mental Diseases' (1883).
© Wellcome Library, London.

The deteriorated state of these brains often frustrated the efforts of people like Bevan Lewis to make them readable under the microscope. Stripping away the outer membranes and tissues was difficult when the brain was almost flattened, as was the task of cutting neat sections with a microtome or razor. The softened brain took up stains such as haematoxylin exceptionally easily, making it difficult to decide whether a stain indicated a pathological condition, the poor state of the brain substance or simply bad sectioning technique. Once one had cleared these hurdles successfully – by following Bevan Lewis's advice, perhaps, or referring to handbooks like Edwin Goodall's *Microscopical Examination of the Human Brain* (1894) – it was time to look through the lens.

Bevan Lewis suggested that general paralysis progressed in three stages: inflammation; the growth of what he called 'spider cells'; and finally the spread of these cells through the whole brain. His spider cells were likely what we now refer to as astrocytes – cells in the brain and spinal cord that repair the tissue after injury. In the general paralytic brain, spiders were shown up by deeper staining and appeared to strangle the tissues around them. Not all were convinced by these new pathological features revealed by the microscope. Scottish psychiatrist Thomas Smith Clouston suggested, in 1902, that many younger asylum officers existed in an 'all-pervading pathological atmosphere', with their zeal for microbiology and bacteriology leading them to overlook other elements of mental illness such as family history.

But the presence of spiders was significant. They suggested that the brain was reacting to some kind of injury or infection. In the 1890s, attention was increasingly focused on toxins and insanity – the possibility of bacteria entering the bloodstream via decaying and infected teeth, for example. The theory that GPI was also the result of infection gained authority. If GPI was a toxic condition, that would explain its multiple manifestations: sores on the skin, easily fractured bones, wasted muscles and mental derangement. An infection coursing through the



The causative organism of syphilis, from Fritz Schaudinn's 'Arbeiten: Herausgegeben mit Unterstützung der Hamburgischen Wissenschaftlichen Stiftung' (1911).
© Wellcome Collection.

bloodstream could be the key to GPI that asylum doctors had been searching for. By the turn of the century, blood, pus, semen and urine were all put under the microscope in the hope of solving the riddle of the disease. Staff training kept pace with these new developments. Edwin Goodall, a young West Riding Medical Officer, was granted time off to attend a bacteriology course at Guy's Hospital. Later, working at Cardiff City Asylum, Goodall said he had found bacterial anomalies in a large proportion of the GPI patients' urine and faeces he examined, but was disappointed when orally administered disinfectants had little effect. Clearly the infection was too deep-rooted to be rectified by simple disinfection.

It would be a few more years before the link between GPI and syphilis was definitively made (though many had suspected it). The causative organism was identified in 1905 and in the 1910s the characteristic spirochaete of syphilis was observed in the brain tissue of several GPI cases. The work of late nineteenth-century asylum staff had done much to shift the focus towards ever-more-minute elements of the GPI patient's bodily fabric. Researchers at the West Riding used a range of techniques and technologies to study the body. From exterior symptoms like reflex anomalies, they progressed inside, opening up the skull, sectioning the brain and scrutinizing the cells. In the course of their investigations doctors did not forget the patient as a person. Rather, microscopic and pathological findings were used in conjunction with clinical observations and life histories to produce a fuller picture of the disease.

West Riding Superintendent James Crichton-Browne (Bevan Lewis's predecessor), addressing the Medico-Psychological Association in 1878, expressed his concern for science being 'hustled … into a subordinate place' and called for it to be employed alongside psycho-social approaches in order to achieve 'a spark of genuine illumination'. Crichton-Browne's warning still resonates 140 years later; for a complete history of the asylum, we need the scientific as well as the social. The microscopic slides and bottled specimens that littered that abandoned asylum basement were artefacts testifying to the scientific life of the asylum. They were part of the stories contained in the patient files, not simply shameful remnants of an exploitative past. The Victorian asylum could be a place of care and, for some, it could be a place of incarceration. But it was also a scientific space, where multiple practices, technologies and techniques were employed to solve the mystery of a widespread and debilitating condition in late nineteenth-century Britain.

FURTHER READING

Bevan Lewis W (1899). A Text-Book of Mental Diseases, second edition, London: Charles Griffin. Available online at **https://wellcomelibrary.org/item/b21272323**

Bracegirdle B (1986). A History of Microtechnique: The Evolution of the Microtome and the Development of Tissue Preparation, Lincolnwood: Science Heritage Ltd.

Casper ST and Jacyna LS (2012). *T*he Neurological Patient in History, Rochester: Rochester University Press.

Goodall E (1894). The Microscopical Examination of the Human Brain, London: Baillière, Tindall & Cox. Available online at **https://wellcomelibrary.org/item/b21445540**

Wallis J (2017). Investigating the Body in the Victorian Asylum: Doctors, Patients, and Practices, Basingstoke: Palgrave Macmillan.

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Good Germs, Bad Germs – participatory 'metagenomics' of the domestic microbiome

Both scientific and popular interest in the microbiome has grown exponentially in recent years. Many people would like to develop more nuanced or 'probiotic' ways of living with microbes. To date however, there has been limited public engagement with the science and technology of metagenomics. Taking advantage of recent developments in DNA sequencing, a project called 'Good Germs, Bad Germs' has been investigating the microbial ecologies found in people's kitchens. Working with a small cohort of households, the project delved into the questions that people ask about bacteria in their home and explored what happens when they work with scientists to find out the answers.

The recent revolution in next-generation sequencing is enabling microbiologists to understand the coding information of microbial life, at higher resolution and faster throughput than ever before. Investigations into the microbiomes of the built environment, including domestic homes, is a dynamic emerging area of study. High-profile research groups (e.g., Knight lab, Green lab, Dunn lab, Gilbert lab, amongst others), are beginning to explore the plethora of microbial communities that live alongside, and within, human communities. Some of this metagenomic work invites contributions from public participants, through citizen science or crowdsourced initiatives. These projects demonstrate that involving members of the public can enable cost-effective science, as well as provide educational and public engagement opportunities. However, non-scientists are rarely involved in the actual development and shaping of metagenomic research (referred to by social scientists as 'upstream' of decision-making about the direction of the research). Public participants' contributions are mostly limited to acting as 'data collectors' (or 'downstream' involvement).

To begin to address this gap, the 'Good Germs, Bad Germs' project was conducted by an interdisciplinary team of social scientists and biologists in 2016–2017 and involved 14 households from a suburban neighbourhood in Oxford. (A short video on the study is available on the project website.) The participants were given an introduction to metagenomics and trained in how to collect microbial samples from their homes using provided kits (*Figure 1*).

Figure 1 Sampling kit provided to participants in the Good Germs, Bad Germs project.

Participating households first undertook a 'kitchen safari', mapping five common sites in their kitchens and then one of their own choosing. They then designed and carried our four further participatory experiments exploring other dimensions of the kitchen microbiome and the effects of different hygiene practices. The

detailed foci of these experiments were developed over the course of six group meetings, informed by the participants' interests, and negotiated by consensus between the researchers and the household members. We looked at the efficacy of different cleaning products, the ecology of chopping boards and the microbiome of domestic fridges. Participants then designed their own personal final experiment. Many chose to look at how their domestic animals shaped the microbiome of the kitchen. After gathering their samples, participants were asked to freeze them until collection. The samples were analysed using 16S rRNA sequencing to identify the types of bacteria present in the swabbed sites. The results were reported at group meetings for participatory analysis and visualization.

This project found that involving public participants in decision-making about the direction of metagenomic experiments provided an opportunity for the detailed and complex aspects of the microbiology of the home to be visualized and discussed. Findings from the project reveal that household participants were willing to take a more 'ecological' approach to understanding how humans and microbes exist together. However, it was also clear that they experience some tensions and conflicting ideas about the 'appropriate' ways to deal with microbes in their kitchens. For example, the study found the participants wanted to see the domestic microbiome in terms of species and struggled with the community ecology data produced by the project methodology.

The study also found that participants were concerned about whether they are 'too' clean, or not clean 'enough'. Through analysis of interviews and group meetings with the participants, our analysis suggests this uncertainty is associated with the complex and often conflicting messages that circulate about microbes. For example, historically, public health promotions have tended to highlight microbes as pathogenic threats that need to be eliminated, while other ideas (such as the 'hygiene hypothesis') have promoted the message that exposure to 'germs' is good for early human development.

We suggest that the participatory model developed through the project has great potential for future research into the microbiomes of further elements of the domestic and broader built environments, enabling scientists and public participants to work together to decide what priorities and direction the research should take.

Carmen McLeod (left)
Jamie Lorimer (right)
University of Oxford

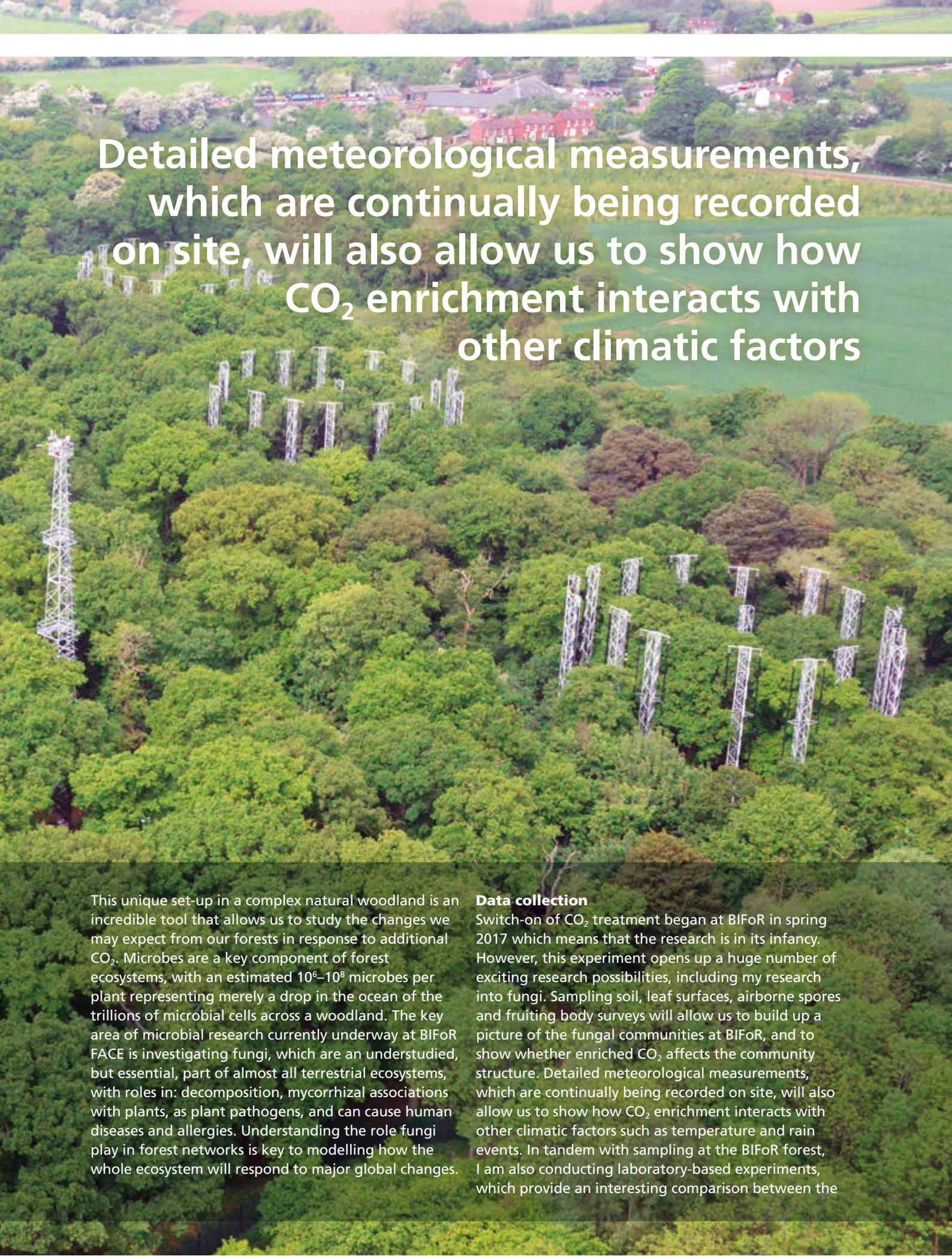
Future Climate Future Forests Future Fungi

What comes to mind when you think of microbiology research? *E. coli* cultures in a lab? White lab coats? How about a high-tech research forest? At a state-of-the-art research forest in Staffordshire, Birmingham Institute of Forest Research (BIFoR) is undertaking an exciting Free Air Carbon Enrichment (FACE) experiment which enables research investigating the effect that climate change will have on our future forests.

What is BIFoR?

BIFoR has a number of researchers conducting a wide range of experiments but the facility that is common to all the researchers is the FACE facility, which is located in the BIFoR research forest in Staffordshire and is situated in a natural unmanaged woodland, dominated by 150-year-old oaks (*Quercus robur*). Nestled amongst the trees are a series of large towers, forming rings around plots of the woodland; there are nine plots in total, grouped into three categories:

- Treatment plots: plots are sprayed with carbon dioxide (CO_2) at a concentration of around 150 ppm above the current ambient CO_2 concentrations of around 400 ppm. This mimics what current models predict to be the atmospheric CO_2 concentration in around 50 years' time.
- Ambient plots: identical to the treatment plots, with the same infrastructure, but they are simply sprayed with air at current-day ambient CO_2 concentration.
- Control or 'ghost' plots: have no towers or other infrastructure, so act as a control against the initial disturbance of the woodland during construction.



Detailed meteorological measurements, which are continually being recorded on site, will also allow us to show how CO_2 enrichment interacts with other climatic factors

This unique set-up in a complex natural woodland is an incredible tool that allows us to study the changes we may expect from our forests in response to additional CO_2. Microbes are a key component of forest ecosystems, with an estimated 10^6–10^8 microbes per plant representing merely a drop in the ocean of the trillions of microbial cells across a woodland. The key area of microbial research currently underway at BIFoR FACE is investigating fungi, which are an understudied, but essential, part of almost all terrestrial ecosystems, with roles in: decomposition, mycorrhizal associations with plants, as plant pathogens, and can cause human diseases and allergies. Understanding the role fungi play in forest networks is key to modelling how the whole ecosystem will respond to major global changes.

Data collection

Switch-on of CO_2 treatment began at BIFoR in spring 2017 which means that the research is in its infancy. However, this experiment opens up a huge number of exciting research possibilities, including my research into fungi. Sampling soil, leaf surfaces, airborne spores and fruiting body surveys will allow us to build up a picture of the fungal communities at BIFoR, and to show whether enriched CO_2 affects the community structure. Detailed meteorological measurements, which are continually being recorded on site, will also allow us to show how CO_2 enrichment interacts with other climatic factors such as temperature and rain events. In tandem with sampling at the BIFoR forest, I am also conducting laboratory-based experiments, which provide an interesting comparison between the

FURTHER READING

Details about BIFoR:

Norby RJ *et al*. (2016). Model–data synthesis for the next generation of forest free-air CO_2 enrichment (FACE) experiments. New Phytol 209, 17–28. doi:10.1111/nph.13593

https://www.birmingham.ac.uk/research/activity/bifor/index.aspx

Forest fungi:

Gange AC *et al*. (2007). Rapid and recent changes in fungal fruiting patterns. Science 316, 71. doi: 10.1126/science.1137489

Classen AT *et al*. (2015). Direct and indirect effects of climate change on soil microbial and soil microbial-plant interactions: What lies ahead? Ecosphere 6, 130. **http://dx.doi.org/10.1890/ES15-00217.1**

Suz LM *et al*. (2015). Monitoring ectomycorrhizal fungi at large scales for science, forest management, fungal conservation and environmental policy. Ann For Sci 72, 877–885. **https://doi.org/10.1007/s13595-014-0447-4**

Treseder KK and Allen MF (2000). Mycorrhizal fungi have a potential role in soil carbon storage under elevated CO_2 and nitrogen deposition. New Phytol 147, 189–200 doi:10.1046/j.1469-8137.2000.00690.x

Phillips RP *et al*. (2012). Roots and fungi accelerate carbon and nitrogen cycling in forests exposed to elevated CO_2. Ecol Lett 15, 1042–1049. doi:10.1111/j.1461-0248.2012.01827.x

A small selection of the fungal fruiting bodies found at BIFoR FACE

complex natural environment, and the less complex laboratory environment which can be more precisely manipulated.

What are we expecting to find?

There have been a number of CO_2-enrichment experiments investigating fungi. Studies have varied from laboratory-based growth chamber experiments, through to other FACE facilities in young plantation forests, but barring an Australian FACE experiment in a eucalyptus forest, no previous FACE experiments have been undertaken in natural, complex, old woodlands such as at BIFoR. For my fungal research at BIFoR, my hypothesis is that the fungal community composition will be altered under elevated CO_2. I also think that any effects we see on the fungal community will be partly due to changes in the forest plants, but also due to direct effects of CO_2 on the fungi.

Looking to the future

My research is just the beginning of microbial research at BIFoR, with an enormous scope for future projects, including further research into fungi as well as other forest microbial communities. One key future project at BIFoR that I would like to highlight will look at microbial enzymatic activity in the soil. This project will lead on from fungal community characterization and investigate whether community changes are accompanied by alterations in enzymatic activity.

Microbes are a **key component** of forest ecosystems

Acknowledgements

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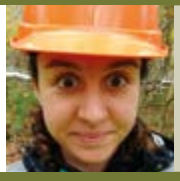

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MICROBES FROM dawn to dusk

As microbiologists we don't take our laboratory experiments home, but the microbes don't hold that against us! They are happy to produce and process many of our household foods, drinks and medicines. For example, pastoral and agrarian societies have long depended on the processing of foodstuffs in the form of fermentation – the metabolism of sugars into acids or alcohols and gases.

The fermentation of newly farmed cereals by wild yeasts introduced alcohol production; probably simultaneously in the Fertile Crescent, Indus Valley and China. These cultivated cereals soon became bread and at one point all leavened bread was thoroughly fermented and often made from a prior culture (beer foam, pressed grapes or even just some of yesterday's dough).

For pastoral societies, the process of acid fermentation of milk from newly domesticated ruminants into cheeses and yogurts removed some of the lactose. This aided consumption of milk prior to the high selection pressure for lactase persistence in Northern Europe, Central Asia and some sporadic African communities. This was key to survival during winters and famines.

Benign microbes prevent the growth of harmful pathogens and enhances the flavour of both sauerkraut and kimchi

Don't forget when you are brushing your teeth tonight to acknowledge *Xanthomonas campestris* for the xanthan gum, a polysaccharide, found in your toothpaste!

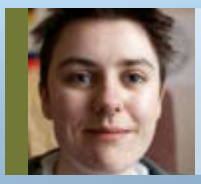
Microbes are also used in food preservation. During the pickling of vegetables as part of the fermentation process, competitive exclusion by benign microbes prevents the growth of harmful pathogens and enhances the flavour of both sauerkraut and kimchi. It is the *Aspergillus* mould that ferments soy beans and wheat to produce the traditional precursor (called koji) for soy sauce. Vinegar is the result of a collaboration between alcohol fermentation by yeasts that is then used as food for acid fermentation by *Acetobacter*. 'Modern-day' food and drink does not escape input from microbes either; fizzy juice, pop, soda; whatever you call them, these sugary drinks all rely on *Aspergillus niger* to produce the citric acid used in production.

Microbes themselves can also be a fine addition to the table – many a stir-fry or breakfast has been thankful for *Agaricus bisporus*, whose fruiting body gives us the portobello, common, button and chestnut mushroom depending on maturity (the white colouring is actually a propagation of mutants!). Or for a more direct ingestion of microbes, try natto – a Japanese fermented soy bean breakfast food made with the bacterium *Bacillus subtilis*. To clean up after dinner and drinks we can make use of enzymes from fungi and Gram-positive bacteria whose lipases, amylases and proteases turn up in biological washing powder.

Sauerkraut is finely cut cabbage that has been fermented by various lactic acid bacteria

This is by no means a comprehensive list but it does highlight some of the important roles microbes play in making household products. Oh, and finally, don't forget when you are brushing your teeth tonight to acknowledge *Xanthomonas campestris* for the xanthan gum, a polysaccharide, found in your toothpaste!

We would like to thank Professor Geoffrey Gadd for sharing his broad knowledge of the wonders of microbiology which stimulated this article.



Elliot Erskine (left)
Nicola Stanley-Wall (right)
School of Life Sciences, University of Dundee

London's MICROBIOTA

A series on applied microbiology themes in the capital

The Tower of London is no longer the only major building in London protected by a moat; it has been joined by the new United States Embassy (right), and this one, more authentically, has water in it. The Embassy is in a large area of development around Vauxhall encompassing the former Battersea Power Station, familiar to many from a 1977 Pink Floyd record cover, and, of more interest to microbiologists and rather less well known, the site of the Brown Animal Sanatory Institution.

It was founded in 1871 with money left in trust to the University of London by Thomas Brown, who required that the Institution was to be established within a mile of Westminster or Southwark 'for investigating, studying, and without charge beyond immediate expenses, endeavouring to cure, maladies, distempers and injuries, any Quadrupeds or Birds useful to man'. For some obscure reason, Brown also stipulated that, should the University of London fail to establish the Institution, the money should be used to endow Professorships in Sanskrit and other languages at the University of Dublin.

An early appointment was that of Emmanuel Klein (left), a Croatian who had trained as a physiologist and anatomist in Vienna. He was appointed scientific assistant to the Institution's first Professor-Superintendent, John Burden-Sanderson, and given the title Assistant Professor in recognition of his outstanding qualifications. Klein enjoyed a long, but not entirely glittering, career in England. Shortly after moving to London, he achieved notoriety as a co-author of *Handbook for the Physiological Laboratory* in 1873. Some of the experiments on animals described in the book provoked public outrage, leading to the 1875 Royal Commission on Vivisection for Scientific Purposes and the subsequent Cruelty to Animals Act of 1876. During the Commission's deliberations, Klein's responses to its questions – declaring that he had 'no regard at all' to the suffering of animals and that 'a man who conducts special research, he has no time, so to speak, for thinking what the animal will feel or suffer' – did little to endear him to the British public.

More positively though, Klein worked extensively in bacteriology throughout his career in England, performing investigations for the Local Government Board and writing *Microorganisms and Disease*, the first English language microbiological text book, published in 1884. In it he extols the ideas and approaches of the great European microbiologists, particularly Robert Koch. But despite this, when he was appointed the same year to a Government commission to investigate cholera

The Brown Institution, Vauxhall, for diseases of animals

in India, Klein felt compelled to dispute Koch's claim to have isolated the causative organism, *Vibrio cholerae*. The prevailing view in British India was still essentially a miasmatic theory of transmission, heavily supported by commercial interests who thought the germ theory a plot to restrict British shipping from India with inconvenient quarantine periods and *cordons sanitaire*. Based on his experiments and observations in India, Klein's report dismissed Koch's claim noting that vibrio-contaminated water failed to cause cholera in large numbers of those that consumed it, including Klein himself, that the bacteria were very sensitive to stomach acid and that no convincing animal model for cholera transmission had been demonstrated. To his credit he did record the ubiquity of the vibrio in cholera victims and came round to the correct view just a few years later, yielding to the overwhelming empirical evidence on the association of the cholera vibrio with clinical disease.

In 1909, Frederick Twort was appointed Professor-Superintendent of the Brown Institution. During his time there he developed a synthetic growth medium for the mycobacterium responsible for Johne's disease (a wasting disease of ruminants) using a supplementary growth factor (now known to be vitamin K), but he is perhaps better known as one of the two, independent discoverers of bacteriophages. In the Lancet in 1915, he reported their lytic effect in a micrococcus and recognized it as the action of an infectious, filterable lethal agent that multiplies during the lethal process. He was, however, reluctant to go the whole hog and identify it as a virus, 'the possibility of it being an ultra-microscopic virus has not been definitely disproved...'. Two years later Felix d'Herelle, investigating an outbreak of dysentery in a French cavalry regiment, noted the action of bacteriophage in *Shigella*. He described the effect and concluded that it was caused by a bacteria-infecting virus, coining the term 'bacteriophage'.

It wasn't until four years later, in 1921, that Twort's paper was rediscovered and he was given some share of the credit. There was some acrimony at this stage and claims that d'Herelle had been aware of Twort's earlier work and failed to acknowledge it, though this has been discounted by others. D'Herelle continued to work on bacteriophages, and later, perhaps in an attempt to bolster his claim to priority, he reported that he had first encountered bacteriophage lysis earlier in his career in 1910, when investigating a diarrhoeal disease of locusts in Mexico. Whatever the truth of this, someone able to stride purposefully into a swarm of locusts in the cause of science has my respect, but to do so when the locusts are suffering from diarrhoea is truly heroic.

Twort was the Brown Institution's last Superintendent. It suspended its activities at the start of the Second World War but, for some unexplained reason, the Luftwaffe seemed to take particular exception to its premises in Wandsworth Road. It sustained bomb damage in 1940, 1943 and February 1944 and was finally finished off by a flying bomb in July 1944. The Brown never reopened and the trust money remaining from its foundation was eventually divided between the Universities of London and Dublin in 1971.

Martin Adams
SfAM President 2011–2014

sfam society for applied microbiology

ANNUAL CONFERENCE

JULY 2018

9–11

Passport to Infection
Infections of Travel & Leisure

9–11 July 2018 | The Grand Hotel | Brighton | UK

We have a very exciting line-up of speakers for you at the *Sf*AM Annual Conference 2018. The 3-day event will be packed full of the latest research on infectious diseases, given by expert microbiologists and clinicians covering a wide range of topics that include migration, medical tourism and unusual infections.

We are especially pleased to announce that our *Journal of Applied Microbiology* Lecture will this year be given by Professor Albert Bosch, University of Barcelona, whose specialist area is the Hepatitis A virus. Albert will be giving us some new insights from an old acquaintance. Another talk to look forward to will be given by Natasha Hochberg, MD, an infectious disease physician with appointments in the Department of Medicine and the Department of Epidemiology at Boston University School of Medicine.

Closer to home we look forward to listening to Robert Aldridge, University College London, whose current research focuses on establishing the burden of disease and health inequalities faced by vulnerable, and often invisible, populations including migrants. Robert is sure to enlighten us as he discusses how to manage the health of mobile populations.

*Sf*AM President, Professor Mark Fielder, will present the prestigious W H Pierce Prize to an outstanding microbiologist who has made a substantial contribution to the science of applied microbiology. The award and subsequent lecture has rapidly become the highlight of the Annual Conference in recent years, with talks from Jack Gilbert, Nicola Stanley-Wall and Brendan Gilmore all receiving standing ovations.

Our highly regarded and often-emulated ECS Committee will be hosting some of the more social and interactive events such as the personal branding workshop, icebreaker, quiz night and perhaps a pub crawl in Brighton.

The 3-day event will be packed full of the latest research on infectious diseases

Hot and bothered – the returning traveller with fever

Nick Beeching
Liverpool School of Tropical Medicine, UK

Monday 9 July 2018

10:00 – 17:00	**Registration** Empress Suite
11:00 – 16:00	**Personal impact and branding in science workshop** Various
18:00 – 19:00	**Journal of Applied Microbiology Lecture: *Hepatitis A virus – new insights from an old acquaintance*** Albert Bosch, *University of Barcelona, Spain*
19:00 – 20:00	**Drinks reception and buffet**
19:15 – 20:00	**Early Career Scientists icebreaker, drinks reception and buffet**
20:30	**Quiz**

Tuesday 10 July 2018

08:45 – 09:30	**Registration** Empress Suite
09:30 – 10:05	**Hot and bothered – the returning traveller with fever** Nick Beeching, *Liverpool School of Tropical Medicine, UK*
10:05 – 10:40	**Holidays from hell – selected case reports from The Hospital for Tropical Diseases** Geraldine O'Hara, *Hospital for Tropical Diseases, London, UK* Eben Jones, *Hospital for Tropical Diseases, London, UK*
10:40 – 11:05	**Refreshments, posters, exhibition**
11:05 – 11:40	**Don't go into the water! Dangers of swimming** Paul Hunter, *University of East Anglia, UK*
11:40 – 12:15	**Sun, sea and Legionnaires' disease** Susanne Lee, *Leegionella Ltd, UK*
12:15 – 13:15	**Lunch, posters and exhibition**

SfAM President, Professor Mark Fielder, will present the prestigious W H Pierce Prize to an outstanding microbiologist

13:15 – 13:50	**Holiday romance – the fun before the fever** Tristan Barber, *NHS, UK*
13:50 – 14:25	**Acting as a health and hygiene expert in group litigation against tour operators** David Horrocks, *Environmental Health Services, UK*
14:25 – 14:50	**Refreshments, posters, exhibition**
14:50 – 15:25	**Infections on cruise ships** Vivek Kak, *Henry Ford Allegiance Health, USA*
15:25 – 16:00	**Migration and health – managing health of mobile populations** Robert Aldridge, *University College London, UK*
16:00 – 17:00	**Attended poster session**
17:00 – 18:45	**Exhibition and drinks reception**

Wednesday 11 July 2018

08:45 – 09:15	**Registration** Empress Suite
09:15 – 09:50	**Lessons learnt from EuroTravNet** Patricia Schlagenhauf, *WHO Collaborating Centre for Travellers' Health, University of Zürich, Switzerland*
09:50 – 10:25	**You ate that? Exotic foods and unusual infections** Natasha Hochberg, *Boston University School of Medicine and Boston Medical Center Travel Clinic, USA*
10:25 – 11:00	**Refreshments and posters**
11:00 – 11:35	**The work of the National Travel Health Network and Centre (NaTHNaC)** Dipti Patel, *National Travel Health Network and Centre (NaTHNaC), London, UK*
11:35 – 12:10	**Sun, sea and surgery – infection risks of medical tourism** Lin H Chen, *Mount Auburn Hospital and Harvard Medical School, USA*
12:10 – 12:45	**Veterinary public health threats and trade** Helen Roberts, *Animal and Plant Health Agency, UK*
12:45 – 13:15	**Early Career Scientists' Annual General Meeting**
12:45 – 13:45	**Lunch and posters**
13:45 – 14:45	**Student presentations**
13:45 – 14:00	**Prevalence and survivorship of staphylococci isolates from airport subsites** Linsey Pierre & Katelyn Jensen, *Marian University, Wisconsin, USA*
14:00 – 14:15	**Aquatic invertebrates and the spread of antimicrobial-resistant bacteria in aquatic environments** Temilola Olanrewaju, *Environmental Sciences Research Institute, Ulster University, Coleraine, UK*
14:15 – 14:30	**Detection of multidrug-resistant *Mycobacterium tuberculosis* using GeneXpert in HIV-seropositive patients in relation with their CD4 lymphocyte count** Binod Rayamajhee, *Kathmandu Research Institute for Biological Sciences, Lalitpur, Nepal*

The Grand Hotel, Brighton

14:30 – 14:45 ***Galleria mellonella* as an alternative model organism to study *in vivo* virulence of intervertebral disc *Propionibacterium acnes* isolates**
Gurpreet Sandhu,
Coventry University, Coventry, UK

14:45 – 14:50 **New Lecturer Research Grant introduction**
Mark Fielder, *SfAM President*

14:50 – 15:25 **SfAM New Lecturer Research Grant Lecture: *Ps. aeruginosa persister cell formation and awakening relies on polyphosphate***
Cláudia Marques,
Binghamton University, New York, USA

15:25 – 15:50 **Refreshments and posters**

15:50 – 15:55 **Introduction to the W H Pierce Prize**
Mark Fielder, *SfAM President*

15:55 – 16:30 **W H Pierce Prize Lecture**

16:30 – 17:00 **Annual General Meeting**

19:15 **Conference dinner, drinks reception and entertainment (pre-paid ticket only)**

*Sf*AM AGM Agenda

87th Annual General Meeting of the Society *for* Applied Microbiology

11 July 2018, 17:30, The Grand Hotel, Brighton, UK

1. **Apologies for absence.**
2. **Approval of minutes published in the September 2017 issue of the *Microbiologist* of the 86th Annual General Meeting held in Gateshead, 2017.**
3. **Matters arising from the previous minutes.**
4. **Report of the Trustees of the Society 2017:**
   (i) Objectives and Activities.
   (ii) Achievements and Performance.
   (iii) Financial Review.
   (iv) Plans for the Future.
5. **Adoption of the 2017 Annual Report.**
6. **Election of new Members, deaths and resignations.**
7. **Nomination and election of new Executive Committee Members.**
8. **Any other business*.**

* *To ensure the meeting keeps to time, items of any other business must be raised with the General Secretary at least 24 hours before the start of the meeting.*

Getting into science policy

Staying up to date with science when you no longer want to work at the bench can prove a bit of a dilemma for those at the start of their career. Fortunately, there are a few lines of work where you can do just that – a career in science policy is one of them! In this article I'll share my experiences and highlight some ways that you can get involved.

Working in science policy

What might you be doing in a science policy job? Well, the term itself is quite broad and can mean subtly different things:

- ***Science for policy*** means ensuring decisions are based on scientific advice (e.g. environmental, health or transport policy).
- ***Policy for science*** relates to decisions that affect science as a whole (e.g., education, research funding).

In both cases, it is important that policymakers and politicians receive high-quality evidence. That way, Government decisions can be effectively informed and scrutinized. That's essentially the role I play: helping microbiologists share their expertise and knowledge with the right people in Parliament and Government.

However, a career in science policy doesn't just mean you're trying to access the corridors of power: there are also jobs in Parliament and Government where you could be actively seeking out expert advice. Wherever you work, the core requirements are the same: a keen eye for details and the ability to communicate in a variety of ways.

Is this the career for you?

Working in science policy can be very similar to a career in *science communications* or *public engagement*. In fact, with science policy you're often just engaging a very niche part of the public, where you need to communicate research in a way that is interesting and easily accessible. Perhaps one of the key differences is that you're asking the intended audience to *do something* with the information you give them.

This aspect is what first attracted me to the idea of a science policy career, midway through my PhD project on neglected tropical diseases. I ended up reading many reports from bodies such as the World Health Organization, where scientists were striving to get the issue on politicians' agendas. Many of us enter research to have a positive impact on the world. I came to see science policy as an obvious way through which research

JOB OPPORTUNITIES

You can keep an eye out for science policy jobs and internships using the following resources:

Civil service jobs
www.civilservicejobs.service.gov.uk

Parliament jobs
www.parliament.uk/about/working/jobs

W4mp www.w4mpjobs.org

Campaign for Science and Engineering

Job adverts are frequently shared on the **PSCI-COM@JISCMAIL.AC.UK** mailing list

It is important that policymakers and politicians receive high-quality evidence

can be translated directly into public benefit. If you feel the same, then science policy might be the direction for you.

A catch-22 situation

As with many careers involving science, the competition for science policy jobs is quite high. Consequently, you can find yourself in the situation where you need to have previous experience just to qualify for temporary internships and secondments. If your interest in science policy blossoms relatively late, as it did with me, you might not feel you've built up the necessary experience.

However, you will have more relevant experience than you think. Having a background in research, although not necessary, gives you the tools to digest large amounts of information and pick out the key points. Attending and presenting at conferences builds networking skills, which are invaluable when reaching out to a vast array of people with different viewpoints, experience and expertise. It also boosts the ability to communicate complex ideas in simple terms. Whether you've been awarded a BSc, MSc or PhD, you'll have some of these skills, so all that's needed is a bit of policy-relevant experience!

BACKGROUND READING

You can find many guides online that describe how policy is made and scrutinized. Some great examples include:

- Newton's apple, who also run workshops throughout UK universities **www.newtons-apple.org**.
- An in-depth booklet titled *Science into Policy*, produced by the Natural Environment Research Council.

Take a look at some science policy reports to get a flavour of the format and tone. This may also help your writing style. Check out the websites of the following groups and organizations:

- House of Commons Science and Technology Select Committee.
- House of Commons Library.
- Parliamentary Office of Science and Technology.
- Campaign for Science and Engineering.

Chris Brown
SfAM *Policy & Public Affairs Manager*

An interview with Tristan Barber

Tristan Barber
Consultant Physician in Sexual Health and HIV
Chelsea and Westminster Hospital
London, UK

Stewart Cumiskey
Society for Applied Microbiology

You have spent time teaching in India, Kenya, South Africa and Nepal – what were you teaching and what did you learn while in those countries?
Wow, a big question. The main things I learned are that some people will walk days for good healthcare; that doctors are human beings and people would sometimes rather be based with their families in Nairobi or Kathmandu rather than rural locations, even if that's where the need is. Also, that nurses are better at assessing what's going on in a clinic rather than doctors who are treated to top-level VIP floss and flannel. Some countries have paternalistic healthcare systems that work. I saw African clinics that process 300 patients for bloods and antiretrovirals from 7am–1pm, daily. Difficult to teach much, when we in London may struggle to see 300 in a week.

Should we be worried about *Mycoplasma genitalium* and what do we know about it?
Mycoplasma genitalium – I don't think we should be 'worried' as such, but do think we need to appreciate we don't test for it much, and ensure we use antibiotics judiciously to ensure we don't drive *Myc. genitalium* resistance. This includes the treatment of 'non-specific' urethritis. More rapid (and point-of-care) diagnostics can help here. We know it affects 2–3% of young people and 7% of young people attending sexual health clinics. Associated disease is usually mild, but it can increase HIV transmission.

There have been some media reports on 'super-gonorrhoea' and the first case that couldn't be treated – what would the world look like if it did become untreatable?
Resistant gonorrhoea is more of a worry. So far it's been contained, but widespread resistance would be problematic, especially as we've just had a restriction on access to spectinomycin (the remaining antibiotic that works) due to production issues. People have got very accustomed to this infection being easily treated. Managing super-resistant gonorrhoea could be very difficult indeed. In the UK this is where we are lucky to have a network of STI clinics and a well-established gonococcal resistance surveillance system.

Our Annual Conference is focusing on Infections of Travel. Obviously you'll be focusing on sexual health – what do you see in your clinic as the most common issue for people returning from overseas?
The most common issue for people returning from overseas is having had sex under the influence of drugs and alcohol, rather than a specific infection. This does sometimes lead to infections, but also often leads to regret and remorse, and may also mean people have missed the window period for preventative interventions like HIV post-exposure prophylaxis (PEP).

Do you agree that the HPV vaccine should be offered to young boys?
HPV vaccines should be offered to all young people, regardless of gender or sexual orientation, to prevent anogenital and head and neck cancers (on the rise), as well as the development of genital warts, which cause a huge amount of morbidity and inconvenience.

You recently hosted a Q+A on sexual health online – do you think there's a future in this kind of approach?
Whilst social media can be helpful for certain things, I think nothing beats face-to-face interactions for really

Produced by the National Institute of Allergy and Infectious Diseases (NIAID), this digitally colourised transmission electron microscopic (TEM) image depicts a single human immunodeficiency virus (HIV), as it was budding from a human immune cell, which the virus had infected, and within which the HIV virus replicates itself.

understanding people's worries and concerns about their sexual activity and the risk of infections. Since the arrival of HIV, we've seen more open and public discourse around sexual health which I think should be maintained and not forgotten.

Your work has been focused on HIV-related neurocognitive disorders – what are the latest findings in this area?

HIV-related neurocognitive impairment is a tricky one. We are now seeing cohorts of people diagnosed and started on HIV medicines much earlier, with less exposure to the virus, so I think the signal that HIV may be involved in neurocognitive abnormalities is starting to dwindle somewhat. Nonetheless, I do think these problems affect a small minority of patients living with HIV, perhaps with a genetic predisposition to different blood–brain barrier viral transit and higher levels of CSF or CNS inflammation.

What are the biggest challenges to sexual health in the UK?

The biggest challenge in the UK is the fragmentation of services following the Health and Social Care Act. Sexual health services are now commissioned by Local Authorities whose budgets are not ring-fenced. This sleight of hand means that services the public perceives to be 'NHS-delivered' can now be put out to tender, risking the public health advances that have been made by our specialty in recent years if cost becomes more important than quality and good public health.

Is there a particular kind of infection that fascinates you more than others? Like, do you have a 'favourite'?

The most intriguing infection is one of my least favourite. Herpes simplex, and the herpes family of viruses, cause a huge amount of disease, including affecting people's mental health. Steps in vaccine development to prevent these infections would have a tremendous effect in improving people's sex lives and worries about passing on infection. Although it may seem relatively inconsequential, it really does cause tremendous problems for individual patients as well as in counselling time, and has profound effects on some people's ability to form intimate relationships, sometimes over a lifetime sadly.

In your experience, do you think that young people are as knowledgeable about sexual health as they should be? Has that decreased over the years?

Young people know some things more than they used to, and some things far less. In general, they know far less about HIV, often thinking it affects only older gay men. With social media in particular, young people can struggle to find or maintain privacy, meaning their sexual activities are often made public, shared and commented on. There is more gender and sexual fluidity, but there can be issues arising around consent also, which can muddy the waters for young people trying to define themselves and what gives them and their partners most pleasure.

Membership CHANGES

We would like to warmly **welcome** the following new Members to the Society.

AUSTRALIA
J. J. Paxman
Z. A. Dyson
S. Sukumar

CZECH REPUBLIC
P. Jaklová

INDIA
S. K. Rawat
P. Sharma
B. Rekadwad
M. M. Royam
A. Angrup
N. Chaudhary
A. Kumar

ITALY
M. Laidani

JORDAN
M. Y. Alkawareek

MALAYSIA
Y. Navaneethan

MEXICO
O. Bravo Ruíz

NEPAL
P. Poudel

NEW ZEALAND
S. Fraser

NIGERIA
S. O. Adebajo
E. O. Fenibo
G. O. Mensah-Agyei
O. A. Oyedele
A. A. Waidi
C. O. Eze
C. A. Ozochi
A. O. Oaikhena
K. I. Ayeni
C. C. Ezekoye
K. E. Onyemata
K. O. Afolabi
O. Osuolale
O. S. Alabi

PORTUGAL
J. Leite

PUERTO RICO
Y. Bernier-Casillas

REPUBLIC OF IRELAND
M. Suguitan

SOUTH AFRICA
F. E. F. Tatsing
S. Dula
C. Kaptchouang Tchatchouang

SRI LANKA
A. M. R. De Zoysa

TURKEY
M. Karamanlioglu

UKRAINE
D. Bobyr

UNITED ARAB EMIRATES
M. A. Khan

UNITED KINGDOM
N. Barratt
E. L. Carter
C. Mur'Tala
Z. Ong
A. T. M. Hubbard
M. von und zur Mühlen
A. Brown
A. Odell
H. McKay
M. A. Miller
P. Butterick
S. C. Lee
J. Santini
G. Gobert
E. Bandeira Lino
M. Gutiérrez Pozo
A. Griffin
C. Verheecke
A. da Silva
E. Penkova
E. Horsburgh
V. Chukwu
Z. Alhareth
C. L. Jenkins
S. Varga
I. Haktanir
C. Winogradow
F. Hassard
H. Lubarsky
C. B. Ghezzou Cuervas-Mons
M. Pursglove
M. G. Clarke
R. S. McInnes
A. Kristek
R. Leyden-Preece
S. C. T. Moorcroft
V. Faulkner
M. Karlikowska
A. Ott
K. M. Morrison
R. Roderick
M. Tilocca
C. Hsu
O. O. Akinola
E. Iles
A. Monteagudo-Mera
J. Copland
A. M. Ezekwem-Ogoke
M. Herdman
T. Osborne
N. Wynn
J. D. Box
S. Wilson
E. P. Everett
D. Plaza
C. G. Hawkins
M. G. Awoniyi
M. Collery
A. A. J. Robertson
L. Liverpool
N. E. Baker
C. L. Kelly
S. Gill
N. Green
J. McLaughlin
C. Bronowski
G. C. Thorne
K. Sedani
K. Robertson
C. Eldridge
B. Carter

UNITED STATES
L. Schwalb
M. K. L. Chee
L.Pierre

ZIMBABWE
M. Njelele

Call for interest: policy campaign on the future of food safety

The S*f*AM Policy Subcommittee is organizing an engagement project to promote cutting-edge food safety research with politicians, policymakers and industry members in the UK. A series of short reports will be produced throughout 2018 and into 2019, looking at how food microbiology may be applied to tackle future food safety challenges in areas including:

- **Brexit and trade.**
- **New food production techniques.**
- **Shifting food demands and novel & functional foods.**
- **Changes in the environment.**

The Subcommittee is inviting applications from Members who have an interest and expertise in food microbiology. Participants will contribute to the drafting of one or more reports, as part of a small working group. Working group members will be selected to ensure diversity and equality of opinion, including representation from our Early Career Scientist network.

For further information, please contact the S*f*AM Policy Manager (Chris) at **christopher@sfam.org.uk**. If you are interested in participating, please also detail your **name**, **affiliation** and **area of interest**.

www.sfam.org.uk

Microbiology... it's our thing.

CONFERENCES

Attend and **participate** in our conferences and meetings

FUNDING & GRANTS

Over **£255,000** worth of grants awarded last year

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Have your say on industry issues and stay updated on the latest news

CAREER DEVELOPMENT

Engage with your peers and contribute on one of our committees

What you get for **your membership**

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Receive small tokens of our **appreciation**

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AWARDS & COMPETITIONS

Prizes to celebrate your achievements

ENVIRONMENTAL MICROBIOLOGY IS

This year, *Environmental Microbiology* (EMI) celebrates its 20th birthday. The trigger for its birth was *Molecular Microbiology* (MMI), founded by Chris Higgins in 1987, published by Blackwell, and has recently celebrated its 30th anniversary. MMI had an attractive, fresh new format, did not charge authors for publication and has been very successful. In 1997, there were no similar journals dedicated to the subject of environmental microbiology, so I proposed the creation of an associated journal of MMI with the aim of reproducing its remarkable success.

EMI had a dream start, which came down to five pivotal factors: Simon Rallison and Amanda McLean-Inglis of Blackwell, who enthusiastically adopted my proposal and implemented it with super-cheerful professionalism; Dave Stahl who, to my grateful astonishment, instantly agreed to be a co-founding Editor and who provided original ideas, competence in topics only vaguely familiar to me, and a generosity and friendship that one rarely experiences; Joan Timmis, who became EMI admin, taking care of everything editorial and solving the myriad of problems arising from the multifaceted interaction network *editors-authors-reviewers-the submission site-production*; SfAM, which invested in the journal, while graciously accepting the principle of no editorial interference; and an amazing number of leaders in the field who believed in the journal and repeatedly submitted some of their best work to it.

As submissions steadily increased, so the Editor Team expanded: we were exceptionally fortunate to have been able to recruit successively Ed DeLong, Michi Wagner, Mike Jetten and Juan Luis Ramos; and subsequently Paola Bonfante, Martin Polz, Victoria Orphan, Rachel Whitaker, Jack Gilbert, Tom Wood, Jay Lennon, Volker Müller, Frank Stewart, Julie Huber, Nicole Webster, Alyson Santoro, David Berry, Jesse Shapiro and Antoine Danchin.

In addition to original research, EMI publishes several features, like *Mini-reviews* (Editor: Juan Luis Ramos), *Webalerts* (Editor: Larry Wackett), *Genomics Update* (Editor: Michael Galperin) and *Crystal Ball* pieces (all Editors), to profile hot topics.

The timing for EMI to appear on the scene was opportune: microbial ecology was developing into an increasingly exciting, dynamic subject, with powerful technological advances, like metagenomics, stable isotope probing (SIP), *in situ*-, high resolution- and 3D-imaging, MS-MS and nanoscale secondary ion mass spectrometry (nano-SIMS), and the evolution of new

conceptual frameworks driven by ecological theory, systems biology, bioinformatics, modelling etc., changing the way things were perceived, approached, done and interpreted. EMI flourished!

Just as EMI started as an offshoot of MMI, EMI itself then paved the way for a new generation of journals: *Microbial Biotechnology* (MBT) was launched to publish environmental research of a more applied nature, and *Environmental Microbiology Report*s (EMIR) was created to publish advances that can be encapsulated in compact form. Both journals became members of the S*f*AM journal stable. MBT celebrated its 10th birthday in 2017, and EMIR turned 10 this year.

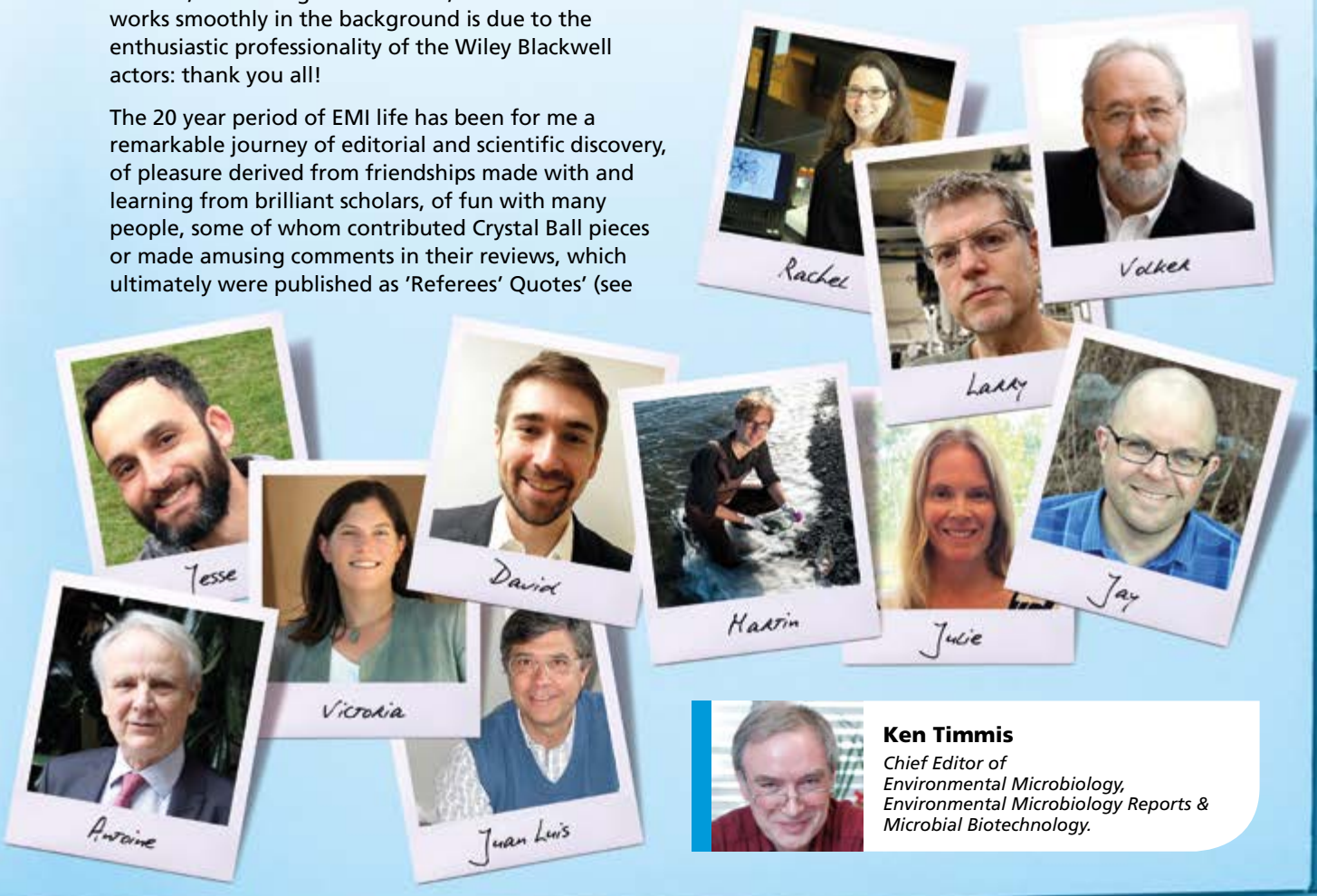
Of course, EMI stands and falls on the originality of the manuscripts submitted to it, and on the quality of the critical reviews provided by its Editorial Board, upon which editorial decisions are made. We have been extraordinarily fortunate to have recruited to the Editorial Board the very best scholars in the field, who not only provide some of the most insightful and constructive critiques we and authors have experienced, but also submit some of their best papers to the journal. Their loyalty and dedication are awesome, and a major factor in the success of EMI, and for this the Editors are truly grateful.

There is of course an entire infrastructure behind EMI that includes the submission site, production, management, marketing, maintenance of the journal website, interfacing with libraries, etc. That all this works smoothly in the background is due to the enthusiastic professionality of the Wiley Blackwell actors: thank you all!

The 20 year period of EMI life has been for me a remarkable journey of editorial and scientific discovery, of pleasure derived from friendships made with and learning from brilliant scholars, of fun with many people, some of whom contributed Crystal Ball pieces or made amusing comments in their reviews, which ultimately were published as 'Referees' Quotes' (see Editorial in the June Issue of EMI), and of satisfaction in EMI's significant contribution to the spectacular advance of microbial ecology in recent years.

My interaction with S*f*AM is another source of considerable pleasure: the excellent symposia on topical subjects which continuously provide new ideas and impulses for EMI, its support and nurturing of young researchers – the next generation of PIs – and its contributions to science and medical policy, are all outstanding. And, S*f*AM has been a staunch supporter of all three journals, featuring highlights in its members' magazine *Microbiologist*, publicizing them in the house blog, MicrobeBlog.org, organizing, hosting and online posting of the digital version of the *Environmental Microbiology Lecture*, etc. Thank you S*f*AM for your terrific, multifaceted support of EMI, and of microbiology in general!

The future? Well, there are a number of initiatives afoot that I hope will, in addition to what EMI always does, keep it ahead of the curve. But one thing we want EMI to do is to contribute meaningfully to current efforts to inform the body politic and public about the role and importance of microbes for us all and the planet, and to explore options for the harnessing of beneficial functions and sabotaging of harmful activities. Some ideas on how we might do this are articulated in a series of Editorials on the future of environmental microbiology, in the June issue of EMI celebrating its 20th birthday.



Ken Timmis
Chief Editor of Environmental Microbiology, Environmental Microbiology Reports & Microbial Biotechnology.

The ENVIRONMENTAL MICROBIOLOGY LECTURE

The next 20 years, and microbes playing at the edge of the cliff

17 October 2018 | 19.00 – 21.00 | One Great George Street | London

At a strategy meeting in 2007, it was proposed by Blackwell and SfAM to create a prestigious annual public lecture, *Environmental Microbiology* Lecture, usually held in October at a historic London venue (generally at the Royal Society of Medicine), to be presented by a leading environmental microbiologist, and that can subsequently be viewed online.

Rita Colwell gave the first lecture in 2008 entitled *Climate, oceans, global warming and cholera*. Subsequent lectures were given by **Ed Delong** (2009): *Deciphering microbial community dynamics, from genomes to biomes*; **Willy Verstraete** (2010): *Microbial Resource Management (MRM): the road to go for environmental biotechnology*; **Willem de Vos** (2011): *Microbes inside*; **Sang Yup Lee** (2012): *Systems metabolic engineering for a green chemical industry*; **Victor de Lorenzo** (2013): *Programming soil bacteria to do amazing things*; **Jim Prosser** (2014): *Unimaginable, unprecedented, microbial diversity: whence, so what, and can we learn from nitrifiers?*; **Ken Nealson** (2015): *Extracellular electron transport (EET): opening new windows of metabolic opportunity for microbes*; **Margaret McFall-Ngai** (2016): *Waging peace: establishment and maintenance of stable alliances between animals and their microbial partners*; and **Rino Rappuoli** (2017): *Vaccines for a 21st century society*. The lectures encapsulate the latest exciting discoveries for a general microbiology audience, are widely viewed, and extensively used in microbiology teaching.

I am honoured to have been invited several times to present the *Environmental Microbiology Lecture*, but thus far always declined on the grounds that others were far more deserving of the honour and, anyway, I prefer to learn rather than teach. However, this year, being the 20th anniversary of the launch of EMI and being celebrated with two lectures, the other of which will be given by my close friend, brilliant microbiologist, Editor of *Environmental Microbiology*, *Environmental Microbiology Reports* and *Microbial Biotechnology*, and Mini-review Editor and Special Issue Editor of all three Journals, Juan Luis Ramos, made it more difficult to decline. To share his podium will be a special treat, not to be missed for the world!

In my talk, entitled *Environmental Microbiology: the next 20 years, and microbes playing at the edge of the cliff*, I shall say a few words about the early days of EMI, summarize some ideas about how environmental microbiology may play out over the next 20 years, and then discuss some research involving extremely talented scholars with whom I have had the privilege to be involved. Much of this will concern water, which is of course the medium of life: the parameters that

We will celebrate the 20th anniversary of the launch of EMI, with two Lectures, one given by Ken Timmis *himself, and the other of which will be given by the Editor of Environmental Microbiology, Environmental Microbiology Reports and Microbial Biotechnology,* Juan Luis Ramos.

Juan Luis Ramos

determine water availability, natural habitats where water availability becomes life-limiting, and which microbes best handle the stress close to the inviable limits of water availability. A fascinating type of habitat that has provided important insights in this regard are hypersaline brine lakes sitting on the Mediterranean Seabed, some 4 km below the surface, which, as study objects, present some interesting logistical issues and are rather unforgiving of lapses of the type 'uh-oh: did someone leave the Niskin bottles on the dock in Messina?'.

Another fascinating habitat I will briefly touch on is the deep subsurface of the Iberian Pyrite Belt, a unique geological formation that has been mined since the 8th century BC and that is the source of the Rio Tinto. Both environments are populated with fascinating microbes playing at the edge of life, the study of which will surely inform us about how they cope at biosphere:geosphere boundaries and, in turn, whether extraterrestrial life might exist where similar conditions occur on other planets.

Ken Timmis

Journal**WATCH**

Highlights and featured articles from the *Sf*AM journals

Environmental Microbiology

www.env-micro.com

Organohalide respiration in pristine environments: implications for the natural halogen cycle

S. Atashgahi, M. M. Häggblom, H. Smidt

This mini-review discusses how current knowledge regarding the natural origin and occurrence of industrially important organohalogens and the evolution and spread of OHRB can be integrated, and describes potential implications for natural halogen and carbon cycles.

Halogenated organic compounds, also termed organohalogens, were initially considered to be of almost exclusively anthropogenic origin. However, over 5,000 naturally synthesized organohalogens are known today. This has also fuelled the hypothesis that the natural and ancient origin of organohalogens could have primed development of metabolic machineries for their degradation, especially in microorganisms. Among these, a special group of anaerobic microorganisms was discovered that could conserve energy by reducing organohalogens as the terminal electron acceptor in a process termed organohalide respiration. Originally discovered in a quest for biodegradation of anthropogenic organohalogens, these organohalide-respiring bacteria (OHRB) were soon found to reside in pristine environments, such as the deep subseafloor and Arctic tundra soil with limited/no connections to anthropogenic activities. As such, accumulating evidence suggests an important role of OHRB in local natural halogen cycles, presumably taking advantage of natural organohalogens.

http://onlinelibrary.wiley.com/doi/10.1111/1462-2920.14016, Vol 10, Iss 3

Cell–cell recognition and social networking in bacteria

V. Troselj, P. Cao, D. Wall

Understanding how bacteria identify their social partners and how they synchronize their behaviours to conduct multicellular functions is an expanding field of research. This mini-review describes recent progress in the field and contrasts the various strategies used in recognition and behavioural networking.

The ability to recognize self and to recognize partnering cells allows microorganisms to build social networks that perform functions beyond the capabilities of the individual. In bacteria, recognition typically involves genetic determinants that provide cell surface receptors or diffusible signalling chemicals to identify proximal cells at the molecular level that can participate in cooperative processes. Social networks also rely on discriminating mechanisms to exclude competing cells from joining and exploiting their groups. In addition to their appropriate genotypes, cell–cell recognition also requires compatible phenotypes, which vary according to environmental cues or exposures as well as stochastic processes that lead to heterogeneity and potential disharmony in the population. This understanding may help us manipulate bacterial social behaviour for medical, ecological or industrial purposes, given the application and development of tools that enable precise tracking of cell-to-cell differences in populations.

http://onlinelibrary.wiley.com/doi/10.1111/1462-2920.14005, Vol 20, Iss 3

Environmental Microbiology Reports

www.env-micro-reports.com

Habitat filtering of bacterioplankton communities above polymetallic nodule fields and sediments in the Clarion-Clipperton zone of the Pacific Ocean

M. V. Lindh, B. M. Maillot, C. R. Smith, M. J. Church

This highlight article examines bacterioplankton metacommunities using 16S rRNA amplicons from the Clarion-Clipperton Zone (CCZ) in the eastern Pacific Ocean and in global ocean transect samples to determine sensitivity of these assemblages to environmental perturbations.

Deep-sea mining of commercially valuable polymetallic nodule fields will generate a seabed sediment plume into the water column. Yet, the response of bacterioplankton communities, critical in regulating energy and matter fluxes in marine ecosystems, to such disturbances is unknown. Metacommunity theory, traditionally used in general ecology for macroorganisms, offers mechanistic understanding on the relative role of spatial differences compared with local environmental conditions (habitat filtering) for community assembly. The authors examined bacterioplankton metacommunities using 16S rRNA amplicons from the Clarion-Clipperton Zone (CCZ) in the eastern Pacific Ocean and in global ocean transect samples to determine sensitivity of these assemblages to environmental perturbations. Habitat filtering was the main assembly mechanism of bacterioplankton community composition in the epi- and mesopelagic waters of the CCZ and the Tara Oceans transect. Bathy- and abyssopelagic bacterioplankton assemblages were mainly assembled by undetermined metacommunity types or neutral and dispersal-driven patch-dynamics for the CCZ and the Malaspina transect. Environmental disturbances may alter the structure of upper-ocean microbial assemblages, with potentially even more substantial, yet unknown, impact on deep-sea communities. Predicting such responses in bacterioplankton assemblage dynamics can improve our understanding of microbially mediated regulation of ecosystem services in the abyssal seabed likely to be exploited by future deep-sea mining operations.

http://onlinelibrary.wiley.com/doi/10.1111/1758-2229.12627, Vol 10, Iss 2

Polar solar panels: Arctic and Antarctic microbiomes display similar taxonomic profiles

K. Tanner, J. Manuel, M. J. Belliure, M. Fernández-Méndez, E. Molina-Menor, J. Peretó, M. Porcar

Solar panels located on high (Arctic and Antarctic) latitudes combine the harshness of the climate with that of solar exposure. This article reports that these polar solar panels are inhabited by similar microbial communities in taxonomic terms, dominated by *Hymenobacter* spp., *Sphingomonas* spp. and Ascomycota. As a result, the authors suggest that solar panels, even on high latitudes, can shape a microbial ecosystem adapted to irradiation and desiccation.

http://onlinelibrary.wiley.com/doi/10.1111/1758-2229.12608, Vol 10, Iss 1

Microbial Biotechnology

Open Access Journal

www.microbialbiotech.com

The next step towards usable microbial bioelectrochemical sensors?

J. B. A. Arends

This article gives an overview on the research on bioelectrochemical systems (BESs) as a tool for fundamental research and for biosensor development.

Microbial bioelectrochemical systems have been in the full spotlight for over a decade due to the promise of being a platform for sustainable electrical power generation from wastewaters. This promise has not yet been fulfilled, but the research on bioelectrochemical systems (BESs) has received a tremendous boost. The field has diversified into exploring various configurations of BESs for energy production/storage, bioremediation/waste clean-up and bioproduction/electrofermentation. Despite the many challenges that still need to be tackled to come to a usable microbial bioelectrochemical sensor, there is the possibility of making pre-colonized, storable electrodes. With

encapsulated microbial catalysts, these bioelectrodes can be used for applications/research questions that need reproducibly coated microbial bioelectrodes or fast responses in bioelectrochemical systems.

http://onlinelibrary.wiley.com/doi/110.1111/1751-7915.12590, Vol 11, Iss 1

This article can be found in the thematic issue: Microbial Electrochemical technologies come of age.

Maintenance and assessment of cell viability in formulation of non-sporulating bacterial inoculants

T. Berninger, Ó. González López, A. Bejarano, C. Preininger, A. Sessitsch

Biostimulants and biopesticides based on non-sporulating bacteria are of great interest in agriculture, but their low shelf life and efficacy under field conditions is often a limiting factor to practical application. Protective formulations are thus necessary. A range of methods to maintain and monitor cell viability is presented in this mini-review to decide on suitable approaches for formulation development.

Genome annotation is, nowadays, performed via automatic pipelines that cannot discriminate between right and wrong annotations. Given their importance in increasing the accuracy of the genome annotations of other organisms, it is critical that the annotations of model organisms reflect the current annotation gold standard. The genome of *Bacillus subtilis* strain 168 was sequenced 20 years ago. Using a combination of inductive, deductive and abductive reasoning, the authors present a unique, manually curated annotation, essentially based on experimental data. This reveals how this bacterium lives in a plant niche, while carrying a paleome operating system common to Firmicutes and Tenericutes. Dozens of new genomic objects and an extensive literature survey have been included for the sequence available at the INSDC (AccNum AL009126.3). The authors propose an extension to Demerec's nomenclature rules that will help investigators connect to this type of curated annotation via the use of common gene names.

http://onlinelibrary.wiley.com/doi/10.1111/1751-7915.12880, Vol 11, Iss 2

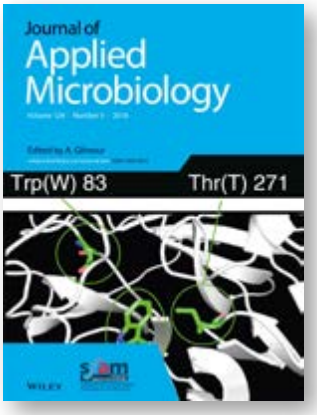
Journal of Applied Microbiology

www.journalappliedmicro.com

Loop-mediated isothermal amplification (LAMP): a versatile technique for detection of microorganisms

Y.-P. Wong, S. Othman, Y.-L. Lau, S. Radu, H.-Y. Chee

This review discusses available types of LAMP techniques together with their applications in the detection of various microorganisms.



Loop-mediated isothermal amplification (LAMP) amplifies DNA with high specificity, efficiency and rapidity under isothermal conditions by using a DNA polymerase with high displacement strand activity and a set of specifically designed primers to amplify targeted DNA strands. Following its first discovery, LAMP was further developed over the years which involved the combination of this technique with other molecular approaches, such as reverse transcription and multiplex amplification for the detection of infectious diseases caused by microorganisms in humans, livestock and plants. To date, there are a variety of LAMP detection methods available including colorimetric and fluorescent detection, real-time monitoring using a turbidity meter and detection using a lateral flow device which will also be highlighted in this review. Apart from that, the commercialization of LAMP techniques has also been reported such as a lyophilized form of LAMP reagents kit and LAMP primer sets for the detection of pathogenic microorganisms. Furthermore, advantages and limitations of this molecular detection method are also described together with its future potential as a diagnostic method for infectious disease.

http://onlinelibrary.wiley.com/doi/10.1111/jam.13647, Vol 124, Iss 3

Current advances in aptamer-assisted technologies for detecting bacterial and fungal toxins

N. Alizadeh, M. Y. Memar, B. Mehramuz, S. S. Abibiglou, F. Hemmati, H. Samadi Kafil

This review provides an overview of aptamer-based methods as a novel approach for detecting toxins in bacterial and fungal pathogens.

Infectious diseases are among the common leading causes of morbidity and mortality worldwide. Associated with the

emergence of new infectious diseases, the increasing number of antimicrobial-resistant isolates presents a serious threat to public health and hospitalized patients. A microbial pathogen may elicit several host responses and use a variety of mechanisms to evade host defences. These methods and mechanisms include capsules, lipopolysaccharides or cell wall components, adhesions and toxins. Toxins inhibit phagocytosis, cause septic shock and host cell damage by binding to host surface receptors and invasion. Bacterial and fungal pathogens are able to apply many different toxin-dependent mechanisms to disturb signalling pathways and the structural integrity of host cells for establishing and maintaining infections. Initial techniques for analysis of bacterial toxins were based on *in vivo* or *in vitro* assessments. There is a permanent demand for appropriate detection methods which are affordable, practical, careful, rapid, sensitive, efficient and economical. Aptamers are DNA or RNA oligonucleotides that are selected by the systematic evolution of ligands using exponential enrichment (SELEX) methods and can be applied in diagnostic applications.

http://onlinelibrary.wiley.com/doi/10.1111/jam.13650, Vol 124, Iss 3

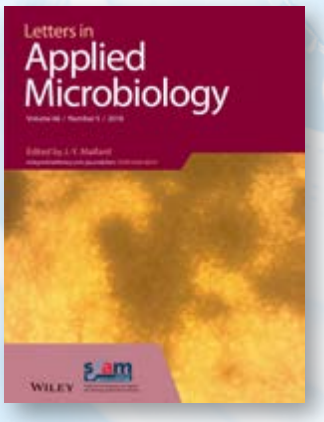
Letters in Applied Microbiology

www.lettersappliedmicro.com

An adapted isolation procedure reveals *Photobacterium* spp. as common spoilers on modified-atmosphere packaged meats

M. Hilgarth, S. Fuertes-Pèrez, M. Ehrmann, R. F. Vogel

This study demonstrates highly frequent isolation of multiple photobacteria (*Photobacterium carnosum*, *Photobacterium phosphoreum* and *Photobacterium iliopiscarium*) from different modified-atmosphere packaged spoiled and unspoiled meats using an adapted isolation procedure. The abundance of photobacteria in high numbers provides evidence for the hitherto neglected importance and relevance of *Photobacterium* spp. to meat spoilage.



The genus *Photobacterium* comprises species of marine bacteria, commonly found in open-ocean and deep-sea environments. Some species (e.g., *Photobacterium phosphoreum*) are associated with fish spoilage. Recently, culture-independent studies have drawn attention to the presence of photobacteria on meat. This study employed a comparative isolation approach of *Photobacterium* spp. and aimed to develop an adapted isolation procedure for recovery from food samples, as demonstrated for different meats: marine broth is used for resuspending and dilution of food samples, followed by aerobic cultivation on marine broth agar supplemented with meat extract and vancomycin at 15°C for 72 h. Identification of spoilage-associated microbiota was carried out via matrix-assisted laser desorption/ionization time of flight mass spectrometry using a database supplemented with additional mass spectrometry profiles of *Photobacterium* spp. This study provides evidence for the common abundance of multiple *Photobacterium* spp. in relevant quantities on various modified-atmosphere packaged meats. *Photobacterium carnosum* was predominant on beef and chicken, while *Photobacterium iliopiscarium* represented the major species on pork and *Photobacterium phosphoreum* on salmon, respectively.

http://onlinelibrary.wiley.com/doi/10.1111/lam.12860, Vol 66, Iss 4

Induction of abiotic stress tolerance in plants by endophytic microbes

R. Lata, S. Chowdhury, S. K. Gond, J. F. White Jr

This review focuses on the potential of endophytic microbes that induce abiotic stress tolerance in plants. These results may help in the development of biotechnological applications of endophytic microbes in plant growth promotion and crop improvement under abiotic stress conditions.

Increasing human populations demand more crop yield for food security while crop production is adversely affected by abiotic stresses like drought, salinity and high temperature. Development of stress tolerance in plants is a strategy to cope with the negative effects of adverse environmental conditions. Endophytes are well recognized for plant growth promotion and production of natural compounds. The property of endophytes to induce stress tolerance in plants can be applied to increase crop yields. With this review, the authors intend to promote the application of endophytes in biotechnology and genetic engineering for the development of stress-tolerant plants.

http://onlinelibrary.wiley.com/doi/10.1111/lam.12740/full

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Patricia Knoerrer
Wiley-Blackwell

Corporate NEWS

The latest news, views and microbiological developments from our Corporate Members

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Secure successes for the future of bioscience

2018 is in full swing, and it's time to look ahead. Next year will be our 10th anniversary as an organization, and development of the next RSB strategy is now underway – we will use this to listen to our members and plot the best way forward for us as an organization to deliver a bright future for the bioscience community.

With Brexit approaching there remain many unknowns about the future. Questions about how trade and transport will be regulated have raised key questions about our national biosecurity. Alongside the risk of allowing harmful organisms into the UK is the vital need to efficiently move and trade the products and elements of biotechnology and research.

Capacity to detect and deal with all potential biosecurity threats at our borders would require increased resources, almost certainly beyond our available skills base.

I recently wrote to the House of Lords EU Energy and Environment Sub-Committee, in relation to its *Brexit: Plant and Animal Biosecurity* inquiry, to highlight how vital continued collaboration and movement of information and expertise is for supporting international biosecurity standards and maintaining high levels of biosafety in the UK.

Continued engagement with the bioscience community on this issue will be important and we value input from the Society *for* Applied Microbiology membership.

As an organization we also aim to ensure a better future for bioscientists; providing them with the greatest support possible during their professional life, training and education.

In partnership with the University Bioscience Managers Association, we awarded the HE Biosciences Technician of the Year award to Gill Scott, a technician manager at the University of Warwick who promotes the best for the students.

Through the Heads of University Biosciences, a RSB Special Interest Group, we awarded this year's HE Biosciences Teacher of the Year to Dr Dominic Henri from the University of Hull , for his terrific enthusiasm and drive for pedagogical development.

These awards allow us to celebrate those who are exceptional in their fields, and showcase the work done by HE practitioners in training the next generation of bioscientists.

Similar values underpin our University Degree Accreditation scheme, and at the end of April we saw the annual Degree Accreditation Award Ceremony, held at the Houses of Parliament. This year, an additional 18 institutions have seen degrees receive Accreditation, bringing the total number of institutions recognized to 52, including four outside of the UK.

As well as recognizing high quality bioscience education to degree level, the Accreditation scheme highlights academic excellence, drives up standards, and shows

that universities are equipping their students with the skillsets that employers value.

It is essential that learning environments are inclusive and supportive. With this in mind, we partnered with several organizations, including S*f*AM, to deliver a workshop for academics wishing to pursue an Athena SWAN award. The day saw a number of informative and fascinating sessions on the diversity scheme, and we hope all who attended or viewed online took food for thought back to their institutions.

And finally, the RSB reached an exciting milestone of having more than 18,000 members, six months earlier than anticipated. Every addition to our biosciences network makes us stronger; we are more likely to overcome challenges when we work together.

We therefore thank S*f*AM and its membership for its continued support, and we look forward to working together as always to deliver a brighter and more secure future for the biosciences.

BIO FOCUS

The RSB reached an exciting milestone of having more than 18,000 members, six months earlier than anticipated

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

POLICY Corner

Food for thought

A safe supply of food for the future?

In the whirlwind of today's political uncertainty and daily crises, it can be easy to lose sight of the fundamentals. For instance, access to a consistent supply of safe food is a basic human need: one that governments are typically responsible for ensuring. In the developed world, the wider public can rest assured that their food security needs will be met for years to come, surely? Nothing can be taken for granted. Changes in the environment, technology and international politics constantly introduce new threats and opportunities to consider.

With a global population set to increase to 10 billion by 2050, merely being able to produce enough food will become a significant challenge. The UK Government has put its weight behind boosting agricultural productivity as the solution, through supporting the agricultural technology (Agri-Tech) sector in particular. Initiatives such as the Agri-Tech Catalyst and the Centres for Agricultural Innovation have been introduced over the last few years in an attempt to invigorate the industry.

HM Government isn't satisfied with stopping there. Last year's Industrial Strategy policy paper resolved to "put the UK at the forefront of advanced sustainable agriculture" as part of a 'Clean Growth' agenda. The catchily titled 'Transforming food production: from farm to fork' programme has committed £90 million of the Industrial Strategy Challenge Fund towards improved food and farming. In addition, a 'Food and Drink Sector Council' has brought together the Government and leading business figures to build proposals for further Government–industry collaboration and support.

Further changes abound, as the Department for Environment, Food & Rural Affairs (DEFRA) looks set to bring a new Agricultural Bill to UK Parliament later this year. A recently published 'green paper' reveals some insight into how this future agricultural policy may look. Keeping in line with the Industrial Strategy, there is an emphasis on supporting Agri-Tech to boost productivity, through developments in areas including plant & animal genetics and precision agriculture. Furthermore, DEFRA

** A preliminary report of Government proposals for future policy and legislation.*

intends to stimulate uptake of new technologies by rewarding farmers who demonstrate better animal health and welfare, improved biodiversity and soil and environmental health.

Stimulating innovation and the uptake of technology is a laudable goal for Government, but as food production techniques change and intensify, technologies to monitor and ensure food safety will need support to keep up. Horizon scanning for emerging issues is therefore crucial. A recent report from the European Food Safety Authority (EFSA) highlights some of the issues we can expect to see over the next few years: examples include invasive animal and plant diseases; food supplements and new food production techniques. No doubt the robust, tireless work of food safety scientists will continue to meet these challenges as they unfold.

But more can be done to promote the efforts of food microbiologists to politicians and the wider public. Innovations in food safety should not be seen as an afterthought to the development of new agricultural technologies and shifting food demands. The Society *for* Applied Microbiology has embarked on a policy project to promote cutting-edge food safety research, and to look at how food microbiology may be applied to tackle future changes in trade, food production and consumer habits. S*f*AM is keen to capture the expertise of our diverse membership, so your input is vital to the success of this campaign. If you would like to be involved, or would just like to know more, please do get in touch!

FURTHER READING

Food and Agriculture Organization of the United Nations (2017). The future of food and agriculture – trends and challenges. Rome. **http://www.fao.org/3/a-i6583e.pdf**

HM Government (2017). Industrial Strategy: building a Britain fit for the future. **www.gov.uk/beis**

HM Government (2018). Health and Harmony: the future for food, farming and the environment in a Green Brexit. **www.gov.uk/defra**

European Food Safety Authority (2017). Technical report on EFSA's Activities on Emerging Risks in 2016. **https://doi.org/10.2903/sp.efsa.2017.EN-1336**

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Chris Brown
SfAM *Policy & Public Affairs Manager*

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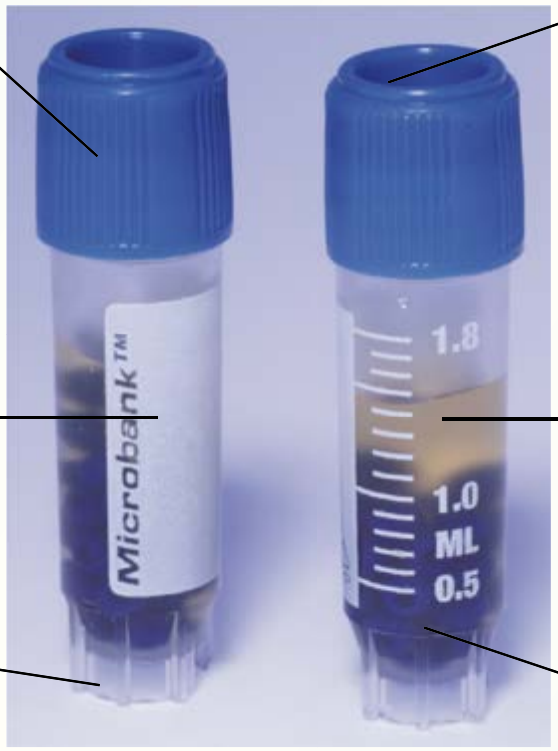

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