Microbiologist

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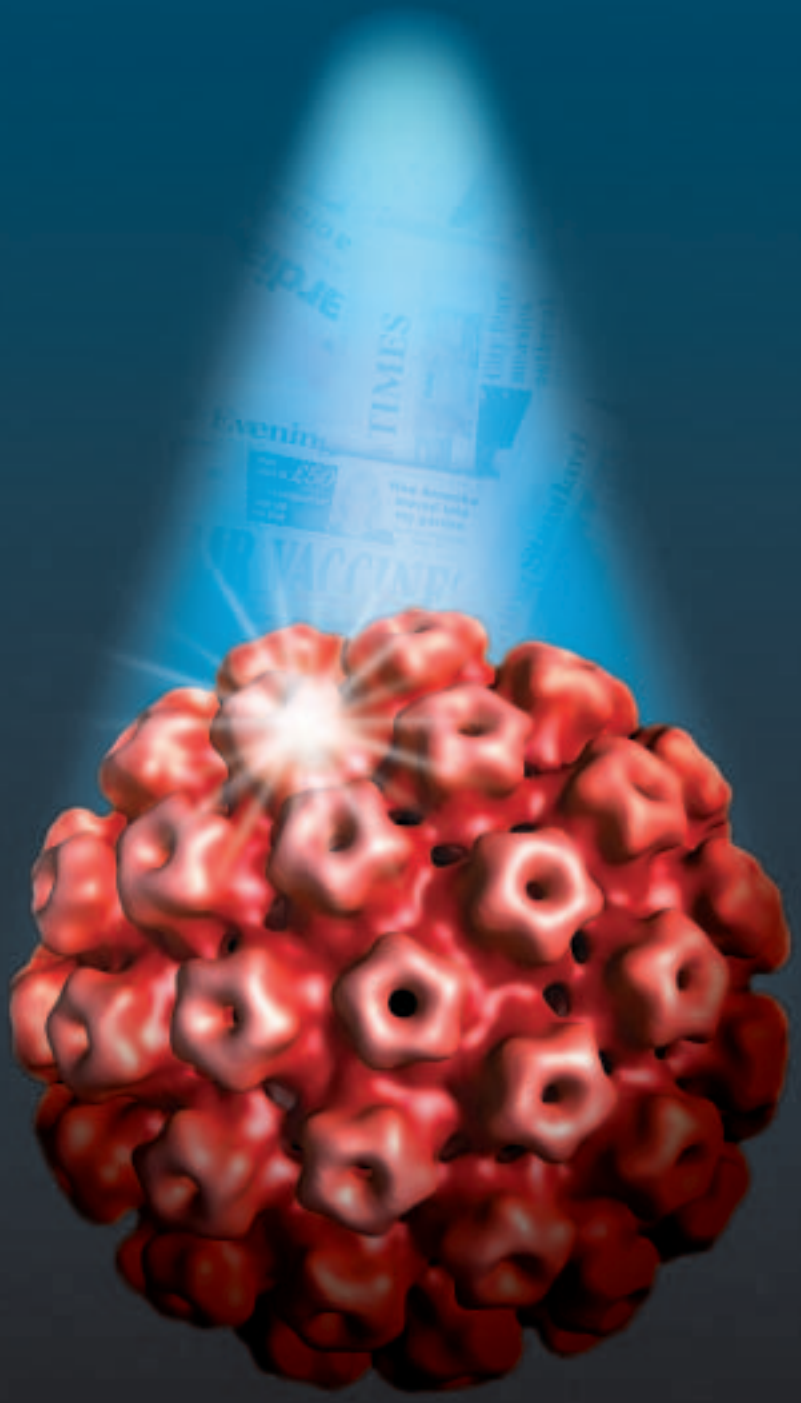

Microbiology in the media

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■ Harnessing the collective intelligence in response to Chalara dieback of ash ■ HPV vaccines and the media
■ Movie microbes under the microscope
■ Historical perspectives: MMR and the media

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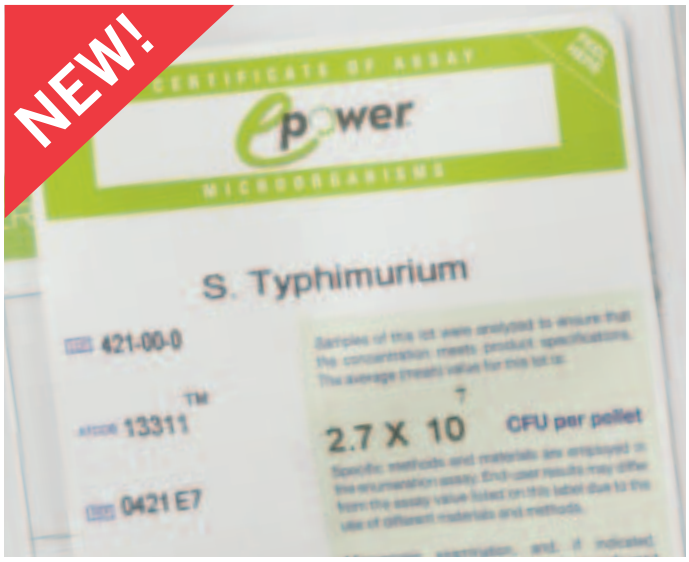

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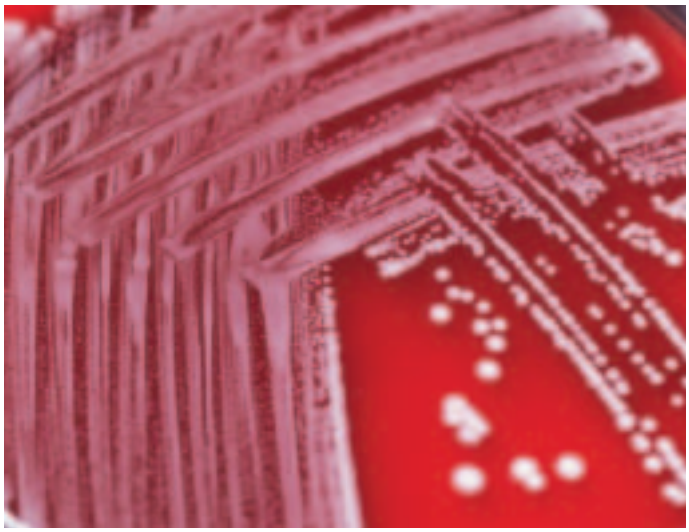

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editorial

Nancy Mendoza reviews the content of this issue of *Microbiologist*

On Friday 6 January 2006, at the end of the working day, I joined my colleagues at the pub to celebrate my first week at the Science Media Centre. No sooner had the top been prised off a bottle of Mexican lager, than our mobiles rang. The boss had received a call from a journalist; there was a patient in Weston-super-Mare, who had returned from Southeast Asia with suspected H5N1 avian influenza. We abandoned our drinks and hotfooted it back to the office.

On arrival, we discovered it was a false alarm — the patient was very poorly but it wasn't the deadly H5N1. Had it been the UK's first case, we would all, at 6pm on a Friday, have been dialling the mobile phone numbers of every flu expert, virologist, epidemiologist, public health expert and X-ray crystallographer (essential if you want to explain how antiviral drugs work) we knew.

Why? Because the chances of Editors pushing for a sensationalized story, catastrophizing that this could be as bad as the 1918 flu pandemic, was almost certain; and there would be a rush to cover the news, given the timing was late on a Friday night. In this issue of *Microbiologist*, John Illman, a health journalist who has reported for several of the UK daily newspapers, discusses the importance of scientists stepping up, in the moment, to have their voices heard when a controversial, or potentially, scary story breaks.

The MMR vaccine scandal of the late 1990s and early 2000s is a case-in-point and one of the reasons that the House of Lords Science and Technology Committee gave for the establishment of a Science Media Centre. Criticism of the media over its reporting of MMR, which is thought to have contributed to low vaccination rates and the subsequent measles outbreak in South Wales during 2013, is, Illman says, justified. However, he is at pains to stress that both scientists and healthcare professionals must accept opportunities to represent their views, or the science behind the story will go unheard and the dominant rhetoric is given over to the dissenters.

Of course planning helps, and if there is a chance to anticipate a story, there is absolutely no excuse for scientists and healthcare professionals to shy away from involvement. Margaret Stanley describes how in the run-up to the introduction of the HPV vaccination for girls, the media reporting helped, rather than hindered, uptake of the vaccine. Stanley outlines a coordinated effort with clear messages; a flexible approach to meet the needs of both the media and the audience; and clearly articulated scientific and medical information. It wasn't all plain sailing, she says, and Stanley and Illman agree on one point in particular: balance is the enemy of quality science reporting.

As well as looking at news coverage, we'll also explore microbiology in the movies and how scientists are using social media to crowdsource for research into Chalara ash dieback.

I hope you enjoy this issue and look forward to meeting many of you at our events in 2014.

Nancy Mendoza

contribute

We are always looking for enthusiastic writers who wish to contribute articles to the magazine on their chosen microbiological subject.

For further information please email the editor, Nancy Mendoza at: **nancy@sfam.org.uk**

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ceo's and **president's** column

SfAM CEO **Philip Wheat** and President, **Professor Martin Adams** talk about the vision and mission of the Society and reflect on past and future developments

As many long-standing Members will know, the Society for Applied Microbiology (SfAM) was founded in 1931 and is the oldest microbiology society in the United Kingdom. As well as facilitating an environment for furthering the science of microbiology by its Members, the Society has also always been known as friendly, promoting inclusivity and cordiality. Our current vision and mission statements, and the values underpinning them try to reflect these long-established aspirations. In our vision statement:

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

To this end, our mission statement declares:

"This vision of SfAM will be achieved 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. SfAM will work with sister organizations and microbiological bodies to ensure that microbiology and microbiologists contribute to evidence-based policymaking in the UK, Europe and worldwide. SfAM will build on a strong history of microbiology in the UK and will move forward in step with the next generation of microbiologists."

The values underpinning these vision and mission statements are:

"SfAM is "The Friendly Society" and will always offer value for money. We are modern, innovative and progressive; we value integrity, honesty and respect; and we seek to promote excellence and professionalism and to inspire the next generation of microbiologists."

The end of the year is an opportune moment for us to reflect on developments over the last 12 months, to review how well we are meeting our objectives and to look forward into next year.

Once again, we feel that SfAM has progressed during 2013. If a learned society is to grow and develop it must always remain relevant to the Members (and potential Members) it is there to serve, and meet their needs and expectations. One marker of whether this has been achieved is by looking at membership numbers. The total number of Members at the end of 2012 was 2,202. A conservative estimate of numbers for the end of 2013 will be at least 2,400, representing an increase of 9% on the year. This increase in membership numbers can be put into a wider context by looking at the increase over a longer time period. So, for instance, if you look at the membership number (1,220) at the end of 2005 and compare this with the estimate for 2013, it shows a very impressive increase of nearly 97%.

Below: SfAM members in 1931

It is also pleasing to report the success of two new grants that were launched in 2013: the **Student Professional Placement Grant** and the **PhD Studentship Grant**. Both proved to be very popular and the budgets for each have been reached. Competition for the PhD Studentship was particularly intense and we are pleased to report that **Dr Dennis Linton** (University of Manchester) and his nominated student **Danielle Weaver** were the successful applicants. The new **Student Professional Placement Grant** also attracted some strong applications. It is designed for students who have been awarded a professional work placement for over four months. Two institutions were awarded grants in 2013 — Public Health England and Nottingham Trent University — and a total of 17 students will benefit as a result.

More generally, we estimate that in 2013 the Society will have awarded at least £250000 in grants to our Members. Competition for all the Society's grants has been very considerable this year and, though success rates remain high, we have had to disappoint more people than usual.

To give yourself the best chance of success, we strongly recommend that if you are going to apply for any *Sf*AM grants in future you first read the terms and conditions carefully and adhere to deadlines; applications must fully comply, otherwise they will not be considered.

Further good news for Members is that the Executive Committee (EC) have once again decided to retain the current membership fees; there has now been no membership fee increase for over 10 years. Indeed, the EC have also agreed to continue the offer to existing Full Members to take advantage of our 'pay for two years and get the third year free' scheme, in effect lowering the membership fee to just over £33 per annum. If you include the additional benefits the Society has introduced over the last few years, this price, and indeed the standard membership, offer terrific value for money.

As mentioned earlier, the Society always endeavours to be inclusive for all its Members and this includes encouraging under-represented groups to become more involved. The Society recently introduced, within the **Scientific Meeting Attendance Grant**, the facility of enabling new parents to claim childcare, should the member (male or female) wish to attend a scientific meeting and need assistance with childcare costs.

We are also pleased to report to Members that at our (3 July) Annual General Meeting in Cardiff, **Professor Christine Dodd** (Food Sciences, University of Nottingham) was nominated (and accepted by Members) as the next **Vice President** of the Society. Christine will serve one year as the Vice President and will then be proposed as the next **President** at our annual meeting in 2014. If the proposal is accepted, Christine will then become the second woman to hold the post out of the last four Presidents.

The year ahead sees a few changes to our normal meetings schedule. The first meeting of the year is the Winter Meeting on 15 January 2014. The topics covered will be "***Food contamination: the food handler's role***" and a concurrent session covering "***Biodefence***". As in 2013, the meeting will be held at the Royal Society, London.

The first change to our normal schedule is in April, when an extra meeting has been organized. This will be held in Manchester to celebrate the centenary of the activated sludge sewage treatment process, which was first developed by Ardern and Lockett at the Davyhulme Sewage Works in Manchester. The meeting will be held on the 1 April (pm) and 2 April at the nearby (up-wind) Lancashire County Cricket Ground.

Another change will be the Spring Meeting to be held on the 30 April on the "***Control of infection: current status and future prospects***". Instead of the venue being at Stratford-upon-Avon, this year it will be the Hilton Hotel, Sheffield.

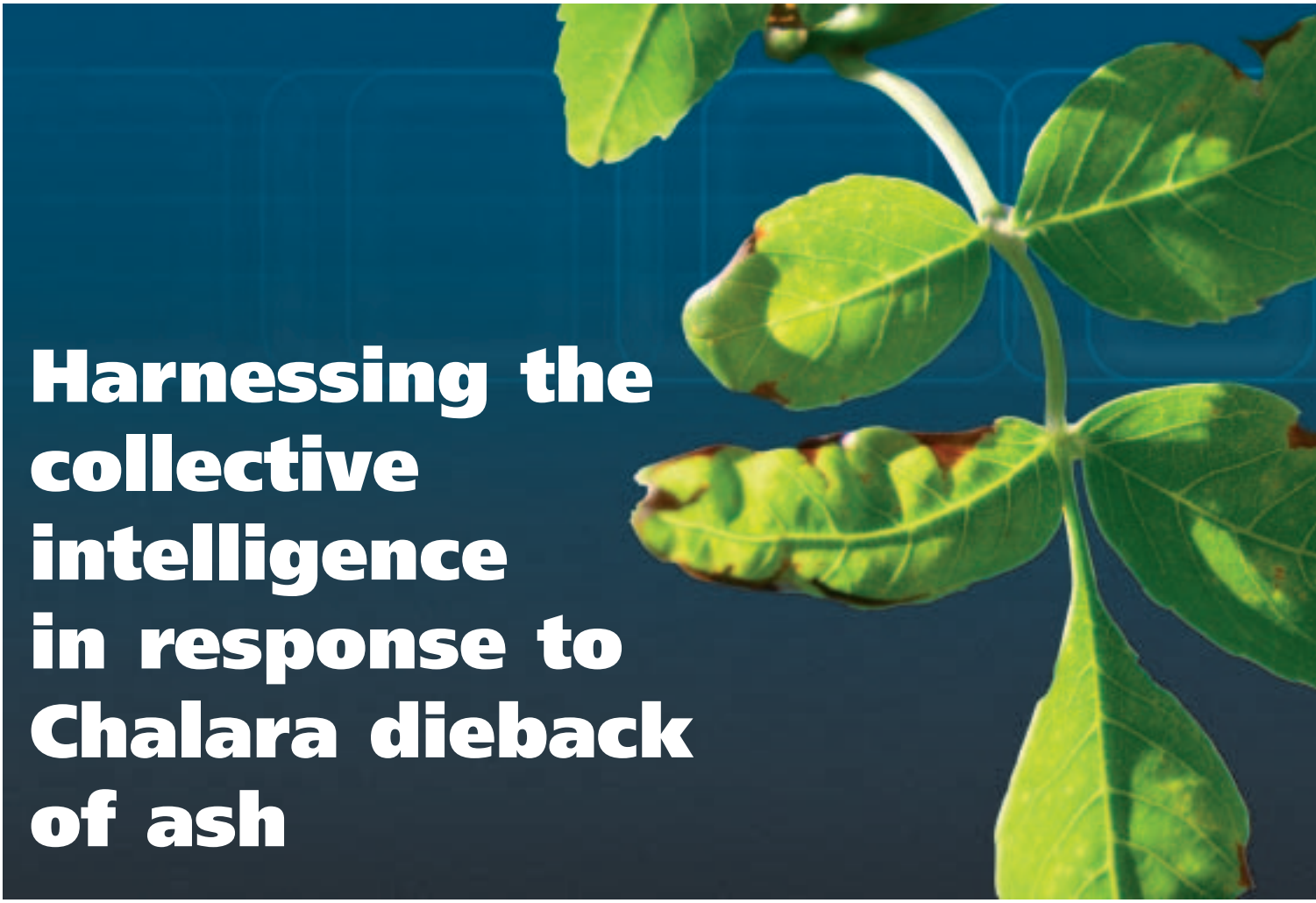
Finally, our Summer Conference has been organized in collaboration with the Med-Vet-Net Association. The meeting will take place from 30 June to 3 July on the topic of "***Zoonoses***". The venue is the prestigious Grand Hotel, Brighton. A full delegate fee is only £250 (which includes three nights hotel accommodation in the Grand Hotel, most meals and full registration for the meeting). Demand is expected to be very high, so early booking at www.sfam.org.uk/summer is highly recommended.

If you would like to attend any of our meetings, but do not have the funds to do so, why not apply for a relevant grant? If Full Members submit an abstract (and it is accepted) for the Summer Conference they can apply for a **President's Fund** award to enable attendance. In addition, if any Student Member wishes to attend, they should apply for a **Conference Studentship** where all their costs (with an upper limit on travel costs) will be reimbursed. Full details of all meetings, grants and studentships can be found by visiting www.sfam.org.uk.

Finally, it just remains for us to thank you all for supporting the Society and to wish you all a happy holiday period and a prosperous New Year.

Philip Wheat
Chief Executive Officer

Martin Adams
President of the Society



Harnessing the collective intelligence in response to Chalara dieback of ash

The 21st century scientist

The evolution of the Internet and the explosion in social media portals has led to a dramatic shift in the way scientific communities relay information and ideas, from traditional unidirectional reporting to multidirectional exchanges (Darling *et al.*, 2013).

These online tools allow researchers to boost their professional visibility whilst sharing thoughts, opinions, articles and commentaries on various topics of interest. With at least 1 in 40 scientists active on the micro-blogging platform Twitter, the benefits of an online profile are far-reaching (Priem *et al.*, 2012). For instance, many scientists have found the use of social media outlets effective in broadening interest in their research articles, as reflected in spikes in download rates (Terras, 2012).

With no geographical constraints on these virtual communities and networks, scientists also often find these outlets conducive to the development of interdisciplinary collaboration.

Beyond scientific boundaries, increasing the visibility of research provides a transparency that is necessary to unlock the ivory tower of scientific research within the public arena. By cultivating the broad interest of the general public in science, researchers are now empowered to consider ways to utilize their huge mass and collective intelligence to accelerate scientific discoveries. This method is a form of "crowdsourcing".

How do scientists design effective crowdsourcing projects?

Despite major advances in computational systems and algorithms, researchers often remain reliant on manual curation for fine-tuning analysis of complex datasets; with current algorithms producing a degree of false or incomplete outputs. Manual intervention is essential to repair these false outputs but this is extremely time-consuming. Crowdsourcing provides the means to utilize people power to accelerate progress in these areas. However, to design effective crowdsourcing projects several key questions require careful consideration, such as: how can researchers motivate their target audience to participate in a crowdsourcing initiative? How do you reach the crowd? If targeting a non-specialist audience, how can researchers mould the required analysis into an interface that can be broadly understood? How will participants be recognized in future publications?

One way of capturing the interest of the general public is by integrating analysis into an interactive game format. Games provide the opportunity to seek solutions to scientific riddles in enjoyable, familiar frameworks. To date, several games have been developed by the scientific community to address specific biological questions (Table 1).

Biogame is a diagnostic game where players try to find malaria-infected cells from multiple cell pictures (Mavandadi

Table 1. Games released as interfaces to scientific research for the general public

Game	Year released	URL	Description
Fraxinus	2013	https://apps.facebook.com/fraxinusgame/	Puzzles. Sequencing alignments of ash-dieback pathogen genome
Dizeez	2013	http://sulab.scripps.edu/dizeez/	Quiz. Links of genes and disease
EyeWire	2012	https://eyewire.org	Mapping of connections between retinal neurons
BioGames	2012	http://biogames.ee.ucla.edu	Classification of malaria-infected cells
Phylo	2012	http://phylo.cs.mcgill.ca	Puzzles. Sequencing alignments of human genome
MalariaSpot	2012	http://www.malariaspot.com	Identification of malaria parasites
GenESP	2012	http://sulab.scripps.edu/GenESP/fluid.htm	Quiz
The Cure	2012	http://www.genegames.org/cure/	Card game. Breast cancer
Happy Match	2012	http://www.citizensort.org/web.php/happymatch	Classification of species
EteRNA	2011	http://eterna.cmu.edu/web/	Puzzles. RNA design and structure prediction
Foldit	2008	http://fold.it/portal/	Puzzles. Protein folding

et al., 2012). In MalariaSpot, players mark malaria pathogens in a microscopy image including white blood cells, within a limited time (Luengo-Oroz *et al.*, 2012). Successful identifications give scores to players. The citizen sort project developed an online game "Happy match" to classify photographs of organisms (Crowston & Prestopnik, 2013). Playing EyeWire complements computational analysis for connecting neurons of the retina based on micrographs. Foldit (Cooper *et al.*, 2010) and EteRNA provide environments where players fold proteins to the correct shape or design RNAs through puzzles. In Phylo (Kawrykow *et al.*, 2012) and Fraxinus (MacLean, 2013) players highlight differences in nucleotide sequence alignments to either flag potential genetic diversity or create more accurate alignments.

Particularly where projects are of high interest to the general public, it is imperative that we harness their passion and convert this into real contributions to scientific progress.

The Facebook game Fraxinus

One disease that has been met with widespread anguish from the general public is Chalara dieback of ash, commonly known as ash dieback disease. The disease is caused by the fungus *Chalara fraxinea* which emerged in Poland in the early 1990s and has since spread rapidly across Europe from east to west. In September 2012, the first case of the disease in native woodland in the UK was reported just south of Norwich.

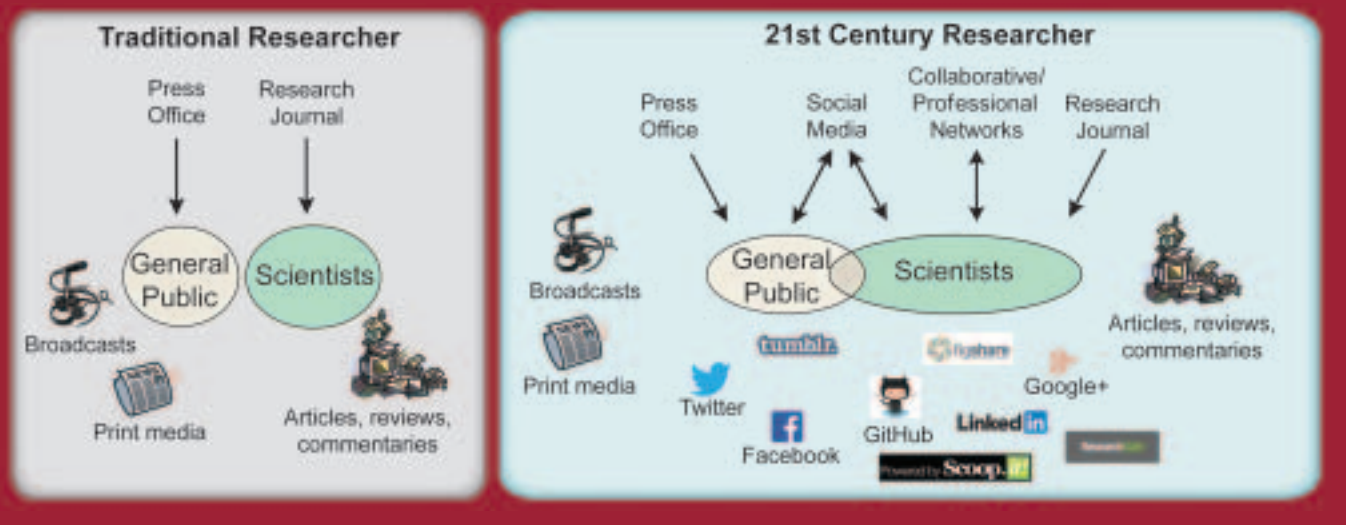
The vast media interest that ensued reflects the very real threat that is posed to our 80 million ash trees here in the UK. For instance, in Denmark, the loss of up to 90% of the ash tree population has been attributed solely to ash dieback disease.

With the ability to understand our adversary paramount, and the cost and speed of genome sequencing rapidly decreasing, generating and publicly releasing sequence data is key to accelerating research on emerging and re-emerging pathogens (Kamoun, 2012). In response, the OpenAshDieBack consortium was set up, led by Norwich researchers at The Sainsbury Laboratory, The John Innes Centre and The Genome Analysis Centre, and supported by BBSRC.

The central goal of this project is to generate and publicly release gene and genome sequence data for the pathogen and host that can be analysed by the worldwide scientific community (http://oadb.tsl.ac.uk/; accessed 23/09/2013). In addition, and in direct response to the widespread concern of the general public, the Fraxinus game was conceived as part of the crowdsourcing initiative.

By hosting Fraxinus on the Facebook platform, participants automatically send invitations across their individual social networks when playing the game, to encourage competition between

Figure 1. The integration of social media into scientific communication
As social media has grown in popularity numerous tools have been developed that can be utilised by scientits to promote communication both within the community and with the general public. Clip art images used with permission of Microsoft

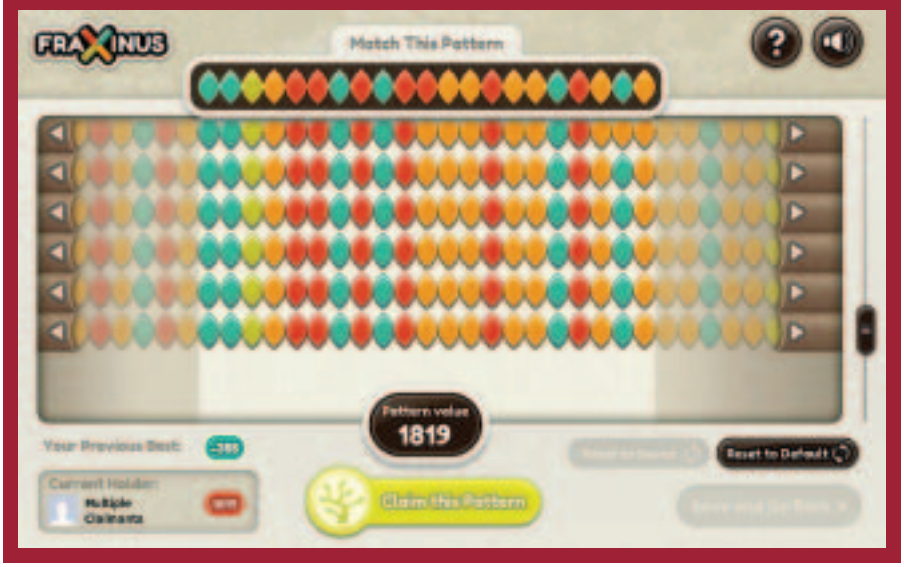


friends and family. With more than a billion active Facebook users (http://newsroom.fb.com/Timeline; accessed 23/09/2013), this provides a substantial forum for the non-specialist audience to contribute biologically relevant analysis to the Fight Back Against Ash Dieback Disease.

Through the underlying OpenAshDieBack research project, an abundance of genomic and transcriptomic data was generated with the aim to assess differences between various UK pathogen isolates and host varieties at the genomic level. This genetic variation, in turn, can provide clues about how this pathogen may be causing disease and what makes a specific tree variety potentially resistant. However, computational pipelines that are commonly used to identify these types of variation are notoriously limited. In contrast, the human eye is much better at recognizing these types of patterns in large data sets.

In the Fraxinus game, players act to manually identify or curate any computationally problematic sequence variation in comparisons between pathogen isolates or host varieties. The corresponding reference genome appears as a series of coloured leaves, each representing a single nucleotide within a defined region of the pathogen or host genomes. The task is to match a series of short stretches of 21 coloured leaves from a second sample isolate against this reference genome sequence (Figure 2). Mismatches represent sequence differences that are used to determine the genetic relatedness between the given sample and the reference isolate. As users steal patterns from their "friends" to improve the score associated with the alignment, the sequence variations are verified over and over again. This, in turn, provides robust analysis of the variation that is identified, eventually outputting the analysis to a database that feeds back into the researchers' analysis. With over 36,000 visits from approximately 18,000 unique visitors from 126 countries within the first week of its release, this game has really captured the enthusiasm of the non-specialist audience. The game contains 10,001 datasets that have all

Figure 2. Fraxinus
The aim is to match the 21 nucleotide stretches of sequence patterns from one sample against the target pattern at the top of the screen, which represents a region of the pathogen or plant genome sequences. Each nucleotide is represented by a single coloured leaf and mismatches relate to important genetic diversity between the sample and either the pathogen or tree genomes. The arrow buttons allow each pattern string to be moved left or right, while individual leaves can be moved, deleted or inserted with click-and-drag movements. As the match improves so does the "Pattern value" with players able to "Claim this Pattern" when they have the highest score



been played to some extent, with the analysis currently being transformed into real scientific results.

The power of the crowd

The Fight Back Against Ash Dieback Disease is built on an effective crowdsourcing network, with world-renowned plant biologists and bioinformaticians at its core. To this aim, various forms of media have been used to promote engagement from a wide demographic. For instance, Twitter and traditional media have been used to spread awareness of the GitHub data repository amongst scientists to encourage their contribution to vital annotation. As a result, the analysis of genomic and transcriptomic sequences from the pathogen and ash tree has revealed many genomic features and repertoires of transcripts that are highly expressed during the infection stage (http://oadb.tsl.ac.uk/?page_id=223; accessed 01/10/2013). Furthermore, in an effort to understand how the pathogen successfully infects ash trees, researchers have identified and classified genes that encode potential effector proteins (http://oadb.tsl.ac.uk/?p=622; accessed 01/10/2013). Effector proteins are secreted by an array of plant and animal pathogens to manipulate host physiology and help successful colonization.

Engagement with the general public has also been crucial to reporting cases of infected ash trees in the wild through the AshTag smartphone application, where users submit photographs of potentially diseased ash trees to help track its spread (https://www.ashtag.org/; accessed 01/10/2013). Employing a combination of social and traditional media is an extremely powerful approach that guarantees to reach the broadest of demographics.

How will crowdsourcing be integrated into scientific research in the future?

Crowdsourcing will undoubtedly continue to increase transparency within the process of scientific discovery, whilst further promoting interdisciplinary collaboration. Computational scientists have long relied on discussion forums and data repositories to communicate. With "big data" becoming commonplace in all areas of research, we can look to our computational colleagues to continue to develop forums that include bench biologists and act as central transparent cross-disciplinary hubs.

The integration of social media has enabled scientists to start to dissolve barriers between research and the general public. However, this is dependent on scientists embracing the full power of the crowd, regardless of the perceived complexities such as issues of data "ownership", complexity of authorship and the threat of being scooped. These issues can often be managed if addressed in the design stage of a project.

With the non-specialist audience forming a vital resource that can be utilized to accelerate scientific discovery, it is our responsibility to ensure that these issues are dealt with effectively to make the most of the power of the collective.

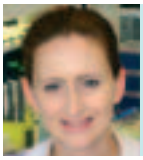
The integration of gaming technology to crowdsourcing initiatives enables the general public to help scientific progression whilst ultimately having fun!

As we look forward, we envisage a future where the largely untapped resource and collective intelligence of the general public is fully embraced in all aspects of research.

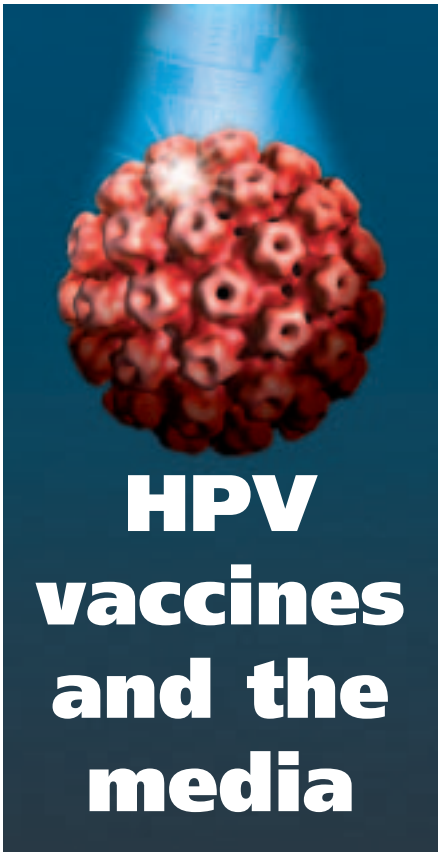
One continuing issue is how to maintain long-term engagement from the crowd. This remains a challenge and will require scientists to fully appreciate and be dedicated to crowdsourcing methodology, with active feedback to the crowd and releasing new and exciting updates to any gaming technology to maintain interest.

references

- Cooper, S., Khatib, F., Treuille, A., Barbero, J., Lee, J., Beenen, M., Leaver-Fay, A., Baker, D., Popovic, Z., and Players, F. (2010). Predicting protein structures with a multiplayer online game. *Nature*, **466**, pp756–760.
- Crowston, S., and Prestopnik, N. R. (2013). Motivation and data quality in a citizen science game: a design science evaluation. 46th Hawaii International Conference on System Sciences (HICSS).
- Darling, E. S., Shiffman, D., Cote, I. M., and Drew, J. A. (2013). The role of Twitter in the life cycle of a scientific publication. *Ideas in Ecology and Evolution*, **6**, pp32–43.
- Kamoun, S. (2012). Genomics of emerging plant pathogens: too little, too late. *Microbiology Today*, p140.
- Kawrykow, A., Roumanis, G., Kam, A., Kwak, D., Leung, C., Wu, C., Zarour, E., Players, P., and Sarmenta, L. (2012). Phylo: a citizen science approach for improving multiple sequence alignment. *PLoS One*, **7**, e31362.
- Luengo-Oroz, M. A., Arranz, A., and Frean, J. (2012). Crowdsourcing malaria parasite quantification: an online game for analyzing images of infected thick blood smears. *Journal of Medical Internet Research*, **14**, e167.
- Maclean, D. (2013). Cutting edge: Changing the rules of the game. *eLIFE*, 2.
- Mavandadi, S., Dimitrov, S., Feng, S., Yu, F., Sikora, U., Yaglidere, O., Padmanabhan, S., Nielsen, K., and Ozcan, A. (2012). Distributed medical image analysis and diagnosis through crowd-sourced games: a malaria case study. *PLoS One*, **7**, e37245.
- Priem, J., Costello, K., and Dzuba, T. (2012). Prevalence and use of Twitter among scholars.
- Terras, M. (2012). The impact of social media on the dissemination of research: results of an experiment. *Journal of Digital Humanities*, **1**, p3. (http://figshare.com/articles/Prevalence_and_use_of_Twitter_among_scholars/104629)




Diane G.O. Saunders (left) and **Kentaro Yoshida** (right)
The Sainsbury Laboratory, Norwich Research Park, Norwich, NR4 7UH, UK.



HPV vaccines and the media

In September 2008, the HPV immunization programme was introduced into the UK national immunization schedule. The vaccine was badged as an anticancer vaccine, targeting HPV 16 and 18, the cause of more than 70% of cervical cancers. Despite a very successful call/recall cervical cancer screening programme, which has reduced the incidents and mortality of the disease by more than 50% since its introduction in 1987, there are still in the UK about 2,800 cases and 950 deaths each year from this disease. Cervical cancer screening detects the high grade pre-cancers (the obligate precursors to frank invasive cancer) allowing effective treatment by excision or ablation and it is estimated that about 20,000 cases of high grade pre-cancers are treated each year, at least 50% of which are HPV 16/18 related. The HPV vaccine was introduced to reduce this heavy burden of disease.

Genital HPV infection is acquired soon after the onset of sexual activity and the programme therefore, targets girls who are 12–13 years' old as the ongoing cohort and had, for the first two years, a catch-up cohort of girls 14–18 years' old. To achieve the objective of reducing disease and infection by the HPV types in the vaccine and to be cost-effective, it needed to achieve a high uptake rate. This was particularly important for girls from deprived groups who have the highest rates of cervical cancer — cervical cancer is a poor woman's disease even in affluent countries. Health economic models estimated that coverage rates exceeding 80% would be needed for cost effectiveness, quite a big ask for a vaccine delivered in three shots at zero, one or two, and six months to teenage girls who are notoriously needle averse. In fact, the UK school-based HPV vaccination programme has been a huge success with 86.8% uptake nationally for all three doses in the most recent statistics for the 12–13-year-old cohort in 2011–12, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/244479/HPV_AnnualVaccineUptake2011-2012.pdf.

Successful vaccine implementation requires that the vaccines are publicly funded and that there is an effective public health and immunization infrastructure for vaccine delivery in order to achieve a high coverage. Clearly, for the UK programme, both of these are and were met, but there is another crucial need. The vaccine recipients, teenage girls and in this instance their parents who will need to consent, need to be convinced of three things. They must be convinced that the vaccine is needed to prevent serious disease, that it works and that it is safe. Mass media coverage played a key role in the perception by the public of the desirability and therefore, acceptance of the HPV vaccine. It is important to remember that the vaccine was introduced at a time when the MMR controversy still featured in both the visual and printed media, and in blogs on the Internet. However, lessons had been learnt by public health authorities and the immunization providers in general, in the importance of communication and the importance of communicating what the HPV vaccine was, what it would prevent and why it was worthwhile.

Communication of the HPV vaccine faced some very significant hurdles, not least of which was that it prevented a sexually transmitted infection and was going to be delivered to 12-year-old girls. The general public and indeed many of the health providers, doctors, nurses, paramedics, knew very little or nothing at all about HPV and its role in the aetiology of cervical cancer. If the vaccine was to be perceived as necessary in the "fight against cancer" then public awareness of HPV, the disease and the vaccine needed to increase. The messages that had to be communicated were:

1) HPVs were very common viruses. Most of us acquired infection at some point in our lives, but most of us developed immunity and cleared the infection.
2) There were many HPV strains but only a few caused cancer. All cervical cancers were caused by HPV, but two types, 16 and 18, were the most important causing more than 7 out of 10 of all cervical cancers.
3) The HPV vaccines prevented infection with 16 and 18, and prevented the pre-cancers caused by them, one of the vaccines also prevented genital warts caused by other HPVs 6 and 11.
4) Despite the efficacy of the vaccine, women still needed to have pap smears since 3 out of 10 cervix cancers were caused by HPVs not covered by the vaccine.

This was really complicated information, particularly for TV news and radio broadcasts, where an interview lasting more than one or two minutes was a rarity. So, how were journalists engaged in the story of HPV vaccines? How were they briefed? And was it successful?

Pharmaceutical companies manufacturing and marketing the two vaccines, Cervarix and Gardasil, clearly had a vested interest in raising the profile of the virus, the disease and the vaccine. Their communication and PR divisions provided press releases, convened media briefings, to which journalists both print and visual were invited, at which medical experts presented information on cervical cancer, its treatment, the opportunities for prevention and HPV virology and immunology. In addition, social psychologists emphasized the importance of raising awareness and the low levels of knowledge about the virus and the disease. Media briefings and press releases were provided by charities and non-commercial organizations, particularly Jo's Trust, a

UK charity set up to support women and their families affected by cervical cancer. Pharmaceutical companies and the information they transmit is often distrusted, so information for journalists from non-commercial or academic and medical organizations such as the Royal Colleges, were central to advocacy for the HPV vaccine and therefore, central to how the media constructed and framed messages about the vaccine and the immunization programme.

A number of scholarly analyses of how the media reported on the HPV vaccine, both in the UK (Hilton *et al.*, 2010) and elsewhere (Kelly *et al.*, 2009), have been published. Hilton and colleagues report that from January 2005 to December 2008 in the UK, 344 news articles in both tabloid and broadsheet journals included coverage of the virus and the vaccine. Importantly, the factual content in these articles in both tabloid and broadsheet was overall correct. Articles described the development of the vaccine, the introduction into the UK immunization programme, the epidemiology of cervical cancer, the association of HPV with cervical cancer, why teenage girls should be the group to be vaccinated and also the nature of HPV transmission genitally, i.e., sexually. Importantly, anti-immunization messages and rhetoric appeared in less than 20% of articles. Nonetheless, it is interesting that anti-immunization sentiments about the programme were more likely to appear in serious newspapers such as *The Guardian* and *The Independent*.

The HPV vaccine story was attractive to sub-editors of newspapers and news Editors for TV programmes since overall, it had very good news messages. Many articles conveyed the message of a scientific breakthrough and, indeed, the development of HPV virus-like particles was a breakthrough. The vaccines were remarkably efficacious; 98% efficacy against disease is remarkable and for once the hyperbole about scientific breakthroughs was justifiable. One of the most important, although tragic, events that propelled cervical cancer and HPV into the public's awareness was the "fight" with cervical cancer of Jade Goody, a 27-year-old reality TV star. Goody's progress through her diagnosis, treatment and ultimately her death were played out in the full glare of the media. Through Jade Goody, the effect of treatment and the physical deterioration that accompanies terminal cancer was communicated in all its painful and agonizing reality to the public. The effect on cervical cancer awareness, uptake of cervical cancer screening and the HPV vaccine was significant. Importantly, Jade Goody's story and the use by the media of the stories of other young women with cervical cancer focused attention on the seriousness of the disease and the fact that it occurred in young women not just the over 70s. The risk benefits of vaccine versus disease were put in perspective in the public mind.

One recurring issue was the fact that genital HPV is a sexually transmitted infection and it was regularly voiced from various groups that the HPV vaccine would encourage girls to be promiscuous and become sexually active. The sound bite that the HPV vaccine was "a sex jab" was too attractive to be resisted by the media. These views were espoused mainly, but not exclusively, by some religious organizations who no doubt were sincere in their anxieties. However, it identified what is a problem in engagement with the media and that is, balanced reporting. In media terms, balanced reporting is providing a platform for grossly different views and widely differing expertise in the subject in question, often with the aim of engendering confrontation, a technique particularly favoured for TV and radio. As a consequence, the outcome is usually unbalanced with a clear polarization of views that are unhelpful in the communication of important issues about the vaccine or the disease. Concerns about the vaccine sexualizing young girls and encouraging promiscuity in adolescent girls were commonplace in the media. This actually focused attention on the behaviour of women, not men, and risked stigmatizing women with cervical cancer or any other HPV associated cancer (Waller *et al.*, 2007). It is a continuing issue with respect to the HPV vaccine.

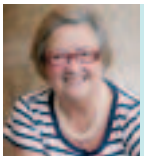
Another issue with respect to balance in the media, and this is not just for HPV vaccines, but for scientific and medical news in general, is the reliance of media organizations on a limited number of scientists or doctors to whom they go for comment on particular issues. Journalists simply look at their contacts page on their smart phone and ring up their favoured scientist for a comment or background to a news story.

Vaccine safety is a major factor in the public mind and anti-vaccine blogs abound on the internet, but overall HPV vaccine safety was intelligently analysed and discussed in the mainstream media. Importantly, when a potentially serious situation arose, public health authorities reacted rapidly and effectively, communicating information clearly and quickly to the media. In September 2009, a young girl in Coventry collapsed and died soon after the first dose of vaccine, the local public health doctors and the Department of Health provided information immediately. Within 24 hours the cause of death, a cancer in the chest totally unrelated to the vaccine, was identified and the involvement of the media and family by the public health authorities was an example of how to manage a potentially serious adverse event.

Overall, the media coverage for the HPV vaccine was positive and undoubtedly contributed to its acceptance by the general public, but we should not be complacent, social media plays an ever-increasing role in communication and effective use of those channels will be critical in the introduction of new vaccines.

references

- Hilton, S., Hunt, K., Langan, M., Bedford, H., and Petticrew, M. (2010). Newsprint media representations of the introduction of the HPV vaccination programme for cervical cancer prevention in the UK (2005–2008). *Soc. Sci. Med.*, Jan 9.
- Kelly, B. J., Leader, A. E., Mittermaier, D. J., Hornik, R. C., and Cappella, J. N. (2009). The HPV vaccine and the media: how has the topic been covered and what are the effects on knowledge about the virus and cervical cancer? *Patient education and counseling*, **77**(2), pp308–313.
- Waller, J., Marlow, L. A., and Wardle, J. (2007). The association between knowledge of HPV and feelings of stigma, shame and anxiety. *Sex Transm. Infect.*, **83**(2), pp155–159.



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historical**Perspectives**

MMR and the media

The measles, mumps and rubella triple vaccine (MMR) was introduced in the UK in 1988. In 1998, a report in *The Lancet* (Wakefield *et al.*, 1998) suggested that it might cause autism. MMR has been in the headlines ever since, generating complaints about inaccurate, sensational and naive media reporting. Such controversy discourages scientists and clinicians from working with reporters. This article suggests, among other things, that this may be counterproductive.

The background

The paper published in *The Lancet* concerned 12 children with bowel and behavioural problems. At a press conference called by the Royal Free Hospital, London, the lead author, Dr Andrew Wakefield, surprised colleagues by advocating single vaccines instead of MMR. The paper did not propose this, but the conference was outside peer review. No one should have been surprised — the single vaccine message had already been distributed in a video news release.

The study was very small, but *The Lancet* was a leading international journal, the Royal Free was a leading teaching hospital and such press conferences were not everyday occurrences. Media interest was thus legitimate, but only *The Guardian*, *The Independent* and the *Daily Mail* reported the study, with heavy emphasis on Government advice to disregard Wakefield.

Supported by various newspapers, including the *Daily Mail*, Wakefield subsequently raised further questions about MMR. In 2001, Prime Minister Tony Blair precipitated extensive media coverage by refusing to confirm if his baby son Leo had been vaccinated. He insisted that this was a private matter, only to generate speculation that he did not trust his own Health Secretary's advice. (It later emerged that Leo had been vaccinated.) In 1998–9, 88% of children had been immunized against measles, mumps and rubella. By 2003–4, coverage had fallen to 80% and to 61% in some London areas. In 2004, a Medical Research Council supported study concluded that there was no evidence linking MMR to autism (Smeeth *et al.*, 2004).

In 2010, the General Medical Council struck Wakefield off the Medical Register for serious professional misconduct over his research methods. Ironically perhaps, it was the tenacity and persistence of a journalist, Brian Deer, who uncovered Wakefield's extensive conflicts of interest and unethical research practice. Deer's work in *The Sunday Times* led to the retraction of the 1998 Lancet report.

In 2013, the Department of Health launched a national catch-up vaccination campaign in response to a rise in measles cases and an epidemic in Swansea. This was mostly attributed to unprotected 10–16 year olds who were not vaccinated in the late 1990s and early 2000s.

The cultural context

The media is alleged to create health scares in order to provoke panic and banner headlines. There is sometimes some truth in these accusations, but the head-on collision between two of the biggest drivers in contemporary life — science and the preoccupation with risk — has created what the sociologist Frank Furedi calls a culture of fear. Previous generations did not ask: should we eat beef? Do mobile phones cause brain cancer? Does living near high-voltage power lines cause cancer? Should we take aspirin to avoid heart attacks? Should we vaccinate our children?

The media did not create this culture, but it does fuel it. However, the media is primarily reactive, not proactive. A study of medical journals in Scandinavia and the UK between 1967 and 1991 found a highly significant increase in the use of the term 'risk' (Skolbekken, 1995). During the first five years the number of 'risk' articles published was about 1,000 – for the last five years there were over 80,000. The media should and did reflect this trend.

During the same period, the relationship between doctors and patients changed, and people became increasingly interested in their health. Again, this was not because of the media, but because of the impact of consumerism; self-help groups; the women's liberation movement, which campaigned against the medicalization of everyday life; and the HIV/AIDS lobby, which provided a template for thousands of advocacy groups for patients with diseases ranging from depression to breast cancer.

How has science, the biggest ever driver of change, changed? Ironically, researchers are still encouraged, as they were half a century ago, to remain at the bench and let their publications talk for them. However, the MMR story is one of many examples exploding the myth that evidence speaks for itself. This may be especially true of vaccination, which has been controversial ever since Edward Jenner's pioneering work against smallpox in the early 1800s.

Research suggests that scientists and healthcare professionals assume that the public will make the right healthcare choices if they are provided with information; this seems logical, but imagine the following scenario. Jane is a young mother who, ironically, because of the success of vaccination, has never seen a case of measles and knows nothing about herd immunity. After reading a harrowing account about a seven-year-old who developed autism after MMR, she cancels her child's vaccination appointment.

Storytelling: statistics versus case histories

Should such emotionally charged stories be published? I believe so because vaccination is not risk-free. There were 24 Government awards to vaccine-damaged children totalling more than £2 million in the 10 years to 2013/14 (Press statement, September 2013). However, context is everything. Critics complain that the media has highlighted the plight of the tiny minority of vaccine-damaged children without stressing the benefits of vaccination to millions of others; the dangers of measles, mumps and rubella; and the risks of single vaccines which leave children unprotected for longer and involve several clinic visits. Yet, to quote one example, the £3 million campaign launched by the Government in 2001, the year of the Leo Blair controversy, to allay parents' fears was widely reported.

So what went wrong? Scientists, I believe, over-estimate the power of statistics in mass communication. Research into what persuaded people to give to charity showed that the better statistically informed the potential donors were, the less money they gave (Small *et al.*, 2008). People who read a short emotional appeal about an African child at risk from hunger gave more than twice as much as those who just saw raw statistics about threats to millions of Africans. Thus, the facelessness of statistics, one of the great strengths in science, can be an abject failure in mass communication.

This presents a unique challenge in the MMR story. A media case history about a child who has been successfully vaccinated would be profoundly dull — the child would be one of millions. Conversely, a story about a "vaccine-damaged" child may be extremely powerful by virtue of being different.

If case histories carry more weight than statistics, why not adopt more of a storytelling approach, combining case histories with statistics? Storytelling is an integral part of every culture. From a very young age we listen to and tell stories. Medical stories are encapsulated in case histories in both medical education and medical journalism. Stories help

us — in a way that statistics cannot — to define ourselves and to compare ourselves with others, giving us a sense of perspective about our place in the scheme of things.

No one recognized this better than the late children's author Roald Dahl who declared: "*It really is almost a crime to allow your child to go unimmunized*" (as quoted in Illman, 2013). Dahl knew the power of this sound bite. His message was reinforced by the death of his own daughter from measles at the age of seven before a vaccine became available. Hers is one of many powerful case histories.

Media case histories have their critics. For example, Professor Raymond Tallis complains about "the curse of the media anecdote" and the habit of giving appealing individuals, with their moving stories, at least as much credence coverage as unappealing data; and of preferring faces to graphs and *vox-pops* to statistics. The anecdote may be an imperfect tool, but communication via p-values and confidence intervals resonate with only a small minority. The real problem is not so much the anecdote, as its misuse. The challenge is in achieving balance — easier said than done.

Balance

Journalists are trained to present both sides of the story in the interest of objectivity and impartiality. This "balance" can work well in a political story in which a Government minister and an opposition spokesperson have equal time or space. It may not work so well in science stories in which two opposite viewpoints are presented as if they are equal.

In *Health, Risk and News: The MMR Vaccine and the Media*, Tammy Boyce complains that what is missing from much of the coverage is any sense of the weight of scientific evidence, which is firmly stacked on the side of the safety of the MMR vaccine (Boyce, 2007). When examining balance, she adds, it is not just a matter of counting which side appeared more often. Balance is also influenced by the way journalists use scientific evidence. Boyce argues that by selecting equal numbers of scientists for and against MMR, journalists suggest that scientists and healthcare professionals overall are split on the issue when, in reality, the vast majority support MMR. Mark Henderson's *The Geek Manifesto: Why Science Matters*, a must-read for any mass communication student, also highlights this legitimate concern.

How does a journalist achieve "balance"? The answer in MMR may seem to be clear, but I have been puzzling over this question for more than 30 years. The most difficult thing to do as a journalist is to present the evidence appropriately, especially in science which is inherently controversial. It is easy enough to report what you are told, but this is rarely enough. Evidence needs to be interpreted and spoken for, and it shifts and changes according to who is doing the interpreting.

Working with the media — or not?

In his widely acclaimed *Bad Science*, Dr Ben Goldacre criticizes the media for poor reporting, especially over MMR. Much of what he says is true, but such attacks discourage scientists and clinicians from working with the media. Avoiding media questions for fear that they may exacerbate public alarm may open up the ground to commercial interests who exploit fear for profit; and to pressure groups who disseminate misleading information. Saying "no" to a media interview request may mean your view will go unrepresented or be misinterpreted as meaning you have something to hide.

For example, in 2003, Channel Five broadcast a hagiographic drama about Wakefield, followed by a studio debate with the man himself. Many experts on public health, paediatrics, autism and vaccination refused to take part. This principled, but misguided, stand robbed viewers of the authority of those who were best able to challenge Wakefield before a huge audience.

Conclusion

Criticism of the media over its reporting in MMR is justified, but healthcare professionals and scientists need to recognize that if they do not accept opportunities to represent their views, they may be misrepresented or go unheard.

further reading

- Furedi, F. (1997). *Culture of Fear*.
- Henderson, M. (2012). *The Geek Manifesto: Why Science Matters*.

references

- Boyce, T. (2007). *In Health, Risk and News: The MMR vaccine and the media*. Peter Lang Publishing, p77.
- Illman, J. (2013). How dangerous is measles? http://www.ovg.ox.ac.uk/blogs/ojohn/how-dangerous-measles. Accessed: 2 October 2013.
- Press statement to John Illman from the Department of Works and Pensions. September 2013.
- Skolbekken, J-A. (1995). The Risk Epidemic in medical journals. *Social Science and Medicine*, **40** pp291–305.
- Small, D. *et al*. (2008). Can insight breed callousness? The impact of learning about the identifiable victim effect on sympathy. http://fraudresearchcenter.org/2011/02/can-insight-breed-callousness-the-impact-of-learning-about-the-identifiable-victim-effect-on-sympathy/.
- Smeeth, L. *et al*. (2004). MMR vaccination and pervasive developmental disorders: a case-control study *The Lancet*, **364** (9438), pp963–969.
- Wakefield, A. J. *et al*. (1998). Ileal-lymphoid-nodular hyperplasia, non-specific colitis and pervasive development disorder in children. *The Lancet*, **351** (9103), pp637–641.

John Illman

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Movie microbes under the microscope

It may surprise *Microbiologist* readers to learn that microbes have been movie stars since the earliest days of cinema. Between 1900 and 1930, moviegoers could watch bacteria and other microbes cavort on the silver screen in dozens of films with titles such as *On the Trail of the Germs* (1912) and *The New Microbe* (1912).

Louis Pasteur, Robert Koch and other scientists had provided convincing evidence for the germ theory of disease in the later parts of the 19th century. The Lumière brothers held the first public screening of projected motion pictures in 1895. Not long afterwards, scientists began using the new technology as a research tool by attaching movie cameras to microscopes. And soon after that, film houses began exhibiting these scientific films as public entertainment and film-makers began creating their own popular movies featuring magnified microbes.

Cinema was an ideal technology for transforming phenomena that were invisible to the naked eye into spectacular visions. Films of microorganisms were popular because they invoked simultaneous reactions of attraction and repulsion in audiences.

Films of microscopic organisms, such as documentary film pioneer Charles Urban's *The Red Snow Germs* (1905) and *Typhoid Fever Germs* (1905), allowed audiences to see for themselves the previously invisible wriggling, writhing aliens that actually lived around them, on them and in them. Yet, these films were also frightening because of the role these microscopic monsters played in disease.

Many fictional films featuring microbes both reflected and fuelled this anxiety with titles such as *The Dread of Microbes* (1911) and Thomas Edison's anti-tuberculosis propaganda film *The White Terror* (1915).

One upshot of the public acceptance of germ theory was the frightening realization that germs were *everywhere*, an anxiety reinforced by early microbial movies. A large number of these films featured scientist characters "discovering" microbes on everyday objects. Food was a particularly common subject as in *The Unclean World* (1903), *The Scientist's Lunch* (1905) and *A Bad Case* (1909). In fact, one of the first acts of film censorship involved a film showing microscopic organisms found on food. In *The Cheese Mites* (1903), the normally invisible mites from a piece of Stilton cheese were made to look like alien invaders when magnified on the screen. The film's peek into this hidden world was actually too revealing for some; the British cheesemakers had the film censored because they were afraid it would negatively impact the public's perceptions of their product.

Many early films attributed germs with almost magical properties to influence human behaviour including problematic human behaviour such as alcoholism or violence. According to *The Germ*'s (1923) promotional literature, the film "*Deals with a new scientific theory, that germs in the blood denote personality, and that serums can be found that will eradicate, these germs, after which a man can commit no crime*." One of the most popular powers ascribed to microbes was the ability to act as an aphrodisiac as seen in numerous comedies such as *The Love Microbes* (1907), *The Kissing Germ* (1909), *The Love Germ* (1912) and *The Germ in the Kiss* (1914).

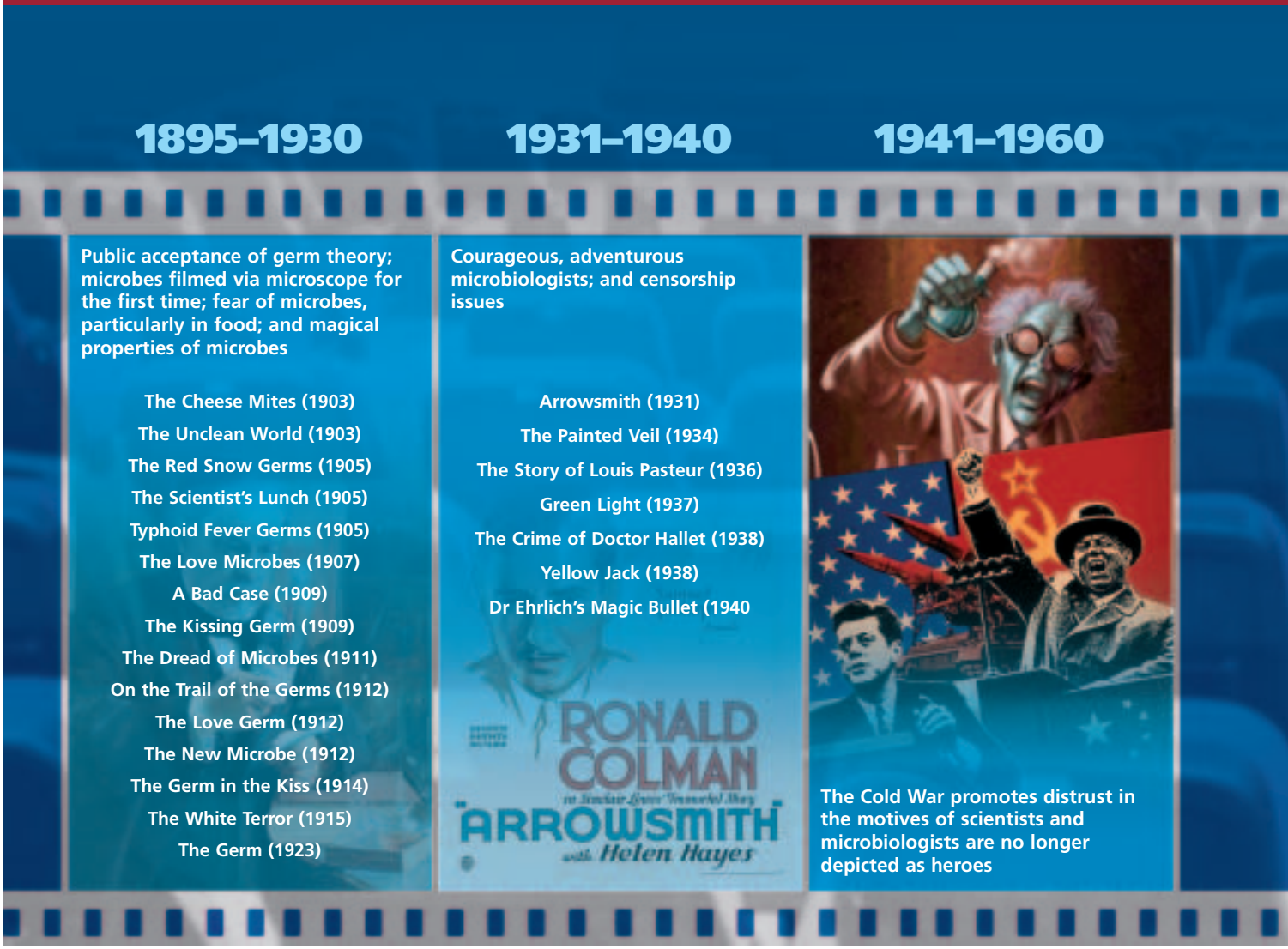
By 1930, film-makers began prominently featuring the bacteriologists who studied these killer pathogens in motion pictures. Paul de Kruif's best-selling 1926 book *The Microbe Hunters* catalogued the scientific exploits of Louis Pasteur, Paul Ehrlich, Walter Reed and other pioneering microbiologists. As the book's title suggests, these "microbe hunters" were not feeble old men working in dusty, darkened laboratories. They were idealistic adventurers who travelled to far off locales to establish the truth about microbial dangers. de Kruif had also provided scientific advice for Sinclair Lewis' 1925 Pulitzer Prize winning novel *Arrowsmith*, which followed the exploits of a fictional scientist who studies a plague outbreak in an exotic country and who also conducts bacteriological experiments in the backwoods of the American West.

The popularity of de Kruif's and Lewis' books made a film adaptation of *Arrowsmith* inevitable. However, the critical and financial success of 1931's *Arrowsmith* paved the way for a host of films featuring stories of courageous bacteriologists.

Arrowsmith was entirely fictional, but the film had the realistic feel of a "bio-pic" which was also a popular genre at the time. Studios figured that if they were successful with a fictional bacteriologist, then why not make movies about real-life microbe hunters? Like *Arrowsmith*, *The Story of Louis Pasteur* (1936) was not only a commercial hit, it was also a critical triumph — winning three Academy Awards as well as being nominated for best picture. Warner Brothers Studio also tackled the story of Paul Ehrlich with 1940's *Dr Ehrlich's Magic Bullet*. The film hit a topical sweet spot for producers Harry and Jack Warner. It was an anti-fascist medical picture featuring a Jewish scientist whose research addressed an important social problem (in this case syphilis).

Whether based on real-life scientists or entirely fictional, almost every bacteriologically based movie that followed borrowed narrative elements from *Arrowsmith*, especially those related to the theme of self-sacrifice. This led to films in which scientists travelled to disease outbreaks in exotic locations or retreated to remote wildernesses in order to conduct experiments in isolation. *In The Painted Veil* (1934), for example, a bacteriologist travels to a remote part of China to study a cholera epidemic. While *Green Light* (1937) casts the dashing Errol Flynn as a scientist who leaves the comforts of the big city to work on a cure for Rocky Mountain spotted fever in the wilds of western Montana.

Film-makers also preferred real life scientists whose research took place in dangerous locations such as *Yellow Jack* (1938), which focused on Walter Reed's work in Cuba. These films also often featured an ethical dilemma reminiscent of *Arrowsmith's* moral quandary about inoculating everybody with his potential cure or maintaining his controlled study. In *The Crime of Doctor Hallet* (1938), for example, the microbiologist commits a crime in order to develop a vaccine for red fever while working in the jungles of Sumatra.



Although his indiscretion is the relatively uninteresting crime of forgery, the film highlighted the lengths a microbiologist was willing to go in order to save humanity from the menace of infectious diseases.

We might think that there was nothing objectionable about stories of heroic scientists, but these films were not exempt from censorship. Some US state censor boards, for example, excised a line of dialogue from *The Crime of Doctor Hallet* which had implied that we should be taking our moral cues from bacteria: "*There's something to be said for bacteria. They don't waste time moralizing. They eat-breed-die and kill.*"

Animal experimentation was a major concern for censors both in the US and in the UK. There was also significant concern within Hollywood's censorship body at the time, the Production Code Administration (PCA), about boycotts of *The Story of Louis Pasteur* because Pasteur was considered the "father of vivisection." In the UK, the film received extensive cuts before it could be shown for the same reasons.

The film facing the biggest struggle with censorship was *Dr Ehrlich's Magic Bullet*. The PCA's restriction on mentioning venereal disease made things difficult for Warner Brothers given that the film was about Ehrlich's discovery of Salvarsan, the first effective medical treatment for syphilis. In the end, the studio convinced censors that the final film was not about Salvarsan the drug, but about Ehrlich the man. By putting the focus on the scientist and not the science, the story became morally acceptable to the censors.

The fad for movies about heroic bacteriologists did not survive the 1940s. During the Cold War, microbiologists were no longer perceived as brave scientists attempting to cure diseases; instead the public viewed them as mercenaries betraying their scientific principles by using their knowledge to create horrific biological weapons.

This change in public attitudes was reflected in the movies and by the 1960s microbiologists had turned into movie villains. The success of the James Bond film Dr No in 1962 led to a flood of imitation "superspy" films in the 1960s. A surprising number of these films featured secret agents whose mission was to prevent the release of weaponized infectious agents whether they were produced in the Soviet Union [*Agent for H. A. R. M.* (1966); *The Nasty Rabbit* (1965); *Project X* (1968)], by Western scientists [*The Satan Bug* (1965)] or within the lairs of "supervillains" [*Billion Dollar Brain* (1967)].

One interesting exception to this period's negative portrayal of microbiologists was 1971's *The Andromeda Strain*, where microbiologists are heroes using science to save the world from the threat of killer microbes from space.

Two movies produced in the early 1970s, *The Omega Man* (1971) and *The Crazies* (1973), deviated significantly from previous bio-weapons films. The effect of these fictional infectious agents was not to cause illness or death. Instead, the weaponized pathogens in these films had a radical transformative effect on the hosts' minds and bodies. In other words, infected people turned into monsters. Monster-spawning plagues became common in horror films of the next several decades, especially when germs were combined with the theme of GMOs as in *Warning Sign* (1985).

By the 2000s, microbial plagues had become what radiation was in the 1950s, the go-to method for creating

cinematic monsters. There have been dozens of recent films where viral or bacterial "plagues" have broken out creating hordes of zombies [*28 Days Later* (2002); *Dawn of the Dead* (2004); *World War Z* (2013)], vampires [*Blade* (1998); *I am Legend* (2007); *Daybreakers* (2009)], and werewolves [*Underworld* (2003)]. But these films are ultimately not about infectious diseases. In today's cinema, microorganisms predominantly serve as metaphors for a wide range of social issues such as conformity, consumerism and classism.

Sensationalized news stories about killer *E. coli* and antibiotic resistant "superbugs" alongside dire warnings about emerging viruses in popular books, like Laurie Garrett's *The Coming Plague* (1994), caused an increased anxiety about microbes in the 1990s. In the last two decades, there have been two prominent films that have specifically addressed the serious threat posed by emerging infectious diseases. In many ways *Outbreak* (1995) and *Contagion* (2011) recall the heroic microbiologist films of the 1930s with their plots featuring virologists saving the world from devastating pandemics. Both of these films raised awareness of emerging infectious diseases far more than any popular science book ever could.

Movies have historically proven to be an effective way to convince the public that a scientific issue needs more political, financial and scientific attention. In *Lab Coats in Hollywood* I refer to the connection between depictions of scientific disasters in movies and increased public attention as the "*War Games* effect" after the 1983 film.

Scientists believe that the more realistically a movie catastrophe is visualized, the more motivated the public will be to fund research in order to prevent the event from occurring in the real world. That is why many scientists willingly signed up to act as science consultants on both these films. *Outbreak*'s film-makers employed a host of leading microbiologists as advisors including pioneering HIV researcher Donald Francis. *Contagion*'s producers also utilized prominent microbiologist Ian Lipkin from Columbia University as their main science consultant along with significant assistance from the CDC.

On *Contagion*, almost every member of the production sought advice from the film's scientific advisors from the actors to the scriptwriter to the set designers. Because of this, almost every scientific element in the film — the scientists, the laboratories, the source of the virus, the disease's epidemiology and the response of the CDC — all felt authentic.

Ultimately, the same "attraction and repulsion" that drew early cinema audiences to films of microorganisms are the same aspects that still fascinate modern audiences. The technology of cinema adds an unreality to microbes that makes them appear both beautiful and disturbing at the same time. For this reason, it is a good bet that we will continue to see microbes in our movies for years to come.

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Bad Bugs Bookclub: 5 years on

April 2009: National Science and Engineering Week marked the launch of the Bad Bugs Bookclub. S*f*AM sponsored the screening of the film *Outbreak* in the Mammal Hall at the Manchester Museum and subsequently also hosted the accompanying discussion of the novel *The Hot Zone* by Richard Preston, in a hospitable bar in Manchester. So in 2014 we will be celebrating five glorious years!

The Bad Bugs Bookclub comprises a group of microbiologists and non-microbiologists (scientists and non-scientists). We read and discuss novels where infectious disease forms part of the plot. Since 2009, we have met around six times each year, talking about 27 different books from all genres: science fiction, horror, crime, classic, romance, historical and factual. Notes from every meeting are posted, with accompanying reading guides, on our website: www.hsri.mmu.ac.uk/badbugsbookclub.

There have been breakaway meetings of the Bookclub at conferences (e.g., ASM Conference on Undergraduate Education; S*f*AM Summer Conference and FEMS Congress), and we have also hosted accompanying events where appropriate, often with funding support (for example, from S*f*AM and the Society of General Microbiology, as well as from other sources such as the Manchester Beacon for Public Engagement). These events have included community quilt making on World AIDS Day (2009 and 2011), a musical tea party for World Malaria Day (2010), guided walks (for example, around Eyam the plague village and the Manchester of Mary Barton) and a series of film screenings.

Our audiences have also diversified. Undergraduate students were always an intended audience and some have hosted Bookclub meetings as part of their final year project work. We also introduced a series of Bookclub meetings into the second year medical microbiology module tutorial programme (2012–2013), and we capitalized on the prevalent interest in vampire and zombie novels to convey principles of infectious disease to children, teachers and families via the Manchester Children's Book Festival (2010, 2012) and the Manchester Gothic Festival (2013).

Personally, I have learnt so much more about microbiology — and literature — through the Bookclub, but I also now appreciate that the 'general public' is less aware of some aspects of microbiology that I thought were almost common knowledge. It has been so interesting to consider and clarify misunderstandings during our discussions, and to relate aspects of the plots to scientific principles of microbiology and current epidemiology of the different diseases described in the novels.

For each book, we also consider how the subject matter might be of value to undergraduate students — for discussion or for extension work. For example, at our most recent meeting, we read *Fever* by Mary Beth Keane (2013). The novel tells the story of Typhoid Mary and really fleshes out the brief captions present in virtually all microbiology textbooks. The novel also describes the living conditions, social strata and prejudices prevalent in New York at the beginning of the 20th century. It is easy to source historical information about Typhoid Mary, the disease, its current epidemiology and research, thus 'hard science' is accessed through the softer approach of a popular novel.

On the 'literature' side, I have made lots of friends at MMU's Writing School, and have even taken a couple of modules on Gothic literature and Creative Writing! Even more terrifying, I am also speaking at *The Times Literature Festival* in October, at an SGM-sponsored event (about 'dirt').

I wish that I were better at using social media to encourage more engagement of a wider audience. I would love to have other readers tweeting about our current book, and other Bookclubs using our books and reading guides, and contributing to our discussions. Perhaps that can be my resolution for the next five years!

references

■ Verran, J. (2013). The Bad Bugs Bookclub: science, literacy and enjoyment. *J. Microbiology and Biol. Education*, **14**, pp110–112.

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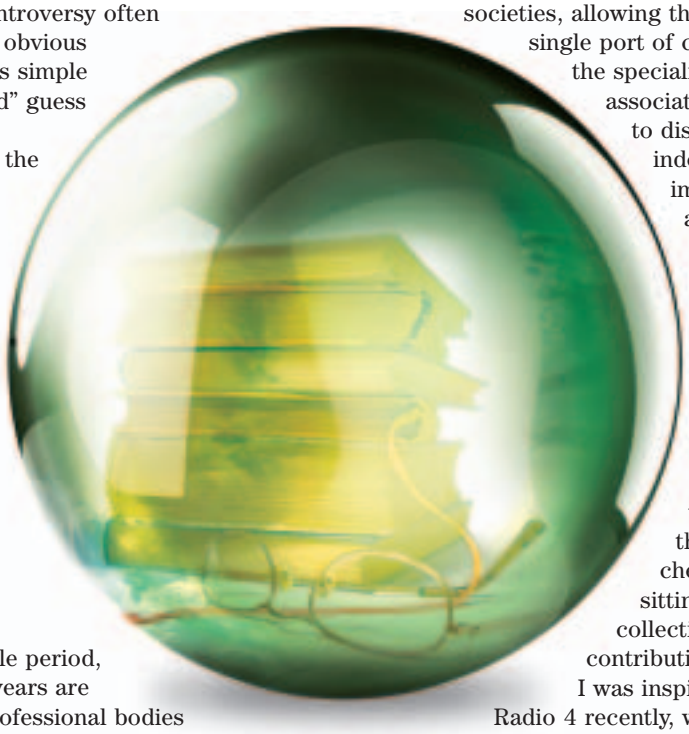
bioFocus

Mark Downs gazes into his crystal ball to view the Society of Biology in 20 years

www.societyofbiology.org

Crystal ball gazing is a black art according to many. Those who look into the future to predict what might be, regularly get it wrong. After all, there is rarely much application of science in the process and, where there is, through good modelling, controversy often remains. Climate change is the obvious example. For most, the future is simple guess work or at best "educated" guess work. It's thus with some trepidation that I try to answer the question asked frequently by Members: "*where do you see the Society in 20 years' time*?" As with all these questions, identifying the variables is difficult enough, let alone their interaction, but for broad business planning purposes and the irresistible need to offer a view I'll try to pen some thoughts.



Firstly, it is worth stressing that the future of any umbrella organization is intimately connected to the fate of its membership. After a fairly stable period, the next 10, and certainly 20, years are uncertain territory for many professional bodies that rely on publishing income to support their broader charitable activity. Open access policies, of course, are critical to this. The debate is often focused on the UK, with Research Councils, The Higher Education Funding Council for England (HEFCE) and the Wellcome Trust driving the agenda. But, with most papers originating outside of the UK, it is likely to be the policies in North America and Asia that determine the real impact on learned society publishers. In the short term, as open access and subscription fees co-exist, incomes may well rise whilst 10 years out it is likely that many societies will see some decline in revenue. But the underlying issue here is that technological advances are creating new ways of communicating and using science information, and we have to find new ways of working to get the best from these.

In my view, however, a key factor for the Society of Biology 20 years on, will be how willing the life sciences sector has been to pool core functionality, and move towards a more integrated approach to delivering membership services and support. There is often talk of mergers within the sector but this is far from the only option, and a mixed economy of continued independence and growth, contraction for some and shared services for others are all likely. But, there will have to be some restructuring, as there has been for both chemistry and physics. With mounting pressure on all organizations to improve efficiency and drive down costs, it can no longer be sustainable for the biology sector to have multiple membership service teams or the generic education or policy work many of us undertake duplicated across societies. We also need to better reflect the way modern science works where cross-discipline and multi-discipline teams are the norm. There are strong and divergent views on the need to maintain specialisms and consensus has not been reached. But the debate is ongoing and we can't ignore it.

To a large extent, individual memberships will drive the agenda. From the individual's perspective it surely makes sense to have one system and one bill for membership of societies, allowing those with multiple interests a single port of call? That doesn't imply that all the specialist services and communities associated with sub-disciplines need to disappear or give up any independence. But it could improve efficiency for everyone allowing more funds to be directed towards support for individual areas.

There is also political pressure to bring the life sciences closer together. A single and strong voice for biology is something that is already bringing benefits, allowing a coherent message to be given to ministers and the media with biology, chemistry, physics and maths sitting at the same table arguing collectively for the value and contribution of science.

I was inspired to hear James Burke on Radio 4 recently, whom I'm sure many will remember for his engaging science TV programmes in the 1970s and 1980s. He was once asked to look 20 years into the future and was scarily accurate in his predictions on the use of technology, especially the information highway. As an avid viewer, I'm hoping I'll have similar luck.

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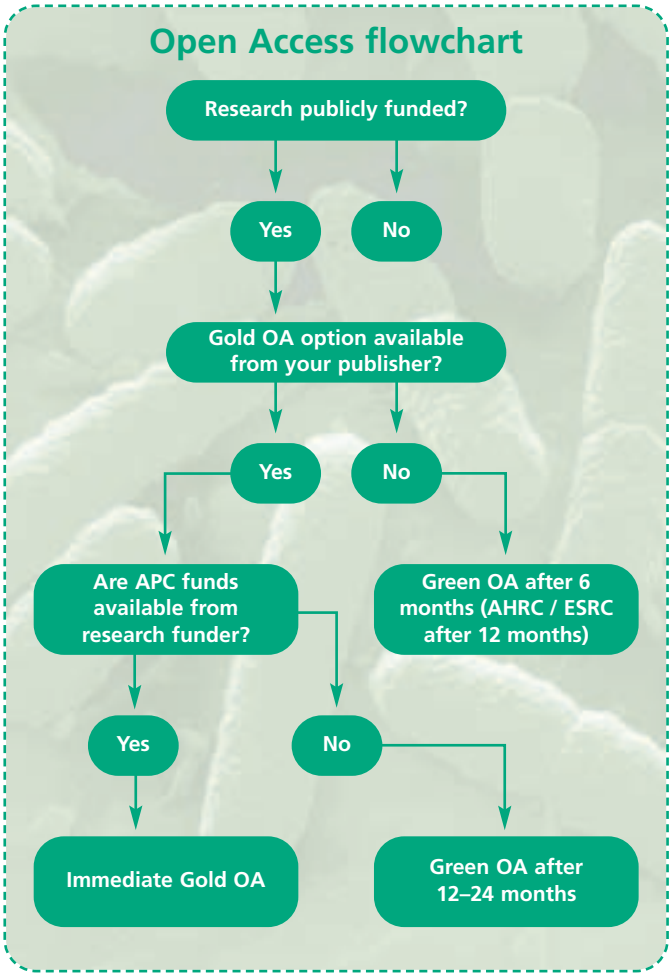
Chief Executive, Society of Biology

journalNews

Open access, a primer for UK authors

The academic publishing environment is markedly more complex than in the years gone by: mandates for both funded and unfunded open access are proliferating, and authors are often confused by their options and obligations. Since the publication of the Finch Report last summer, there have been numerous enquiries, debates and discussions on the subject of open access, both 'gold' (i.e., pay-to-publish services offered by journals such as *Microbial Biotechnology* or *MicrobiologyOpen*, or by the OnlineOpen option available for *JAM* and *LAM*) and 'green' (i.e., deposit of the accepted manuscript in an online repository), and what open access means for libraries, researchers, societies, universities and the UK economy.



Research Councils UK (RCUK) funds approximately 50% of UK research. Their current open access policy applies to 'peer-reviewed research articles...which acknowledge Research Council funding, that are submitted for publication from 1st April 2013', http://www.rcuk.ac.uk/documents/documents/RCUKOpenAccessPolicy.pdf. The policy clearly states that dedicated funding for article processing charges (APCs) is provided in the form of block grants specifically allocated for publication charges, rather than research, which in turn has necessitated universities formulating their own open access policies, policies for distributing and managing the RCUK block grants, and communication plans aimed at helping their researchers answer a seemingly simple question: 'what do I have to do?'

In order to comply with RCUK's definition of 'gold', a journal must provide 'via its own website, immediate and unrestricted access to the final published version of the paper, which should be made available using the Creative Commons Attribution (CC BY) licence'. This specific 'unrestricted' open access license is required by both RCUK and the Wellcome Trust, and allows others to modify, build upon and/or distribute the licensed work, including for commercial purposes, as long as the original author is credited. Unless mandated to adopt CC BY, authors might be well advised to consider publishing under an alternative license that makes more provision to safeguard their rights and limits the use of an article by other parties to non-commercial uses (for example, CC BY-NC or CC BY-NC-ND).

Although the wording of the initial RCUK policy favoured 'gold' open access over the fall-back option of 'green', the revised policy and supporting guidance does make clear that 'The choice of route to open access remains with the researchers and their research organizations and, where funding for APCs is unavailable during the transition period, longer embargo periods [i.e., 12 months rather than RCUK's preferred six months] will be allowable.' In other words, an author may still comply with the RCUK policy without paying a fee. The 'Decision Tree' prepared by the Publishers Association represents a useful summary of what this all means in practice (Finch *et al.*, 2012).

At the time of writing, the House of Commons Business, Innovation and Skills Committee Report (published September 2013) has concluded that 'The Government's committed and proactive stance to increasing access to published research findings is admirable, as is its desire to achieve full open access. Gold open access, at scale, is a

desirable ultimate goal', however, 'The major mechanism of transition must be green open access, specifically through strong immediate self-archiving mandates set by funders and institutions, either as a funding condition or tied to research assessment as appropriate', (http://www.publications.parliament.uk/pa/cm201314/cmselect/cmbis/99/9902.htm).

The Higher Education Funding Council of England (HEFCE) has begun its formal consultation process on open access and submissions to the Research Excellence Framework (REF) post-2014, though conclusions are yet to be drawn from submissions to that.

Although seemingly stepping back from glimmering 'gold', BIS' conclusions are perhaps more in line with policies elsewhere around the globe, which tend towards the unfunded 'green' option. The tricky combination of unfunded mandates and short embargo periods, such as RCUK's preferred six months, makes many STEM (science, technology, engineering and mathematics) journals, and societies whose activities rely on revenues received from those journals, nervous: 'green' open access relies on the structure and organization provided by subscription journals, which are unlikely to survive if libraries cancel their subscriptions to those journals because the content is available elsewhere (http://www.publishingresearch.org.uk/documents/ALPSPPApotentialresultsofsixmonthembargofv.pdf).

It awaits to be seen what revision, if any, will be made to the RCUK open access policy following the BIS report and what other mandates may emerge, but the one conclusion that can be drawn with certainty is that there is much more discussion to be had in both the funded and unfunded open access debates.

OA **podcast**

The latest micropod is now online. This edition on '*Open access publishing*' features; *Sf*AM's Phil Wheat, Deborah Kahn from BioMedCentral, and Jennifer McLennan at eLife, discussing what open access means for the scientific community. It is available online at: http://www.sfam.org.uk/en/news-features/micropod.cfm/open-access-publishing.

references

■ From the Publishers Association's paper, 'Finch, Willetts, RCUK, Green OA, and embargoes' (2012).

Vicky Johnson
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journal**Watch**

News about the Society's journals

Highlighted Articles from the *Sf*AM journals

Journal of Applied Microbiology

Antimicrobial activity of phenolic compounds identified in wild mushrooms, SAR analysis and docking studies.
M. J. Alves *et al*.

Although the antimicrobial activity of extracts from several mushroom species has been reported, studies with the individual compounds present in those extracts are scarce. In this report, the antimicrobial activity of different phenolic compounds identified and quantified in mushroom species from all over the world was evaluated. Furthermore, a structure-activity relationship (SAR) analysis and molecular docking studies were performed, in order to provide insight into the mechanism of action of potential antimicrobial drugs for resistant microorganisms. It was identified that phenolic compounds could be used as antimicrobial agents, namely against some microorganisms resistant to commercial antibiotics.
bit.ly/JAM-Alves

Zinc as an agent for the prevention of biofilm formation by pathogenic bacteria.
C. Wu et *al*.

Biofilm formation is important for the persistence of bacteria in hostile environments. Bacteria in a biofilm are usually more resistant to antibiotics and disinfectants than planktonic bacteria. The team at University of Montreal, Canada, previously reported that low concentrations of zinc inhibit biofilm formation of *Actinobacillus pleuropneumoniae*. This study evaluates the effect of zinc on growth and biofilm formation of other bacterial swine pathogens. It found the antibiofilm activity of zinc could provide a tool to fight biofilms, and the non-specific inhibitory effect may well extend to other important human and animal bacterial pathogens.
bit.ly/JAM-Wu

For more information about *Journal of Applied Microbiology*, visit www.sfam.org.uk/JAM

Letters in Applied Microbiology

Antimicrobial efficacy of liposome-encapsulated silver ions and tea tree oil against *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Candida albicans.*
W. L. Low *et al*.

The activity of alternative antimicrobial agents such as tea tree oil (TTO) and silver ions (Ag^+) with multiple target sites impedes the development of antibacterial resistance and might be useful in improving the current treatment strategies for various chronic wound infections. Results show that encapsulating silver (as the ion Ag^+) and tea tree oil (singly and in combination) in a controlled release liposomal carrier system can improve their antimicrobial efficacy as well as reduce the effective concentration required. These findings may impact on the problems of agent toxicity caused by the need for high effective doses, or microbial resistance where long-term application is required.
bit.ly/LAM-Low

Microbial diversity and prevalence of foodborne pathogens in cheap and junk foods consumed by primary schoolchildren.
M. J. Kim *et al*.

Food safety is especially important for children, but only limited information is available about the microbiological quality of cheap and junk foods that are consumed frequently by primary schoolchildren (e.g., dried cakes, candies and chocolates). The present study investigated the microbial quality of cheap and junk foods, and our results indicate that these foods are a potential health risk for children, therefore, deeper concern about the safety of these foods and effective countermeasures should be established to improve their microbiological safety. The present study may contribute to the development of an appropriate child food safety management system.
bit.ly/LAM-Kim

For more information about *Letters in Applied Microbiology*, visit www.sfam.org.uk/LAM

Microbial Biotechnology

Prebiotics, faecal transplants and microbial network units to stimulate biodiversity of the human gut microbiome.
P. Van den Abbeele *et al*.

Current society practices contribute to a decreased microbial diversity of the human gut microbiome, thus disturbing the intimate association between humans and the gut microbes. In this context, the authors review existing (prebiotic) and novel (faecal transplants, key microbial network units) approaches to manage the human gut microbiome.
bit.ly/MBT-Abbeele

The SuperChip for microbial community structure and function from all environments.
T. C. Hazen.

We have the technological capability to produce a SuperChip that would provide detailed analysis of any sample for bacteria, archaea, viruses, fungi, microalgae, protists, etc. It would require putting together a multidisciplinary, multi-institutional, multinational team but its applications and utility would truly be universal for all types of samples.
bit.ly/MBT-Hazen

For more information about *Microbial Biotechnology*, visit www.sfam.org.uk/MBT

Environmental Microbiology

Methane, microbes and models: fundamental understanding of the soil methane cycle for future predictions.
L. Nazaries *et al*.

Methane is an important greenhouse gas and microbes in the environment play major roles in both global methane emissions and terrestrial sinks. However, a full mechanistic understanding of the response of the methane cycle to global change is lacking. Here, the authors synthesize recent knowledge on soil microbial and biogeochemical process, and the impacts of climate change factors on the soil methane cycle. They also identify the research gaps in each of the topics identified above, provide evidence which can be used to demonstrate microbial regulation of the methane cycle and suggest that incorporation of microbial data from emerging -omic technologies could be harnessed to increase the predictive power of simulation models.
bit.ly/EMI-Nazaries

Antimicrobial use in aquaculture re-examined: its relevance to antimicrobial resistance and to animal and human health.
F. C. Cabello *et al*.

Approximately 80% of antimicrobials used in aquaculture enter the environment with their activity intact where they select for bacteria whose resistance arises from mutations or more importantly, from mobile genetic elements containing multiple resistance determinants

transmissible to other bacteria. Such selection alters biodiversity in aquatic environments and the normal flora of fish and shellfish. The commonality of the mobilome between aquatic and terrestrial bacteria, together with the presence of residual antimicrobials, biofilms and high concentrations of bacteriophages, where the aquatic environment may also be contaminated with pathogens of human and animal origin, can stimulate exchange of genetic information between aquatic and terrestrial bacteria. Excessive use of antimicrobials in aquaculture can potentially negatively impact animal and human health as well as the aquatic environment and should be better assessed and regulated.
bit.ly/EMI-Cabello

For more information about *Environmental Microbiology*, visit www.sfam.org.uk/EMI

Environmental Microbiology Reports

Assembly-free metagenomic analysis reveals new metabolic capabilities in surface ocean bacterioplankton. H. Luo and M. A. Moran.

This study uses a recently developed computational method to confidently assign metagenomic reads to microbial clades without the requirement of metagenome assembly, by comparing the evolutionary pattern of nucleotide sequences at non-synonymous sites between metagenomic and orthologous reference genes. The authors found evidence for new, ecologically relevant metabolic pathways in several lineages of surface ocean bacterioplankton using the Global Ocean Survey (GOS) metagenomic data, including assimilatory sulfate reduction and alkaline phosphatase capabilities in the alphaproteobacterial SAR11 clade, and proteorhodopsin-like genes in the cyanobacterial genus *Prochlorococcus*. These findings raise new hypotheses about microbial roles in energy flux and organic matter transformation in the ocean.
bit.ly/EMR-Luo

Bacterial communities associated with *Microcystis* colonies differ from free-living communities living in the same ecosystem. B. Parveen *et al*.

The search for a better understanding of why cyanobacteria often dominate phytoplankton communities in eutrophic freshwater ecosystems has led to a growing interest in the interactions between cyanobacteria and bacteria. Against this background, we studied the location of bacteria within *Microcystis* colonies, and compared the structural and phylogenetic diversity of *Microcystis*-attached and free-living bacterial communities living in the same French lake, the Villerest reservoir. Our findings suggest that *Microcystis* colonies constitute a distinct habitat for bacteria living in freshwater ecosystems, and that direct and indirect interactions (cell lysis, nutrient recycling, etc.) may occur between them inside these colonies. **bit.ly/EMR-Parveen**

For more information about *Environmental Microbiology Reports*, visit www.sfam.org.uk/EMIR

Melissa McCulloch
Wiley-Blackwell

About S*f*AM journals

Journal of Applied Microbiology

Journal of Applied Microbiology publishes research and review papers on all aspects of applied microbiology; including environmental, food, agricultural, medical, pharmaceutical, veterinary, taxonomy, soil, systematics, water and biodeterioration.

Letters in Applied Microbiology

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Environmental Microbiology

Environmental Microbiology provides a high profile vehicle for publication of the most innovative, original and rigorous research in the field. The scope of the Journal encompasses the diversity of current research on microbial processes in the environment, microbial communities and microbial interactions.

Environmental Microbiology Reports

Environmental Microbiology Reports (EMIR) shares the same scope as *Environmental Microbiology* (EMI). This journal is available online only and holds compact research papers as an alternative to the full research papers published by EMI.

In the 35th of a series of articles about statistics for biologists, **Anthony Hilton** & **Richard Armstrong** discuss:

Are the data log normal?

StatNote 35

Introduction

In many of the StatNotes described in this series, the statistical tests assume the data are a random sample from a normal distribution (StatNote 1, Hilton & Armstrong, 2005a). These StatNotes include most of the familiar statistical tests such as the 't' test (StatNote 3, Hilton & Armstrong, 2005b), analysis of variance (ANOVA) (StatNote 30, Hilton & Armstrong, 2012) and Pearson's correlation coefficient ('r') (StatNote 14, Hilton & Armstrong, 2008). Nevertheless, many variables exhibit a more or less 'skewed' distribution. A skewed distribution is asymmetrical and the mean is displaced either to the left (positive skew) or to the right (negative skew). If the mean of the distribution is low, the degree of variation large and when values can only be positive (Limpert et *al.*, 2001), a positively skewed distribution is usually the result. Many distributions have potentially a low mean and high variance including that of the abundance of bacterial species on plants (Hirano *et al.*, 1982), the latent period of an infectious disease and the sensitivity of certain fungi to fungicides (Romero & Sutton, 1997). These positively skewed distributions are often fitted successfully by a variant of the normal distribution called the log-normal distribution (Hattis & Burmaster, 1994; Limpert *et al.*, 2001).

Both the normal and log-normal distributions result from many factors acting independently but without any single factor having a dominant influence. If the effects of the different factors are 'additive', i.e., one would have to add together their individual effects to achieve the final 'result', then the data would be fitted by a normal distribution. If, however, effects are 'multiplicative' and therefore, have to be multiplied together to achieve the final result, then the resulting distribution will also be log normal. Exponential growth of a quantity in which variation is symmetrical, will also result in a log-normal distribution. For example, if the mean number of bacteria present in a culture is 1×10^6 and variation is symmetrical, 1 cell division more or less will yield 2×10^6 or 5×10^5 bacterial cells. The resulting range of values achieved by sampling will be asymmetrical, i.e., multiplied or divided by 2 around the mean and the distribution will be skewed (Limpert *et al.*, 2001). In addition, the size and age structure of many plant populations (Limpert *et al.*, 2001) and the growth of fungal colonies on artificial media (Righelato, 1975) frequently follow a log-normal distribution since exponential growth is likely to be involved. Similarly, the growth of symbiotic lichens may be exponential at least in the early stages and result in a size frequency distribution of thalli that may be fitted by a log-normal model (Armstrong, 2013). This StatNote describes fitting the log-normal distribution with reference to two scenarios: (1) the frequency distribution of bacterial numbers isolated from cloths in a domestic environment and (2), the sizes of lichenized 'areolae' growing on the hypothallus of *Rhizocarpon geographicum* (L.) DC.

Scenario 1: Bacteria isolated from cloths

A study was carried out to determine the degree of bacterial contamination on dishcloths collected from domestic kitchens (Hilton & Armstrong, 2005a). A total of 51 'in-use' dishcloths were collected from the kitchens and the aerobic colony count from each material determined in the laboratory. As bacteria grow exponentially on the cloths, symmetrical variation between cloths could result in a log-normal distribution. The distribution of the data is shown in Figure 1. In StatNote 1, this distribution was tested for normality and it was concluded that data exhibited a marked deviation from a normal distribution.

Scenario 2: Size of areolae in the lichen *R. geographicum*

The crustose lichen *R. geographicum* comprises yellow-green lichenized areolae which develop and grow in association with a non-lichenized fungal hypothallus (Armstrong, 2013). The areolae contain cells of the unicellular green alga *Trebouxia* and although they frequently maintain their individuality, they largely cover the surface of the fungal hypothallus. The areolae are highly variable in shape and morphological differences between them may be attributable to their location on the thallus (Runemark, 1956). Hence, areolae that develop on the marginal hypothallus as it advances ('primary' or 'pioneer' areolae) are generally punctate or verrucose (warty), while those in the centre of the thallus ('mature' or 'secondary' areolae) have a more complex morphology and are often angular or lobed. Areolae appear to grow exponentially on the surface of the fungal hypothallus and to be highly variable in size (Armstrong, 2013), which suggests a log-normal distribution may fit their size distribution.

Twenty-three thalli of *R. geographicum*, 0.5–2.4cm in diameter, growing on a south-facing slate cliff at a maritime site were studied. Each thallus was photographed in its

entirety using a Canon IXUS-70 digital camera incorporating a 12x zoom lens. A scale measure was placed next to each thallus. The size of areolae was estimated using a PC and 'Image-J' software developed by the National Institute of Health (NIH), Bethesda, USA and available as a free download (Syed *et al.*, 2000; Armstrong, 2013). A transect line was drawn across the maximum diameter of each thallus. The maximum diameter of each areola that touched the transect line was then determined. The frequency distribution of areolae sizes from all thalli measured is shown in Figure 2.

How is the analysis carried out?

A log-normal distribution was fitted to the numbers of bacteria and size distribution of lichen areolae using STATISTICA software (Statsoft Inc., 2300 East 14th St, Tulsa, Ok, 74104, USA) (Pollard, 1979). A log-normal distribution is defined as that of a variable X such that ln(X - Ø) is normally distributed. The distribution has three parameters: Ø (where X > Ø), the mean (μ), and the variance ($\sigma 2$). In many applications, the value of Ø can be assumed to be zero and a two-parameter model fitted to the data. Goodness-of-fit to a log-normal model was tested using the Kolmogorov–Smirnov (KS) 1-sample test (StatNote 34, Hilton & Armstrong, 2013).

Interpretation: bacterial numbers

The number of bacteria isolated from the cloths was in the range 20–220,000,000 (median = 33,000,000). The frequency distribution of bacterial numbers is shown in Figure 1 and exhibits a degree of positive skew, i.e., the median of the distribution is to the left and the tail to the right of the distribution. Although the log-normal distribution clearly provides a better fit to the data than the normal distribution, there are also significant deviations from a log-normal distribution (KS = 0.20, P < 0.05). Hence, there were fewer cloths with lower numbers of bacteria (<20,000,000) and more than expected with larger numbers of bacteria (>20,000,000), compared with the predictions of a log-normal model. Hence, exponential growth of the bacteria together with symmetrical variation between cloths does not completely describe bacterial growth on domestic cloths and other factors are likely to be involved. The sample size was quite small (N = 51), however, and a much larger sample of cloths may be required to determine whether the log-normal distribution actually describes this variable.

Interpretation: lichen areolae

The size-class distribution of the mature areolae of the lichen *R. geographicum* is shown in Figure 2 and is also positively skewed. The modal class is at an upper size limit of 0.6mm and the maximum diameter of areolae is 2.8mm. By contrast with the cloths, a log-normal distribution significantly fitted this distribution (deviation from model: KS = 0.05, P > 0.05). This result has several implications regarding the growth of areolae of *R. geographicum*: (1) that growth may be influenced by many factors acting independently and with multiplicative effects and (2) that growth is likely to be exponential with a symmetrical pattern of variation between different areolae.

Conclusion

The data may not follow a normal distribution but a closely related distribution called the log-normal distribution. Both the normal and log-normal distributions are similar in that they result from a variety of factors acting independently. If the effects of the different factors are additive, the result is a normal distribution and if effects are multiplicative, a log-normal distribution will be the result. Hence, bacterial and fungal growth (Righelato, 1975) may follow a log-normal distribution and microbiologists should be alert to this possibility if: (1) the data do not appear to follow a normal distribution but exhibit a degree of positive skew, (2) the mean of the distribution is low, the degree of variation large, and when values can only be positive, or (3) if there is the possibility of exponential growth together with symmetrical variation.

Figure 1. *Histogram illustrating the observed distribution of values for the cloth data and the predicted log-normal (continuous line) and normal (dotted line) distributions. The Kolmogorov–Smirnov (KS) tests the difference between the observed and expected frequencies (KS = 0.20, P < 0.05). Because of the large absolute counts, the limits of each class are in scientific units, e.g., E7 represents 1 x 10^7*

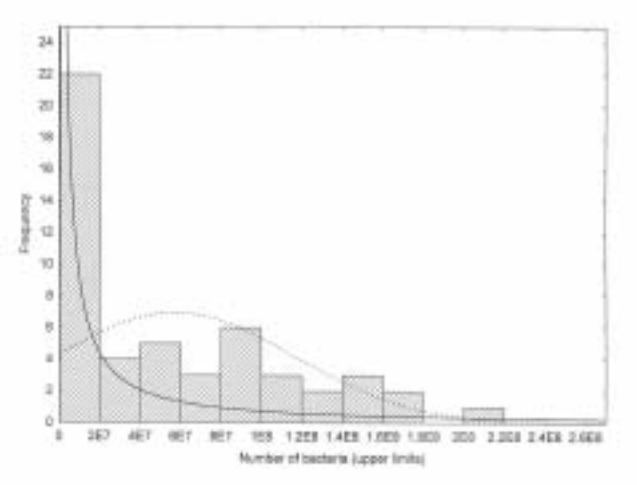
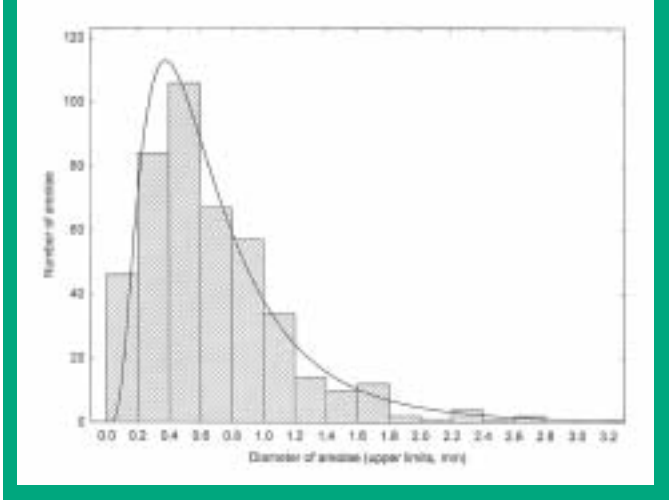


Figure 2. *Size-class frequency distribution of areolae within the central region of 23 thalli of the crustose lichen Rhizocarpon geographicum (L.) DC. Deviation from log-normal model (KS = 0.05, P > 0.05)*



references

- Armstrong, R. A. (2013). Development of areolae and growth of the peripheral prothallus in the crustose lichen *Rhizocarpon geographicum*: an image analysis study. *Symbiosis*, **60**, pp7–15.
- Hattis, D. B., and Burmaster, D. E. (1994). Assessment of variability and uncertainty distributions for practical risk assessments. *Risk Analysis*, **14**, pp713–730.
- Hilton A., and Armstrong, R. A. (2005a). StatNote 1: Are the data normal? *Microbiologist*, **Vol. 6**, No.2, pp34–35.
- Hilton, A., and Armstrong, R. A. (2005b). StatNote 3: Testing the difference between two groups. *Microbiologist*, **Vol. 6**, No.4, pp30–32.
- Hilton, A., and Armstrong, R. A. (2008). StatNote 14: The correlation of two variables (Pearson's 'r') *Microbiologist*, **Vol. 9**, No.3, pp34–36.
- Hilton, A., and Armstrong, R. A. (2012). StatNote 30: The one-way analysis of variance (ANOVA): Fixed effects model. *Microbiologist*, **Vol. 13**, No.3, pp32–35.
- Hilton, A., and Armstrong, R. A. (2013). StatNote 34: The Kolmogorov-Smirnov test. *Microbiologist*, **Vol. 14**, No.3, pp28–30.
- Hirano, S. S., Nordheim, E. V., Arny, D. C., and Upper, C. D. (1982). Log-normal distribution of epiphytic bacterial populations on leaf surface. *Applied and Environmental Microbiology*, **44**, pp695–700.
- Limpert, E., Stahel, W.A., and Abbt, M. (2001). Log-normal distributions across the sciences: keys and clues. *BioScience*, **51**, pp341–352.
- Pollard, J. H. (1979). *Numerical and Statistical Techniques*. Cambridge: Cambridge University Press, p97.
- Righelato, R. C. (1975). Growth of mycelial fungi. In: Smith, J.E., and Berry, D. R. (Ed.) The filamentous fungi Vol 1. *Industrial Mycology*, Arnold, London.
- Romero, R. A., and Sutton, T. B. (1997). Sensitivity of *Mycosphaerella fijensis,* causal agent of black sigatoka of banana, to propiconozole. *Phytopathology*, **87**, pp96–100.
- Runemark, H. (1956). Studies in *Rhizocarpon*. I. Taxonomy of the yellow species in Europe. *Opera Botanica*, **2**, pp1–152.
- Syed, A., Armstrong, R. A., and Smith, C. U. M. (2000). Quantification of axonal loss in Alzheimer's disease: an image analysis study. *Alzheimer's Reports*, **3**, pp19–24.

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book review

Microbial Biofilms: Current Research and Applications

Editor: Gavin Lear and Gillian D. Lewis
Publisher: Caister Academic Press
ISBN: 978-1-904455-96-7
Reviewed by Alison Graham, Newcastle University

In this book, Gavin Lear and Gillian Lewis have brought together contributions from leading researchers on a wide range of topics related to biofilm biology. Inside there are 11 chapters that cover everything from the impact of biofilms in the environment to their roles in disease and energy generation.

The book starts with an interesting chapter on the role of quorum sensing and moves on to discuss biofilms in two aspects of disease – host tissue infection and implant-related infection. This is followed by a series of chapters that collectively cover the impact of biofilms in the environment. Firstly, the significance of plant-associated biofilms, then the role of biofilms in the soil, followed by applications in bioremediation and wastewater treatment systems, and corrosion and fouling. Chapter eight covers the importance of biofilm communities to freshwater rivers and streams, and how measures of the community structure can provide indications of water quality and ecological health. This is followed by a review of extracellular enzymes in aquatic biofilms.

The search for energy sources other than fossil fuels is becoming ever more important. One potential method is to exploit microbial metabolic activity for biological energy generation. The penultimate chapter reviews the biological processes associated with microbial fuel cells and the electron transfer mechanisms of several model bacteria. The final chapter then provides a thorough review of the use of biofilms in biocatalysis, discussing the developments in biofilm reactor technology and challenges in using biofilms for biological catalysis.

The text throughout is full of up-to-date references to the original research, and to other work, but with sufficient background to set the discussion in context. Without exception, the text flows well and is easy to read. This makes it an ideal starting point for undergraduate or postgraduate students entering the biofilm field. The figures and tables in the book are useful and full of information; however, all are black and white. It would have been nice for more images and illustrations to have been included and for at least some of these to have been in colour.

This book is useful for anyone interested in biofilms and particularly microbiologists working in the environmental and remediation fields. Given the cost, it is more suited to institution or research group purchase. Overall, this book makes a valuable contribution to the growing literature on biofilms and should have a place in all university libraries.

Wednesday 15 January 2014

Winter Meeting

- **Food contamination: the food handler's role**
- **Biodefence**

Including the Denver Russell Memorial Lecture

The Royal Society, London, UK

Programme*

*Please note that this is a provisional programme and likely to change. For the latest information please visit www.sfam.org.uk/en/events/index.cfm/Winter_meeting

10.00 – 10.30 **Tea, coffee and registration**

Chair: **To be confirmed**

10.30 – 11.15 **The Denver Russell Memorial Lecture: Food safety — current and future challenges**
Colin Dennis

11.15 – 11.50 **Nasty germs: in the bed or reds under the bed?**
Tim Brooks, Public Health England, UK

11.50 – 12.25 **General introduction to food contamination**
Chris Griffith, retired

12.25 – 13.30 **Lunch**

Session A Food contamination: the food handler's role

Chair: **To be confirmed**

13.30 – 14.05 **The food manufacturer**
Peter McClure, Unilever, UK

14.05 – 14.40 **The caterer**
Tayo Irawo, independent consultant

14.40 – 15.00 **Tea and coffee**

15.00 – 15.35 **The retailer**
Peter Mather, Sainsbury's Supermarkets Ltd, UK

15.35 – 16.10 **The consumer**
Ellen Evans, Cardiff Metropolitan University, UK

Session B Biodefence

Chair: **To be confirmed**

13.30 – 14.05 **Biodefence over the ages and predictions for the future**
Petra Oyston, DSTL, UK

14.05 – 14.40 **If the anthrax does not get you the worms will! All you need to know about *Bacillus anthracis* from nasty things in the mail to tea, sharks and green fluorescent nemotodes**
Les Baillie, University of Cardiff, UK

14.40 – 15.00 **Tea and coffee**

15.00 – 15.35 **Glanders and melioidosis — past lessons and future perspectives**
Andrew Simpson, DSTL, UK

15.35 – 16.10 **Synthetic biology and biosecurity**
Brett Edwards, University of Bath, UK

To register online for this meeting please visit www.sfam.org.uk/winter
or contact Sally Hawkes ■ Email: sally@sfam.org.uk ■ Telephone +44 (0)1933 382191

Activated Sludge

Control of waterborne disease: a century of the activated sludge sewage treatment process

See the full programme overpage

On 1–2 April 2014, S*f*AM will hold a meeting in Manchester to celebrate the centenary of the activated sludge process. This will be an opportunity for microbiologists and sanitary engineers to update their knowledge of the microbiology of this important process. Papers include the use of cutting-edge molecular biology and bioinformatics tools to investigate the microbial consortia involved, as well as investigations of how the process can be used to remove priority pollutants and organic matter, suspended solids and pathogens. The meeting will also look to the future, with presentations on granular sludge systems and full-flow anaerobic treatment options. *The following article discusses the development of the process, which is still in use today.*

Have you ever wondered what it was like to live through the industrial revolution? All those *dark satanic mills* belching black smoke? Well, never mind the air, what about the water? If you lived in the UK between 1850 and 1900, you had a 20–25% risk of dying from a waterborne disease, with the risk being highest in the overcrowded cities.

It is a sobering thought that in 1842, 17 years was the average age of death in a Manchester labourer's family. In most cities, the middle classes lived on higher ground, partly to avoid problems caused by occasional flooding. However, the urban poor were not so lucky, with their lower-lying streets and basement dwellings becoming flooded with what was effectively dilute sewage. Furthermore, most people obtained their drinking water from local wells, which inevitably had become infected through groundwater contamination — if not from floods, then from 'night soil' (faeces) deposited onto the bare earth. The likelihood of contracting typhoid or some other diarrhoeal disease is only too imaginable for a microbiologist. Even royalty fell victim, with Prince Albert dying of typhoid in 1861.

The unsanitary conditions in the UK led to various investigations of the situation, e.g., Edwin Chadwick published his *Sanitary Report* in 1842, followed in 1845 by a Royal Commission report on the *Health of Towns and Populous Places*. These reports were published before Pasteur's germ theory of disease had been widely accepted, so the 'miasma' (bad air) theory of disease transmission was dominant. Thus, following the London 'Great Stink' of 1858, there were various attempts to prevent odours, e.g., by sewage collection. For example, Joseph Bazalgette oversaw the construction of

sewers across London to contain the stench, so that by 1866 most of the city was connected. However, initially, the sewage was not treated but transported down the River Thames to be discharged on the outgoing tide. It is interesting to speculate whether political pressure would have been applied with such force if the Houses of Parliament had not been built on the banks of the Thames, which was so badly polluted in 1858 that curtains soaked in lime had to be hung at the windows to keep out the 'Great Stink'!

In 1898, the Royal Commission on Sewage Disposal was established to determine what could be done about sewage pollution. The final report of this Commission, published in 1912, set standards for wastewater treatment, some of which are still in use. For example, the '20:30 Royal Commission Standard', whereby a treated effluent must not contain more than 20mg/l of easily degraded organic matter (measured using the BOD5 test) and not more than 30mg/l of suspended solids (in both cases, so long as the receiving water dilutes the effluent by at least 8-fold). This standard was soon adopted by many other countries and is still in current use.

By 1894, the Manchester City Council Rivers Department had established one of the first wastewater treatment facilities in the modern world, on the banks of the newly constructed Manchester Ship Canal at Davyhulme, on land made available by cutting off loops of the River Irwell. The treatment process at this works was initially based on the 'sewage farm' principle, where raw sewage was trickled over the land, which acted as a physical filter and source of microorganisms to degrade the waste. However, rather than the traditional grassland, Davyhulme developed a more efficient system of clinker beds (*bacteria beds*) with a herring-bone pattern of distribution channels. (Incidentally, experiments to measure the activity of slime growing on the clinker surface and reported in a 1902 publication possibly constitute the first investigation of what we now call 'biofilm'.) The use of bacteria beds reduced the area required but the works still occupied a considerable area of valuable land. Fortunately, *necessity being the mother of invention*, just across the River Irwell in Salford, the trickling filter had been developed by 1893, resulting in a 10-fold reduction in the land area requirement.

Nevertheless, the growing population of Manchester and the connection of additional and new houses to the sewer system meant that the Davyhulme site, though large, would still be too small to even rely on the new trickling filter technology. Therefore, the scientists of the Rivers Department undertook research at Davyhulme on alternative processes. The team consisted of Gilbert Fowler, a consulting chemist who had been responsible for directing research since 1904, Edward Ardern, a resident chemist since 1899 and William Lockett, a junior chemist. Lockett was also undertaking an MSc at Manchester University, under the supervision of Chaim Weizmann (a chemist and, incidentally, the Zionist leader who became the first President of Israel) and Fowler, who also held a university position. Weizmann's lab was renowned as a centre of excellence for the development of industrial microbiology (including the production of acetone and butanol using *Clostridium butylicum*), so Manchester was a natural choice for development of the microorganism-based activated sludge process. There was also the significant influences of Manchester being a major industrial city with a history of overcrowding and poor sanitation, and wealthy from cotton.

During a visit to the USA in 1912, Fowler witnessed the development of a novel system for sewage treatment, where algae and other microorganisms were grown as a biofilm on inclined slate panels in a tank of aerated sewage. This system was able to clarify the sewage and partially nitrify it over a 24 hour period. On his return from the USA, Fowler instructed Ardern and Lockett to conduct batch-culture experiments by aerating sewage in large bottles. Initially, it took five weeks for full treatment but, by stopping aeration so that the biomass settled before decanting the treated wastewater, a sludge of active microorganisms was produced (Ardern & Lockett, 1914). Each subsequent batch increased the sludge volume so that the process became quicker as the biomass concentration increased; an early example of process intensification through biomass retention! On 3 April 1914, this work was communicated at the spring meeting of the Society of Chemical Industry, in the Grand Hotel (now luxury flats) on Aytoun Street in Manchester.

This process is now known as the *Activated Sludge* process, because it relies on collecting and reusing settled sludge that had seemingly become 'activated' via aeration. Although microbiology was a fairly new science at the time, it was soon established that the activity of this sludge relied on microorganisms, mostly flocculent bacteria and associated protozoa. Although initially developed as a batch process, the practicalities of operating such a system with constantly flowing sewage meant that a continuous process was eventually required. They also conducted experiments at Davyhulme on the best method of aeration, comparing surface paddles with surface inverted cone impellers (the 'Simplex' system) and the use of compressed air from submerged pipes. Owing to practical difficulties at the time when using surface paddles or submerged aeration, the Simplex system was adopted at Manchester's Davyhulme works. Nowadays, submerged aeration tends to be used as it offers more efficient oxygen transfer. Incredibly, even 100 years after its introduction, the activated sludge process is still in use at larger sewage treatment works across the globe.

Sewage treatment, principally through the metabolic activities of bacteria and protozoa to remove organic pollutants and pathogenic microorganisms, together with the supply of pure drinking water, has saved countless lives. In fact, it has been estimated that by breaking the cycle of waterborne disease, more lives have been saved than by all medical interventions put together. Not bad for organisms that, until Pasteur's work, were not thought to exist and a city with a false reputation for excessive rain.

references

- Ardern, E., and Lockett, W. T. (1914). Experiments on the oxidation of sewage without the aid of filters. *J. Soc. Chem. Ind.*, **33** (**10**), pp523–539.
- Chadwick, E. (1843). *Report on the sanitary condition of the labouring population of Great Britain*. HMSO, London.

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The SfAM Activated Sludge Meeting

Control of waterborne disease: a century of the activated sludge sewage treatment process

Tuesday 1 – Wednesday 2 April 2014 ■ Lancashire County Cricket Club, Manchester, UK

Programme*

*Please note that this is a provisional programme and likely to change. For the latest information please visit www.sfam.org.uk/en/events/meetings-diary.cfm/activatedsludge

Tuesday 1 April 2014

13.00 – 14.00 Tea, coffee and registration

Chair: To be confirmed

Session 1: History and microbiology

Chair: To be confirmed

14.00 – 14.30 **Introduction: Development, success and future of the activated sludge process**
Mike Dempsey, Manchester, UK

14.30 – 15.00 **Faecal indicators of sewage pollution**
Dave Kay, Aberystwyth, UK

15.00 – 15.30 **Microbial diversity in activated sludge (16S rRNA & FISH)**
Tom Curtis, Newcastle, UK

15.30 – 16.00 Tea and coffee

16.00 – 16.30 **Metaproteomics for a functional insight to activated sludge**
Paul Wilmes, University of Luxembourg

16.30 – 17.00 **Filamentous microorganisms in activated sludge**
Mark van Loosdrecht, TU Delft, The Netherlands

Wednesday 2 April 2014

08.30 – 09.00 Tea, coffee and registration

Session 2: Pharmaceuticals, PCPs, heavy metals (keeping potable water potable)

Chair: To be confirmed

09.00 – 09.40 **Effects of pharmaceutical compounds on selection for antibiotic resistance in aquatic microbes**
William Gaze, Exeter, UK

09.40 – 10.20 **Cytotoxic drugs, endocrine disruptors, and illegal drugs: where do they go? (Sex and drugs and rock 'n roll: where will it end up?)**
Mark Scrimshaw, Brunel University, London, UK

10.20 – 10.50 Tea and coffee

10.50 – 11.30 **Pharmaceuticals, chiral drugs, illicit drugs and sewage epidemiology**
Barbara Kasprzyk-Hordern, University of Bath, UK

11.30 – 12.10 **Removal of hazardous chemicals during activated sludge treatment**
Elise Cartmell, Cranfield University, UK

12.10 – 13.10 Lunch

Session 3: Nitrification

Chair: To be confirmed

13.10 – 13.50 **Ammonia and nitrite oxidizing bacteria in activated sludge: guild ecology & chaotic instability**
To be confirmed

13.50 – 14.30 **Nitrous oxide as early warning of nitrification failure in activated sludge**
Tom Stevenson, Cranfield University, UK

14.30 – 15.00 Tea and coffee

Session 4: Phosphate recovery

Chair: To be confirmed

15.00 – 15.40 **Omics approaches to enhanced biological phosphate removal**
To be confirmed

Session 5: Gene transfer

Chair: To be confirmed

15.40 – 16.20 **Horizontal gene transfer in activated sludge via phage**
Michael Larkin, Queen's University, Belfast, UK

Session 6: Epilogue

Chair: To be confirmed

16.20 – 17.00 **Back to the future: upstream anaerobic digestion**
Ana Soares, Cranfield University, UK

17.00 Meeting ends

To register online for this meeting please visit www.sfam.org.uk/sludge
or contact Sally Hawkes ■ Email: sally@sfam.org.uk ■ Telephone +44 (0)1933 382191

Wednesday 30 April 2014

Spring Meeting

8th broadening microbiology horizons in biomedical science meeting

● Control of infection: current status and future prospects

The Sheffield Hilton Hotel, Sheffield, UK

IBMS CPD ACCREDITATION 6 POINTS

Programme*

*Please note that this is a provisional programme and likely to change. For the latest information please visit www.sfam.org.uk/en/events/index.cfm/springmeeting

09.25 – 10.25	**Tea, coffee, trade exhibition and registration**
10.25 – 10.30	**Chairman's welcome**
Chair:	**To be confirmed**
10.30 – 11.00	**Antibiotic resistance and its implications for infection control** Helena Parsons, Sheffield Teaching Hospitals, Sheffield, UK
11.00 – 11.30	**Viruses and their infection control implications** Michael Ankcorn, Sheffield Teaching Hospitals, Sheffield, UK
11.30 – 12.00	**Challenges for the antimicrobial application of bacteriophage technologies** Michael Mattey, Fixed Phage, Glasgow, UK
12.00 – 12.30	**Patient experience of surgical site infection** Judith Tanner, De Montfort University, Leicester, UK
12.30 – 14.00	**Lunch and trade exhibition**
Chair:	**To be confirmed**
14.00 – 14.30	**How clean is my hospital?** Stephanie Dancer, NHS Lanarkshire, UK
14.30 – 15.00	**Natural chemical diversity to combat infectious diseases** Marcel Jaspars, University of Aberdeen, UK
15.00 – 15.30	**Natural antimicrobials, the future of infection control?** Valerie Edwards-Jones, Manchester Metropolitan University, UK
15.30 – 16.00	**Infection control** Martin Kiernan, Southport and Ormskirk Hospital NHS Trust, UK
16.00	**Close, tea and coffee**

To register online for this meeting please visit www.sfam.org.uk/spring
or contact Sally Hawkes ■ Email: sally@sfam.org.uk ■ Telephone +44 (0)1933 382191

Summer Conference 2013 report

Hilton Cardiff Hotel, Cardiff, UK, Monday 1 July – Thursday 4 July 2013

Lactic acid bacteria and bifidobacterium
Actinobacteria

Including the *Journal of Applied Microbiology* (JAM) Inaugural Annual Lecture

This year's Summer Conference was held at the Hilton Hotel Cardiff, 1–4 July. The conference began with a preconference workshop on Public Engagement followed by the Inaugural *Journal of Applied Microbiology* Lecture which was held at the National Museum Cardiff and was presented by Professor Peter Setlow. The conference continued over the next three days and covered the topics; '*Lactic acid bacteria and bifidobacteria*', and '*Actinobacteria*'.

The first speaker of the '***Lactic acid bacteria and bifidobacteria***' session was Todd Klaenhammer who gave an insight into the genomics of bacteria in starter cultures and who started off by telling the audience that "*you must have a sequence to do biology*"! In showing why genomic sequences are important, Todd described some of his work that has helped us to better understand the dynamics of competition and evolution in starter cultures including mechanisms to help *Lactococcus lactis* resist attack from virulent phage and the adaptive evolution of *Streptococus thermophilus* to the dairy environment. Todd also described findings that may help to increase probiotic functionality such as the use of lipoteichoic acid-deficient strains which have been shown to increase IL-10 production in dendritic cells, reducing inflammation in a colitis model. Todd finished by describing the use of lactic acid bacteria as oral delivery vehicles for the targeted expression of anthrax protective antigen.

Oscar Kuipers continued the session with his talk on '***Synthetic approaches in engineering antimicrobial peptides in lactococci***.' Oscar's group are currently trying to fill the 20 year discovery void in the antibiotic pipeline by using genetic approaches to modify bioactive peptides to produce stable, novel antibiotics. Oscar outlined the four main approaches: 1) genome mining using BAGEL3; 2) using modularity to shuffle sequences; 3) hypermodification and 4) introduction of extracircular and heterocyclic modifications. After a refreshment break, Sylvain Moineau continued with '***New insights in viral protection in lactic acid bacteria***.' Sylvain described current understanding of the CRISPR system which has been described as a form of immunological memory in bacteria to prevent reinfection with bacteriophage. Infected bacteria acquire a sequence of spacer DNA from the infecting phage, resulting in a BIM (bacteriophage insensitive mutant) phenotype. The spacer sequence provides a 'memory' of the phage infection and protects against subsequent reinfection. Sylvain also described that the same phenomenon has been observed with the acquisition of plasmid spacers to give a PIM (plasmid interfering phenotype). The final speaker of the session was Willem de Vos who gave an overview of '***Pangenomics of paradigm probiotics'*** which focused on *Lactococcus rhamnosus*. *L. rhamnosus* GG (LGG) is commonly found in the GI tract and is used extensively as a probiotic. LGG is unusual in that it is a non-pathogen which produces mucus-binding pili to enable it to maintain close association with host cells. Recent genomic and functional characterization which examined functions related to carbohydrate transport and metabolism, production of mucus-binding pili, bile salt resistance, prophages and CRISPR adaptive immunity has revealed diversity amongst strains of *L. rhamnosus* and has provided insights into the adaptation of this organism to different, and in some cases, multiple niches.

Clare Taylor

The '***Lactic acid bacteria and bifidobacteria***' session continued after lunch with four speakers covering a broad range of topics. Luc de Vuyst, Brussels University, kicked off the afternoon session with a fascinating talk on '***Growth and physiology of bifidobacteria***'. Luc discussed these fascinating bacteria, which make up a minor fraction of the human microbiota and yet play a vital role in carbohydrate degradation. Using a typical pathway these bacteria break down monosaccharides such as glucose and fructose to produce lactic acid and acetic acid in a 3:2 ratio, although this ratio is dependent upon substrate consumption. Luc went on to explain that some strains of these bacteria are also able to break down inulin type fructans. The acetic acid produced by these bacteria then cross feeds other colon bacteria. Luc's talk gave a real insight into some of the properties of these bacteria.

Douwe van Sinderen, University College Cork, was the next speaker of the afternoon. Douwe's talk '***Functional genomics of bifidobacteria for health***' began by discussing some bifidobacteria in terms of their health promoting and probiotic properties. Douwe explained that whilst we know that various bifidobacterial strains and species demonstrate probiotic activity, the mode of action for this activity is largely a matter of speculation. Douwe went on to discuss recent genomic exploration of bifidobacteria and the impact this has had on our understanding of these organisms. From the development of genetic tools allowing access and modification of the bifidobacterial genome to giving us a better understanding of the particular adaptations to their environment, Douwe demonstrated how important this area is.

After a break for tea the '***Lactic acid bacteria and bifidobacteria***'session concluded with two talks firstly Jan Knol, Wageningen University, discussed '***Intestinal microbiology in early life***' then Glenn Gibson, University of Reading, finished the session with a talk on '***Targeting***

bifidobacteria with prebiotics'. Jan explained that newborns are essentially sterile, but that within the first few days early microbial colonizers help to develop a baby's gut microbiota. These early colonizers can play a vital role in the development of this symbiotic relationship between humans and their gut microbiota and may even impact on the long term composition and activity of the microbiota. For this reason, Jan said, it is important to understand more about the dynamics that lead to this early development of the gut flora. Jan went on to discuss the importance of using this knowledge to help develop milk substitute products for optimal gut microflora development.

Glenn Gibson finished the session off with a very entertaining talk on prebiotics. Glenn discussed some of the fascinating research he was involved in, looking at the effects of prebiotics on different groups of people including athletes and the elderly. Glenn went on to talk about some recent research looking at using prebiotic supplements to promote health in the overweight and in those with metabolic syndrome.

Clare Doggett

Following on from an attended poster session student, delegates had the opportunity to attend this year's student session entitled "***Career options — what's next***?" Many students, whether fresh out of an undergraduate degree or a PhD, with experience or not, are unsure of their next steps. This session offered a live student audience the opportunity to question an experienced and varied panel about careers in microbiology. As well as providing advice about common career paths for young microbiologists – research and teaching, the panel also highlighted that a career in microbiology can be in other diverse areas, such as public engagement and sales. Ali Ryan of the S*f*AM PECS Committee chaired the session, and introduced the panellists: Colin Hinds-Payne, Careers Advisor at Cardiff Metropolitan University; Clare Doggett, Communications Officer for S*f*AM; Louise Fielding, Director of Research at the Cardiff School of Health Sciences, Cardiff Metropolitan University; Phil Wheat, CEO of S*f*AM and Claire Hill, Project Manager at Medical Wire.

The first question asked was "*What type of CV should I have?*" The panellists gave plenty of advice! A CV needs to be balanced, whilst being tailored specifically to each job application. It is a document to sell yourself, so write to the reader. What are they looking for? How are you different? Why should they pick you? Look at the job specification, determine the skills required and adapt your CV appropriately. An important point raised was that a CV should be truthful — make sure you can do what it says you can. In order to enhance your CV, a number of suggestions were made. Take all of the opportunities you can and more importantly make opportunities as this shows initiative. Get involved with societies, go to conferences and engage with groups like the PECS Committee.

The second audience question came from a biomedical science undergraduate, "*Can I complete my professional portfolio through voluntary work?*" Again the panellists answers were diverse. There isn't a problem with the work being voluntary, but for any placement like this you will need to have financial support from elsewhere. An audience member contributed with their experience "*voluntary is financially stressful, but sometimes necessary to make you stand out and to get your qualification*". To get work, try contacting your local lab(s) and send them a speculative CV. Voluntary work shows motivation, enthusiasm and reliability. It can lead to paid employment in the future, so treat it as a paid job. Relating back to question one, capitalize on new opportunities such as public engagement with S*f*AM — this can open doors to possible job opportunities. Colin Hinds-Payne posed a question to the audience: "*What is employability?*" Colin explained it is about knowing your skills, recognizing when to use them and then applying them to the situation.

Question three: "*I am ending my degree soon, and I don't see myself in academia, so I am considering other careers like public health surveillance or policymaking. Have you got any advice*?" Here it is important to become and stay informed, so watch the news, and attend events like Voice of the Future and workshops run by organizations like Sense About Science. Learn as much as you can about parliament and policies. It would be advantageous to check the Society of Biology's job section, as they are the umbrella society of about 80 life sciences societies, and will advertise jobs for all of them. Finally, try looking at the civil servants website for jobs.

The fourth question asked was "*My PhD funding ran out last September, and I have been unable to find work since, I've tried everything I can think of. Interviewers say I am too skilled, and they can't afford a PhD. I have tried making opportunities, but funding is scarce. I have also volunteered and been involved in public engagement. What else can I try to get a job?*" You should start by visiting the careers service of your university; they actually have a three year duty of care after you leave. Keep asking your supervisors, as they may be able to help you get funding. Make sure your interview techniques aren't at fault, target what skills they require and sell yourself. You may already have the skills, but not realize it, so really think about it. Another audience member commented on their experience "*I tried a lot of avenues to get work. Some companies don't even put through CVs for consideration. Having a PhD can also make you too expensive to potential employers*". Some postdoctoral job seekers don't mention their qualification, to apply for lower grade jobs. If you are going for a job that doesn't require a PhD, maybe you should be honest with the interviewers, and state that you applying for the job for a reason. Definitely don't be afraid to talk about wages, however sometimes you cannot negotiate down.

The final question of the session was "*Employers want you to have experience when you apply, but I don't have enough, how can I get it*?" Sometimes even if you don't have the experience, but you know you have the skills, make an application and sell yourself. If you don't have the skills or the experience, volunteering can be a great way to boost both. Whilst doing a PhD, take all opportunities given, especially if you are asked to teach. Some universities also offer staff training which you could benefit from. It is important to be realistic about the level of job you are applying for, sometimes you need to start at the bottom and work your way up. Having aspirations is crucial, but you need to be realistic to reach your desired career. Make sure you work in your undergraduate summers, and any gap years, take all opportunities. Mention what you have done on your CV, as this can make interviewers curious and want to ask you.

This was a brilliant session, which as an undergraduate, I personally found very interesting and useful. Despite employment problems in our field (like many others), the panel highlighted many ways in which you can improve your prospects of following your chosen career path.

Stewart Barker

Wednesday morning was the start of the '***Actinobacteria***' session. The morning began with William Whitman, University of Georgia, providing an introduction with his talk on '***Bergey's taxonomic outline of the Actinobacteria***'. William talked about the recent changes to the taxonomic outline of the Actinobacteria in the 2012 *Bergey's Manual of Systematic Bacteriology*. These changes have created more consistency between the Actinobacteria and other prokaryotes, which William explained, facilitates comparisons between phyla. William went on to talk about some of the challenges with the classification of Actinobacteria and the need for a continuously updated 'living phylogenetic' tree.

Following on from William, Gilles van Wezel, Leiden University, discussed the '***Evolution of sporulating actinomycetes***'. Gilles talked about the importance of

accurate molecular taxonomy in the era of large genome data sets, and presented his work on a novel method of classifying actinomycetes based on the conservation of SsgA and SsgB proteins. These proteins are developmental regulators and in streptomycetes are required for septum-site localization during sporulation-specific cell division. Gilles expanded on this to explain how they were using these proteins to validate previous taxonomic research into the actinomycetes as well as suggesting the possible reclassification of certain species.

The next speaker of the morning, William Fenical, University of California, took us on a journey to marine environments in his talk on '***Accessing marine actinomycetes for drug discovery***'. William discussed the use of specific media and methods to isolate obligate marine actinomycetes as opposed to common isolation methods that often resulted in strains of actinomycetes which were closely related to those isolated from terrestrial sources. William gave a couple of examples of recently isolated obligate marine strains, which had been recently isolated. He explained that these strains could be characterized by the synthesis of unique secondary metabolites which could provide a new direction for drug development.

After a coffee break we settled back in to hear two more speakers for the morning session. Firstly Michael Goodfellow, Newcastle University, presented work on '***Actinobacteria from extreme habitats: new opportunities for drug discovery***' before Francisco Barona-Gomez, National Laboratory for Genomics for Biodiversity, Iraputo, discussed '***Evo-mining: an evolution-inspired strategy for the discovery of natural products in Actinobacteria***'. Michael began by reminding us that bacteria are, and always have been, the dominant form of life on this planet and are found in nearly every environment. Michael discussed pioneering research on actinobacteria which have been isolated from the Actama Desert, the oldest and driest desert in the world. Innumerable novel actinobacterial species have been isolated including those from 'rare' genera. Michael went on to say that some of these species produce novel bioactive compounds which may well pave the way for new pharmaceutical compounds.

Francisco concluded the morning's session talking about 'Evo-mining'. Francisco used his presentation to demonstrate how evolutionary principles could guide the discovery of novel natural products. Francisco explained that using an approach they named 'Evo-mining' his team had been able to uncover novel synthetic pathways including those in well-studied laboratory strains. Following a fantastic morning of talks we broke for lunch and further discussions on the mornings topics.

Clare Doggett

The '***Actinobacteria***' session continued after lunch and poster viewing, chaired by Mike Goodfellow with two speakers addressing different sources of actinobacteria in the environment. First, Martha Trujillo from the University of Salamanca in Spain, outlined an accidental discovery of *Micromonospora* while trying to isolate *Rhizobia* from legumes. As these organisms are slow growing, their presence is not detected until the plates have been incubated for at least 2 weeks, as opposed to the 3 days needed to grow *Rhizobia*. The *Micromonospora*, the most abundant of which they have found to be *M. saelicesensis* are normal inhabitants of nitrogen-fixing nodules but their current function in root nodules is unclear. Genomic analysis of *M. lupini* Lupac08 revealed that there are approximately 680 genes that code for transport and metabolism of carbohydrates and 200 hydrolytic enzymes, yet the organism is not pathogenic to plants. The '*Micromonospora* Puzzle' remains unclear but it is hypothesized that there is a plant/soil associated lifestyle and plant growth promotion traits may be a feature. The second presentation was by Matthew Hutchings of the University of East Anglia, who took us on a tour of ants and actinomycetes. The species of ants used in his lab, *Aquamonas octopinosus*, is unable to digest leaves or flowers and has developed a

tripartite symbiotic relationship with a fungus and actinomycete bacteria (*Pseudonocardia*) to create massive honeycomb-like garden structures. The ants have specialized glands that secrete food for the bacteria to absorb. The *Pseudonocardia* are vertically transmitted and while there is only one species present per nest, as workers get older and leave the nest, an increase in microbial biodiversity is seen. *Pseudonocardia*, along with *Streptomyces*, has been found to produce antimycins that have the potential to be developed as potent anticancer drugs via the Bcl anti-apoptotic route. The ants and their microbiomes can be seen at the university webcam: http://bit.ly/LCAntCam.

Louise Fielding

The student presentations session was chaired by the Postgraduate and Early Career Scientists (PECS) Committee Chair, Emmanuel Adukwu. This session provided the opportunity for four PhD students to present their work on different aspects of applied microbiology. The first speaker was Xiaolei Ze from the University of Aberdeen, who discussed the role of keystone species on the degradation of resistant starch in the human colon. The study investigated the inter-individual variation on the composition of the gut microbial community and its relationship with the ability to ferment resistant starch (RS) in the human large intestine. In the study, anaerobic pure cultures and defined co-incubations were performed to compare the abilities to degrade RS by four of the most abundant amylolytic species present in the human colon. Each bacterial isolate was incubated *in vitro* with the mixed bacterial communities from four volunteers who showed remarkable differences in the digestibility of RS *in vivo*. From the study, it was concluded that *Ruminococcus bromii* exhibited a superior ability to degrade RS when compared with other highly abundant species of amylolytic bacteria. This study provided an excellent example of a keystone species from within the human colonic microbial community with respect to RS fermentation.

Following on from Xiaolei; Benjamin McCutcheon from Brighton University gave a presentation on the genomic, (meta)genomic and functional characterization of a novel RelBE type toxin-antitoxin addiction module associated with the human gut microbiome. Benjamin and his research colleagues recently identified a RelBE type toxin-antitoxin module (p22-TAM) potentially enriched in the human gut microbiome. Here they examined i) carriage of this module between different genetic units (plasmids, bacteriophage, chromosomes), ii) the prevalence of homologous sequences in a range of environments, iii) functions associated with gene neighbourhoods surrounding these modules, and iv) impact of p22-TAM carriage on bacterial stress response. From this, they found that p22-TAM-like modules have a significantly higher abundance within the mammalian gut, are prevalent in the plasmid fraction and have a negative correlation with functions normally associated with the gut microbiome. The p22-TAM is implicated in facilitating survival upon exposure to antibiotics, and may also play a role in other stress responses. Their study concluded that a higher prevalence of the novel p22-TAM with gut-associated plasmids, and the increased cell survival on exposure to antibiotics suggest carriage may be advantageous to gut microbes. This provides new insight into the structure and functions of the gut microbiome.

The penultimate presentation was given by Suzy Moody from Swansea University entitled '**The secret life of an antibiotic: albaflavenone and its novel role *in vivo***.' Albaflavenone is a sesquiterpene antibiotic produced by *Streptomyces coelicolor*. A disruption mutant incapable of producing albaflavenone was found to have a significant phenotype when grown under osmotic stress, being unable to produce the pigmented antibiotics *S. ceolicolor* is renowned for. Experiments were carried out to elucidate how albaflavenone was mediating this change in phenotype. Phenotype, assays and qRT-PCR data provided evidence for albaflavenone being a novel bacteria hormone and results

Daniel Amund winning first prize for his poster

point to a new signalling role for this antibiotic.

To finish, Wan Zawiah from The University of Reading gave a presentation on the survival of *Salmonella* under conditions not permitting growth. The aim of the study was to determine the variations in survival among representative serovars of *Salmonella enterica* under conditions not permitting growth. Wan presented results demonstrating that the survival of *Salmonella* is affected by environmental conditions such as temperature, pH and water activity, but strain variation is also a significant source of variability. This is significant as mathematical models predict survival as a function of environmental conditions.

The session was brought to an end by Professor Mark Fielder who thanked and praised the students for their excellent presentations.

Christiana Adesanwo

The first of the S*f*AM award lectures was presented by Catherine Adamson of the University of St Andrews, who received the New Lecturer Grant following her appointment to a lectureship in 2010. Her presentation, entitled '***HIV-1 maturation inhibitors: a novel class of antiretroviral drug***', provided a fascinating overview of the development of a class of drugs that target a previously neglected step in the life cycle of HIV-1: the maturation of the viral particle. Catherine introduced the compound Bevirimat, which targets the Gag protein that is essential for assembly of viral particles. She presented data showing that Bevirimat inhibits the proteolytic activation of Gag. Furthermore, with some beautiful cryo-electron tomography images, Catherine demonstrated that blocking Gag proteolysis results in viral particles that contain the hexagonal Gag lattice structure but lack the inner nucleocapsid-related layer. These immature viral particles are non-infectious. Unfortunately, Phase II clinical trials of Bevirimat were suspended in 2010 when it was found that around 50% of HIV-1 infections are resistant to the drug due to naturally occurring variants in the region of the *gag* gene that encodes the proteolytic cleavage recognition site. The aim is now to characterize this domain to enable the rational design of new derivatives of Bevirimat with broad specificity for HIV-1 variants.

The **W H Pierce Prize** was awarded to Lori Snyder, Reader in Bioinformatics at Kingston University. Lori gave an excellent and informative presentation on '***Finding sunken treasure in the genome sequencing data flood***'. Lori has been on the front line of microbial genome sequencing for many years, and she described how the field has developed over the last decade or so. In particular, the introduction of next-generation sequencing technologies in 2006 led to a deluge of sequence data. Lori showed, somewhat reassuringly, that computers cannot process all this information accurately and that there is still a place for manual analysis of genome sequences. For example, careful analysis of genome sequences enabled the identification of large (32 kbp) tandem repeats in the *Neisseria meningitidis* genome and unusual inversions in the genome of *Bacteroides fragilis*. Lori described her work on Correia Repeat Enclosed Elements (CREE) in the genome of *Neisseria gonorrhoeae*. These elements are similar to Insertion Sequences, but do not code genes within them. Resequencing of a *N. gonorrhoeae* strain following serial passage in the laboratory provided the first evidence that CREE sequences can invert in this organism. These elements contain outward-facing promoters, and it is possible that inversion may modulate the expression of proximal genes. Lori also described the identification of flagellar genes within bacterial genome sequences, including several species that have never been reported to be motile. Clearly, there is plenty of scope for fishing out important biological information from the vast oceans of microbial genome data.

Nick Jakubovics

After an entertaining evening at the conference dinner, held at Cardiff Castle, the ***Actinobacteria*** session continued on Thursday morning with a talk on '***Genome mining to understand and manipulate antibiotic production in actinomycetes***' by Mervyn Bibb. Mervyn discussed novel mechanisms of immunity and enzymology uncovered in the search for new antibiotics. This work has focused on the Actinomycetes as they are an immensely important group for antibiotic production, producing two thirds of the known antibiotics, with half being clinically used ones. Genes for antibiotic synthesis are generally clustered on the chromosome; using molecular methods this suggests a relatively simple strategy could be used for their isolation by sequencing and cloning the genes of interest into an expression host easier to grow than the Actinomycete itself. However, cells making antibiotics need to express immunity to the antibiotics themselves. In the native species this immunity is usually regulated to be expressed with antibiotic production and cells may be sensitive at other times. Examples of studies were given where immunity mechanisms were knocked out and the antibiotic was no longer made, showing a regulatory link between immunity expression and antibiotic production. In other examples early induction of resistance allowed increased production of antibiotics. Novel enzymology was another feature which has been seen. For example, cypemycin exhibits some of the features of a lantibiotic, but its biosynthetic gene cluster does not show typical features. Post-translational modifications such as dehydration of threonines was shown to be due to an unusual enzyme, the gene for which was unique in the database. Bioinformatic analysis revealed the widespread occurrence of cypemycin-like gene clusters within the bacterial kingdom and in the archaea. Thus, genome mining has identified both new synthesis pathways and new mechanisms of control.

In '***Application of phage integrases in streptomycetes and beyond***', Maggie Smith discussed the mode of action of phage integrases and the advantages these present for genome engineering. Phage integrases catalyse a highly directional integration of phage DNA into a host chromosome. Some commonly used integrases need host factors to work, e.g., phage λ integrase, but the examples presented do not need these and so this makes them useful. These phage integrases are interesting as they need only a very short homologous sequence and allow conservative site-specific recombination. Serine integrases are one example and their mechanism of action was discussed in detail. These mediate site-specific recombination between short (40–45bp) attachment sites, *attP* in the phage and *attB* in the host. Mediated by the integrase, during recombination all four strands of DNA are cut at once at precise points allowing only a 2bp overlap; strand exchange then occurs by a 18° rotation and then the strands are religated. This converts the *attP* and *attB* sites to the sites *attL* and *attR*. Reversal of this process (excision) at these two sites is not possible without a recombination directionality factor (RDF) which reconfigures the integrase to excise not integrate. Work on streptomycete phage has shown that the integrases from different phage have slightly different dinucleotide specificity. Maggie then went on to describe examples of work which utilize these very precise site-specific recombination abilities for synthetic biology engineering, for example, cloning a biosynthetic gene cluster and ensuring all the elements are realigned in the right order.

In the talk '***Biology of plant pathogenic streptomycetes***', Dawn Bignell presented studies on the characteristics of *Streptomyces* species such as *S. scabies* and *S. acidiscabies* which cause a variety of scab diseases of plants (e.g., potato, beet, turnip); potato scab in particular is of great economic importance. A secondary metabolite thaxtomin A, a phytotoxin, is the cause of necrosis of potato tuber tissue and stunting of seedlings by inhibiting cellulose synthesis. The six genes and regulator are conserved in a gene cluster in the main pathogenic species *S. scabies* and *S. acidiscabies*. Another gene *necI*, needed for tissue colonization, is also conserved in the plant pathogenic species

and may suppress the plant's defence responses to infection. Functional genomics studies have also identified other potential pathogenicity factors such as concanamycins; those from *S. scabies* are phytotoxic. Expansin-like proteins have also been described which loosen cell walls and may enable plant/microbe interactions. Another gene cluster found in *S. scabies* is highly similar to that for coronafacic acid (CFA), present in another plant pathogen *Pseudomonas syringae*. In *Pseudomonas*, CFA is a component of the non-host specific phytotoxin, coronatine (COR), a known plant immune suppressor. However, genes for the other biosynthetic components of COR were not present in the *S. scabies* gene cluster but unique genes were and so the exact pathogenicity function of the CFA-like molecule is currently unknown. A recent study in Newfoundland isolated new pathogenic strains from scaby potatoes which phylogenetic studies have shown are distinct from known *Streptomyces* pathogens; none made thaxtomin A or carried the gene; therefore strategies to make potatoes thaxtomin resistant is not going to be a very useful control mechanism in the long run.

Paul Hoskisson's talk on '***Human Pathogenic Streptomyces***' discussed a group of poorly understood species which cause actinomycetoma — infections which result in tissue masses which are slow growing in deep tissue and bones, causing bone damage; antibiotic treatment is largely ineffective and so surgical intervention is typical which may result in limb amputation. Remaining infection can slowly spread. This is now included by WHO on the list of neglected tropical diseases. A range of types are found in areas such as rural Africa, the Middle East and the Neotropics, affecting the lower limbs and feet, mainly in those of low socio-economic status. This is typically seen in young farmers at an age when they are most active in fields, particularly foot infections after rains and trauma (thorns). Little is known of the factors needed for virulence, for example, is morphology important like in fungi which cause the similar disease, eumycetoma? Genome sequencing presents a strategy to look for common virulence factors seen in other bacteria such as adhesion factors, toxins, cell invasion, replication and host evasion mechanisms. Also, common genomic structures like pathogenicity islands could help identify important virulence factors. Findings from sequencing of two type strains, *S. somaliensis* and *S. sudanensis*, and a clinical strain of *S. somaliensis* were discussed. The two species were found to be almost identical with a high number of shared genes; the genomes were typical of *Streptomyces* genomes but with fewer environmental regulators which may be an adaptation to growth in the more stable environment of human tissue. A range of potential virulence and multi drug resistance genes were described. Surprisingly from this finding, when *S. sudanensis* and *S. somaliensis* were tested in the wax moth larvae model system (*Galleria mellonela*) by injection into the prohind leg, then *S. sudanensis* had no effect whereas both *S. somaliensis* strains caused melanise (insect infection response). Another surprising finding was that despite the known epidemiology of the disease these species or their genes could not be isolated from soil, although other *Streptomyces* species were present. This makes the disease epidemiology hard to establish despite the evidence from other factors which suggest this is the main route of infection.

Christine Dodd

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■ **Full Student Membership** confers the same benefits as Full Membership at a specially reduced rate for full time students not in receipt of a taxable salary.

■ **Associate Membership** is only open to those with an interest in applied microbiology without it being a prime aspect of their job. For example, school teachers and those taking a career break; on maternity leave, or working temporarily in other areas. It does not provide access to any journals or Society grants and awards.

■ **Honorary Membership** of the Society is by election only and this honour is conferred on persons of distinction in the field of applied microbiology. Honorary Members have access to our online journals.

■ **Retired Membership** is available to Full Members once they have retired from their employment. Retired Members are entitled to all the benefits of Full Membership except grants and access to the Society's journals.

■ **eAffiliate Membership:** This category of membership is open to microbiologists residing in Band I developing countries and is free of charge. It is an online only membership and provides access to the eAffiliate bursary only.

■ **eStudent Membership:** This category of membership is open to undergraduate students only. It is an online only membership and is free of charge. This category of membership does not provide access to the Society's grants or journals.

■ **Corporate Membership** is open to all companies with an interest in microbiology. Corporate Members benefits include:

- Quarter page advertisement in each issue of *Microbiologist* (which can be upgraded to a larger size at discounted rates).
- The opportunity to publish press releases, company news, etc., in each issue of *Microbiologist*.
- FREE banner advert on the Society website with a direct link to your company site.
- Up to three members of company staff attending Society meetings at members' rate (this means a 50% discount on non member registration rate).

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benefits

The Society for Applied Microbiology is the voice of applied microbiology within the UK and was founded in 1931. Society members play a leading role in shaping the future of applied microbiology, and enjoy many benefits, including:

- The opportunity to apply for one of our many grants or funds.
- Eligibility to win any of our awards or nominate a candidate for the SfAM Communications Award.
- Access to our five peer–reviewed Journals: *Journal of Applied Microbiology*, *Letters in Applied Microbiology*, *Environmental Microbiology*, *Environmental Microbiology Reports* and *Microbial Biotechnology*.
- Free access to the entire collection of digitized back files for *JAM* and *LAM* dating back to 1938.
- A topical quarterly magazine, *Microbiologist*.
- Substantially reduced rates for attendance at SfAM meetings and conferences.
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- Invitation to the annual *Environmental Microbiology* lecture.
- Fostering cross disciplinary research.
- A 25% discount on the extensive Wiley–Blackwell collection of titles.

Detailed information about all these benefits and more can be found on the Society website at: www.sfam.org.uk.

GRANTS & AWARDS: Many grants, awards and prizes are available to members including the W H Pierce Memorial Prize and prizes for student oral presentations and posters at the Summer Conference. In addition to these substantial awards, the Society has funds to assist members in their careers as microbiologists. These include the President's Fund, Conference Studentships, Sponsored Lecture Grants and the popular Students into Work Scheme.

Full details of all the Society's grants and awards can be found on the website together with application forms.

JOURNALS: The Society publishes two monthly journals: *Journal of Applied Microbiology* and *Letters in Applied Microbiology*. We also produce this quarterly colour magazine, *Microbiologist*, which contains features, topical news stories and full details of our meetings. The Society is also a partner with Wiley–Blackwell in the monthly journals: *Environmental Microbiology*, *Environmental Microbiology Reports* and *Microbial Biotechnology*.

All Full and Student Members receive free access to the online versions of the Society's journals, and can also submit papers to our journals via an online submission service.

MEETINGS: We hold three annual meetings; the Winter Meeting is a one-day meeting with parallel sessions on topical subjects. The Spring Meeting is a one–day meeting tailored for personnel in clinical microbiology. The Summer Conference is held every June/July and comprises a main symposium, a poster session, the AGM and a lively social programme. All members are invited to our prestigious annual lecture held to commemorate the success of our *Environmental Microbiology* journal. We also hold joint ventures with other organizations on topics of mutual interest.

WEBSITE: The website is the best source of detailed information on the Society and its many activities. It has fully interactive membership areas where you can find archive issues of *Microbiologist*, exclusive SfAM documentation and much more.

Membership changes

NEW MEMBERS

We would like to warmly welcome the following new members and hope that you will participate fully in the activities of the Society.

Australia

K. A. Hammer; R. McLean; S. Muehlen

Belgium

B. A. Stenuit; C. Vinueza

Canada

J. A. Tetro

China

Z. Liu

Columbia

F. A. Ramos Rodriguez

France

C. Baliere

Germany

T. R. Vonnahme

Ghana

F. Adzitey

India

R. Dewanti; I. Ghosh; J. Jublee

Indonesia

L. Nuraida

Ireland

A. Crowley; E. Ferguson; C. Guinane

Korea

C-J. Cha

Malta

D. Spiteri

Mexico

L. Espinosa Tolentino

New Zealand

R. Fraser

Nigeria

F. Adeoshun; A. Afolayan; O. A. Aregbesola; C. C. Egbe; T. O. Egwuatu; K. E. Eimuhi; J. O. Eimuhi; V. A. Njoku; I. A. Odetokun; C. T. Olateru; P. Oleghe; A. O. Olugbile; O. O. Omobofe; S. O. Samuel

Pakistan

F. Syed

Portugal

C. Silva Pereira

South Korea

M. Rahman

Uganda

S. Bagaaya

UK

F. Alberti; T. Arif; W. Armour; M. Ben Khala; N. Blackwell; G. H. Boother; C. Bowen; V. Bratby; B. Chadwick; S. Challa; S. Charles; D. Childers; H. Y-L. Choo; L. Cieslak; C. Cooper; F. Coukan; H. Davey; P. Druggan; H. El Kadri; F. Ferrara; S. H. Fisher; D. Flynn; L. P. Fossier; A. Frangleton; C. Gachon; I. Garaiova; M. Gibson; Z. S. Goh; F. Goodwin; A. Green; A. Green; R. Griffin; C. Grob; J. Harris; K. Hataglou; R. Hatch; S. Hawkings; C. Hendy; N. Holdforth; E. J. Holmes; A. Howat; A. L. Irvine; R. Jenkins; R. Johns; C. Johns-Gardner; P. Kane; D. Keen; J. Kelly; T. Korin; R. Koy; S. Kuehne; J. Lock; L. Mackay; C. M. Madden; A. Majeed; S. McClarty; S. McGrath; C. Moore; C. Mur'Tala; Z. Mycroft; P. Nash; V. Nkwenti; L. O'Brien; J. O'Donnell; E. Oluwadare; A. Otter; F. Parkinson; L. Pickthall; D. A. Poole; C. Price; G. Pritchard; T. Puttick; B. M. Rabi'u; K. Randall; D. Reddiar; S. Rout; H. Sharma; S. H. Simms; D. Smith; S. Starkings; S. Stewart; V. Taylor; V. Tennyson; J. K. Thomas; C. B. Thomson; K. Thorley; S. L. Tingey; S. Tylisczuk; L. Vanchieri; Y. Wang; D. Weaver; J. Webb; E. Wilcox; G. Wilson; L. Wright; P. A. Zaman

USA

N. Blanco Herrera; A. Chakraborty; H. E. Fisher; L. J. Harris; W. Ju; R. Oni; B. Portoni; S. Ruengvisesh; A. Sayler; C. Sevilla; J. Wall; Y. Wang; A. Xu; P. Zoder

Losses

We were saddened to learn of the death of the following Member of the Society:

George A. Prentice.

New Committee Members

Brendan F Gilmore

Brendan graduated with a BSc (Hons) in Pharmacy (1999) and a PhD in Medicinal Chemistry (2004) from Queen's University Belfast. He was appointed to a Lectureship in Pharmaceutics (Pharmaceutical Microbiology) in July 2004 in the School of Pharmacy at Queen's. In 2005 he was a visiting researcher in the laboratory of Professor Howard Ceri, University of Calgary, where he remains a visiting scientist in the Biofilm Research Group. He was promoted to Senior Lecturer in Pharmaceutical Microbiology in 2010. His research aims to elucidate the mechanistic and biochemical pathways central to the process of microbial biofilm formation and to uncover novel targets for prevention of microbial biofilms; spanning microbiology, chemical biology, and synthetic/medicinal chemistry directed toward antimicrobial and anti-biofilm applications. His main interests include the role of proteolytic enzymes in biofilm formation and development of novel approaches for biofilm control in chronic infections. He has an active research interest in antibiotic biodiscovery from marine bacteria and archaea (extreme halophiles). Brendan is the 2013 recipient of the Royal Pharmaceutical Society Science Award for his research contributions in the field of biofilm control and pharmaceutical microbiology. He is an Editor of the textbook '*Hugo & Russell's Pharmaceutical Microbiology*' (8th Ed) and is responsible for teaching all aspects of pharmaceutical microbiology and infectious diseases to undergraduate pharmacy students at QUB.

Brian Jones

Brian graduated from Cardiff University in 2000 with a BSc (Hons) in Genetics. He completed a PhD in 2004, also at Cardiff University, investigating the role of swarming in the pathogenesis of *Proteus mirabilis* urinary tract infections. In 2004, he joined the Alimentary Pharmabiotic Centre and Microbiology Department at University College Cork, Ireland, where he began to work on the human gut microbiome and associated mobile metagenome. In 2008, he took up a position at the University of Brighton, where his research group continues to study the pathogenesis of device-associated infections, as well as the structure and function of the human gut microbiome.

Val Edwards-Jones

Val worked for 20 years in the NHS as a diagnostic microbiologist and then transferred to academia after undertaking her PhD on toxic shock syndrome in burned patients. Since then, Val has continued to research and has published in several areas of medical microbiology including rapid diagnostic techniques, wound infection, biofilms and antimicrobial agents.

Val is very interested in the role of biofilms in chronic wounds and continues to work with the healthcare professionals and industry to help improve these issues. Val also works as a microbiological advisor with Maverick TV who produce the series *Embarrassing Bodies* on Channel 4.

John Threlfall

Since being awarded a PhD in Microbial Genetics in 1969, John has worked in the UK Health Protection Agency (HPA) (formerly the Public Health Laboratory Service, now Public Health England) in a variety of roles. Most recently he served as Director of the HPA Laboratory of Enteric Pathogens from 2004 to 2008 and as Head of R&D in the Gastrointestinal, Emerging and Zoonotic Infections Department from 2008 to 2010.

In 2007, he was appointed Project Director for the EU-funded Med-Vet-Net Network of Excellence and continued in this role in the Med-Vet-Net Association until 2011.

From 2010 to 2012 John was employed as Programme Manager for the HPA for the EU-funded EURLOP (EU Human Reference Microbiology Options Project) and ECDC-funded EU-LabCAT project, which were targeted at rationalizing various aspects of human reference microbiology within the EU. The recommendations from these projects are currently being implemented. He was appointed to the European Food Safety (EFSA) Biohazards (BIOHAZ) Panel in 2009 and has recently been elected for a second three-year term of office.

His principal interests are antimicrobial drug resistance in bacterial zoonotic pathogens and the molecular epidemiology of foodborne zoonoses; he has published extensively in these areas.

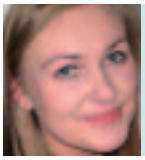
In the loop

pecs

News from the S*f*AM Postgraduate and Early Career Scientist Committee

Public engagement

In recent years public engagement has been a hot topic. But what is it? Why has it become so important and why are scientists so keen to get involved?



Agnieszka Piotrowska

Firstly, the term public engagement, as defined by the Higher Education Funding Council for England, is '*the involvement of specialists listening to, developing their understanding of, and interacting with, non-specialists*'. In other words it is getting people involved in science by explaining it at a level that can be understood. But why exactly do scientific societies want to get actively involved? Very importantly, misrepresented scientific research, and generally unsubstantiated 'science' is sometimes given a platform in the media which can be misleading to the lay person. This can occur in many media forms available in today's society, so it is important for the population to be aware of the possible misinterpretations and misconceptions that exist. It is essential, therefore, to make sure the public is well informed on how to critically interpret scientific news. A good example of this is the organization Sense About Science. They work with scientists and members of the public to change public debates, and to equip people to make sense of science and evidence.

Furthermore, as scientists we should always encourage greater understanding of science for many reasons, for example, public health issues. Several S*f*AM public engagements events have aimed to give children (and the occasional adult!) a better understanding of pathogenic bacteria, and the process in which bacterial illnesses are identified. One of the take-home messages is the importance of good hygiene, in addition to getting children interested in 'behind the scenes' science. This is not only beneficial for public health, but could also set the path for the next generation of microbiologists!

It can be a daunting task to organize an outreach event and get a good turnout. The easiest way is to arrange it in a family friendly environment. An example could be to join a local fair and ask a school teacher if they would be interested in taking part in a public engagement event. There are also various events already organized for Science, Technology, Engineering and Mathematics (STEM) ambassadors — it is free to join the STEMNET and you need only commit to participating in one event a year. STEM ambassadors contribute through clubs, careers days, and regular lessons to give a fresh perspective to young people and engage their interest and imagination.

Alternatively, if you are creative and would like to organize your own outreach event, there are opportunities to find support and funding from many professional bodies that would be happy to support you, and may even offer help and support with the organization. This year the PECS Publications Officer, Jenni, participated in a Science Communication training day; "*…this workshop was designed to enhance our skills and demonstrate the impact and benefits of our research to schools and the public. We were shown interactive ways to deliver activities and become confident to use resources and engage with wider audiences*". These days can be useful training and are also good networking opportunities.

You need to have a clear end-goal in mind when organizing an event; it really needs to be planned well. One of the first things to ask yourself when planning an event is 'What do you really want the audience to remember when they have left you'? Your event can be funny and interesting, but you need to ensure that people visiting leave with this message. Organizing hands-on activities can be a great way to keep kids engaged — it can be messy though so beware! A good example of a very well-known activity is the 'handwashing experiment'. Using UV glow cream and a UV light you can show them how well they washed their hands, explaining how important it is to do so and what the potential consequences are if they don't. If possible, try to have some freebies for them to take home — preferably with some information about your activity or a link to a website where they can learn more.

If it is successful, hopefully they will pass on what they learnt to their family members and friends. You can also use the time with your captive audience to advertise other public engagement events taking place.

Even if you don't organize your own event, there are many societies that carry out public engagement, and I'm sure that you will find something that is right for you. Just do it – it is fun and very rewarding (it is also very good for your CV!).

Don't forget — S*f*AM has a **Public Engagement Grant** you could apply for and the Society also gives opportunities to Members to volunteer at public engagement events they are taking part in. Get involved!

careers

Pupils to policy via public health

Hefin Davies describes his varied career journey

Given the magazine and its audience, I think it's only right and proper to declare up front that my degree was in pharmacology, therapeutics and toxicology, and I enjoy books on particle physics. Specializing in a particular field was not for me, though, and my career since has mostly been jobs where I get to work with, or apply knowledge from, a number of fields. I'm happy to be a jack-of-all-trades (less so a master of none) because for me, it's the way of thinking that comes with working in science that's most interesting.

Graduating without any firm convictions as to career paths, I took advantage of the freedom and applied to Voluntary Service Overseas (VSO). At that time, VSO ran a scheme to place science or maths graduates as teachers in secondary education level abroad. For me, this was an opportunity to live and work abroad; experiencing another culture rather than floating by with a rucksack on my back.

Passing the interviews and sitting through the teacher training courses, I was placed as a general science teacher in the village of Bongo in the Upper East Region of Ghana. At the time, general science comprised everything from optics to fish farming, something I was completely unprepared for. I mean, how many of you could design a fish farm in sub-Saharan Africa based on your university education? My first three months were spent combatting language/accent issues (the local language of Gurune and Welsh didn't mix easily) and removing spiders from the neglected laboratories.

Dusty: a stock answer when anyone asks me about my experiences abroad, but how can you condense two years into a few sentences? I'm not going to try here.

I brought many things back with me from Ghana: a love of teaching science, the malaria parasite, long hair and a chieftaincy title (Naba Asikoulga II for the curious reader) to name a few. The biggest impact on my life, though, has been perspective. To this day I look back at the knowledge, experiences and emotions of my time in Bongo to put my current situation, whether personal or professional, in its place.

Returning to the UK and still none the wiser about a career, I simply looked for opportunities to use and work with science. I never once considered teaching because of the differences between the education systems in the UK and Ghana. In Ghana, every student wanted to learn, regardless of their ability. That made a huge difference. There were also laxer health and safety controls, which as a science teacher opened up a world of possibilities. My mother, a head teacher, subsequently confirmed I would probably have been sacked in the UK for some of my practical lessons. My students, on the other hand, got better results than any previous year group at the school.

Combing job adverts, I spotted a recruitment drive for scientific officers at the Food Standards Agency (FSA). Just the sort of thing I was looking for and a move to London as well. Moving to the anonymity of London from the goldfish bowl of Bongo would be a welcome change. I was successful, having given an interview presentation on the MMR media coverage, and recruited into the somewhat oddly titled 'incidents branch'.

Food law is there to make sure that all food is safe and fit for consumption. When it goes wrong somewhere along the food chain, the incidents branch are called. They are there to link between the reports from local authorities, industry or the public and those who assess the risk to consumers. Once the risk has been assessed, decisions must then be taken on how to manage the risk and how this should be communicated. The work covered everything from outbreaks of foodborne disease to chemical spills and labelling discrepancies.

As the scientific officer within the team, I was there to explain the risk assessments in a language understandable to non-scientists. The science teaching stood me in good stead.

My first brush with microbiology was an investigation into levels of *Listeria* spp. in cooked sliced meat. Not necessarily a safety issue, but indicative of hygiene failings at some point in the chain. I quickly learned how difficult it was to pin down a source of bacterial contamination (a spill is so much easier). Thanks to the knowledge of the FSA's own microbiologists and those within the Health Protection Agency (now Public Health England) *Salmonella* spp. and *E. coli* spp. followed soon after, picked up by one of the tens of thousands of food samples taken annually.

Is it safe? A question that seems so simple yet can be incredibly tricky. We have regulatory standards and national guidance on unsafe levels of pathogens in food to help us, certainly, but that's only part of the story. Can one result from a shop-bought product be sufficient to require action against tons of product up and down the country in people's homes? Sometimes. It's rarely black and white and has to be considered 200–300 times a year [317 microbiological incidents in 2012 (FSA annual report of incidents 2012)].

My first big outbreak was *Salmonella* Montevideo in 2006 and what an outbreak to start with. A well-known confectionary company's chocolate products were identified as the probable cause resulting in a UK-wide recall of products and a lot of scrutiny from all quarters. Being at the centre of the investigation as the situation developed was fast-paced and exciting, especially as details emerged of the extent to which the company were aware of the contamination at one of its sites. The resulting prosecution and fine of £1 million were seen as thoroughly justified.

The key to any outbreak response is bringing together the microbiological, environmental and epidemiological evidence as quickly and thoroughly as possible to try and establish the likely source. We rarely have all the evidence we would like but decisions are needed to prevent further cases. We only have to look at the *E. coli* O104 outbreak in Europe during 2011 to see what can happen when quick decisions have to be made on incomplete evidence.

Having been away from Wales for five years, I decided it was time to return and took a job with the FSA's office in Cardiff. My incidents role was fairly similar but now, 'microbiologist' had been added to my job title. I was responsible for microbiological risk assessment work, using my experience from the previous few years.

I ended up working with a lot of people in different organizations who had been involved in the South Wales *E. coli* O157 outbreak in 2005, which tragically resulted in the death of a young boy. The outbreak and resulting Pennington enquiry set the landscape for my role over the next few years. I got to know staff from local authorities and Public Health Wales very well, which ultimately benefited the response to incidents and outbreaks. For any outbreak control team, I would already know most of the other people around the table, making the communication slicker and easier.

Despite the job title, my role included environmental contamination and managing the post-Chernobyl sheep movement restrictions in North Wales; therefore, I had to add radiological protection to my ever-increasing scientific bow. As the role developed, genetic modification and nanotechnology joined the party.

With my Ghana experience showing through, I started sharing this knowledge with others by preparing teaching sessions on pretty much anything for anyone who was prepared to listen. Whether FSA staff, board members, university students or foreign visitors, I would happily don my Einstein wig and talk about carbon nanotubes.

Ultimately, I became a scientific advisor and support to the entire office in Wales. It was more than just 'explaining all the long words' and meant that I got to experience and work on everything that the FSA is responsible for. Breadth of experience is what I enjoy and what keeps me interested.

I have now moved on and work on developing food safety policy and negotiating legislation in Europe. The 'scientific' jobs may have gone but the skills I've developed, the knowledge I've gained and the way of thinking that comes with scientific inquiry; well, they stay with me.

references

- FSA annual report of incidents. (2012). http://www.food.gov.uk/multimedia/pdfs/incidents-report-2012.pdf.

Hefin Davies
Official Feed and Food Controls Policy, Food Standards Agency

Students into Work Grant report

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Bdellovibrio and *Salmonella* isolation from reptiles

Human salmonellosis remains a major public health burden, with over 99,000 reported cases in the EU in 2010 (http://www.efsa.europa.eu/en/efsajournal/pub/2597.htm). However, the true incidence of salmonellosis may be much higher than this (up to 2,000 times higher in some countries) according to one recent serological study (Falkenhorst *et al.*, 2012). Salmonellosis is usually considered to be a foodborne disease, but an increasing number of cases have been linked to contact with pet reptiles (Bertrand *et al.*, 2008). Exotic animals have become increasingly popular pets in recent years. More than 500,000 pet reptiles were imported into Frankfurt airport alone during 2007 (Bertrand *et al.*, 2008). *Salmonella* colonizes many reptiles asymptomatically, with the prevalence in some species reaching almost 100% (Caine *et al.*, 2009). The use of antimicrobials to reduce *Salmonella* numbers in reptiles is not advised because of emerging problems with resistance and the high prevalence of this pathogen in reptiles. Biological control using bacteriophages may be an option, as phages have been used to control *Salmonella* in poultry and pigs in experimental trials (Atterbury *et al.*, 2007; Wall *et al.*, 2010). However, bacteriophages tend to have a restricted host range and continual use of phages usually results in the emergence of resistant populations of bacteria.

An alternative biological control exists in the form of the Gram-negative bacterium *Bdellovibrio bacteriovorus*. *Bdellovibrio* is a predatory bacterium that invades and kills other Gram-negative bacteria, including pathogens such as *Salmonella*. Unlike bacteriophages, resistance to *Bdellovibrio* predation cannot arise from a single mutation event. In fact, only one resistance mechanism has been found so far, the production of an intact S-layer (Sockett, 2009). *Bdellovibrio* and like organisms (BALO) have been isolated from the faeces of some animals and humans (Schwudke *et al.*, 2001); however, to date, no studies have attempted to isolate *Bdellovibrio* from reptiles. In our study, we attempted to isolate BALO from reptiles as a first step towards developing a biological treatment to reduce *Salmonella* in pet reptiles.

Faecal samples were collected from pet reptile species (bearded dragon, milk snake, corn snake, tortoise) at the School of Veterinary Medicine, University of Nottingham, and species from the reptile section of Twycross Zoo. The faecal samples were diluted approximately 1:10 in Ca-HEPES buffer. Volumes, 1ml of each faecal suspension were cultured for *Salmonella* by selective enrichment in Rappaport-Vassiliadis (RV) broth, followed by streaking onto a selective medium (Brilliant Green agar). Putative *Salmonella* isolates were confirmed by agglutination with poly-O antiserum. The resistance of the *Salmonella* isolates to a range of antimicrobials was determined using the disc diffusion method.

Bdellovibrio isolation from the faecal samples was performed by adding a cocktail of prey bacteria (*Salmonella* and *E. coli*) to the faecal suspensions and incubating at 30°C for up to two weeks. *Bdellovibrio* isolation from some sources requires prolonged incubation, and therefore, 1ml volumes of the faecal enrichment cultures were taken every three days to examine for the presence of *Bdellovibrio* by both light microscopy and direct culture using a double-layer agar overlay containing prey bacteria (Lambert & Sockett, 2008). The plates were incubated for up to two weeks at 30°C and regularly examined for the presence of typical *Bdellovibrio* plaques. Putative *Bdellovibrio* plaques were transferred to Ca-HEPES buffer containing prey bacteria and incubated for 2–3 days at 30°C.

In this study, we found that 4/25 (16%) faecal samples tested positive for *Salmonella* spp., all of these samples were taken from the pet reptile species at the university. This result is in line with previous suggestions that a presence of *Salmonella* in reptiles is to be connected to a specific area instead of individual animals (Caine *et al.*, 2009). All four *Salmonella* isolates from the pet reptiles were resistant to penicillin, erythromycin and ampicillin, but limited or no resistance was recorded for tetracycline, chloramphenicol and streptomycin. The resistance of these isolates to ampicillin is particularly worrying as this is one of the antimicrobials often relied upon to treat invasive *Salmonella* infections (Crump *et al.*, 2011). A number of faecal samples (8/25, 32%) including both samples from the university (bearded dragons, milk and corn snakes) and Twycross Zoo (monitor lizard, boa constrictor, glass lizard), contained small, highly motile bacteria which resembled *Bdellovibrio*. We plan to confirm whether or not these bacteria are *Bdellovibrio* or like organisms by 16S rRNA gene sequence analysis, and

by culturing with a range of potential prey bacteria.

In conclusion, *Salmonella* spp. was isolated from reptile species which are commonly kept as pets in the UK; in addition, bacteria resembling *Bdellovibrio* and like organisms were isolated from a number of faecal samples taken from the university and Twycross Zoo. If these isolates are confirmed as *Bdellovibrio* or like organisms, this may be a first step towards using this bacterium to reduce the prevalence of *Salmonella* in pet reptile species. As a veterinary student with a strong interest in microbiology and public health, this project has provided me with invaluable practical laboratory experience, beyond the scope of the veterinary curriculum, in the field of zoonoses, which will undoubtedly aid my career potential in this field. This project would not have been possible without the generous grant from the Society for Applied Microbiology, for which I thank the Society wholeheartedly, the guidance of my supervisor Dr Robert Atterbury, the helpful practical advice and scientific input from Professor Liz Sockett, and the willingness of the University of Nottingham and Twycross Zoo to supply me with the necessary samples for which I am grateful.

References

- Atterbury, R. J., Van Bergen, M. A., Ortiz, F., Lovell, M. A., Harris, J. A., De Boer, A., Wagenaar, J. A., Allen, V. M., and Barrow, P. A. (2007). Bacteriophage therapy to reduce *Salmonella* colonization of broiler chickens. *Appl. Environ. Microbiol.*, **73**, pp4543–4549.
- Bertrand, S., Rimhanen-Finne, R., Weill, F. X., Rabsch, W., Thornton, L., Perevoscikovs, J., Van Pelt, W., and Heck, M. (2008). *Salmonella* infections associated with reptiles: the current situation in Europe. *Euro. Surveill.*, **13**, pp1–6.
- Caine, C., Tyre, D., and Ferraro, D. (2009). Incidence of *Salmonella* on reptiles in the pet trade. *RURALS: Review of Undergraduate Research in Agricultural and Life Sciences*, **4**, p12.
- Crump, J. A., Medalla, F. M., Joyce, K. W., Krueger, A. L., Hoekstra, R. M., Whichard, J. M., and Barzilay, E. J. (2011). Antimicrobial resistance among invasive nontyphoidal *Salmonella* enterica isolates in the United States: National Antimicrobial Resistance Monitoring System, 1996 to 2007. *Antimicrob. Agents Chemother.*, **55**, pp1148–1154.
- Falkenhorst, G., Simonsen, J., Ceper, T. H., Van Pelt, W., De Valk, H., Sadkowskq-Todys, M., Zota, L., Kuusi, M., Jernberg, C., Rota, M. C., Van Duynhoven, Y. T., Teunis, P. F., Krogfelt, K. A., and Molbak, K. (2012). Serological cross-sectional studies on *Salmonella* incidence in eight European countries: no correlation with incidence of reported cases. *BMC Public Health*, **12**, p523.
- Lambert, C., and Sockett, R. E. (2008). Laboratory *maintenance of Bdellovibrio. Curr. Protoc. Microbiol.*, Chapter 7, Unit 7B 2.
- Schwudke, D., Strauch, E., Krueger, M., and Appel, B. (2001). Taxonomic studies of predatory bdellovibrios based on 16S rRNA analysis, ribotyping and the hit locus and characterization of isolates from the gut of animals. *Syst. Appl. Microbiol.*, **24**, pp385–394.
- Sockett, R. E. (2009). Predatory lifestyle of *Bdellovibrio bacteriovorus. Annu. Rev. Microbiol.*, **63**, pp523–539.
- Wall, S. K., Zhang, J., Rostagno, M. H., and Ebner, P. D. (2010). Phage therapy to reduce preprocessing *Salmonella* infections in market-weight swine. *Appl. Environ. Microbiol.*, **76**, pp48–53.

Kostijn van Ginkelt
University of Nottingham

President's Fund report

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The role of fungi in biodegradation of compostable plastic polylactic acid

Figure 1. *Compostable disposable PLA containers*

Conventional plastics such as polyethylene terephthalate (PET), polyvinylchloride (PVC), polyethylene (PE), polypropylene (PP), polystyrene (PS) and polyamide (PA) have been used for decades in a diverse range of applications as they are easily processed, available in large quantities, inexpensive and they have favourable mechanical characteristics. However, they are non-biodegradable and when they are used as short shelf-life products, as they are resistant to microbial attack, they accumulate in the environment and cause waste disposal problems. Recycling has not developed sufficiently to keep up with increasing amounts of plastic consumption and demand. In addition, the vast majority of conventional plastics are derived from petrochemicals and their manufacture is dependent on non-renewable fossil fuels.

Poly(lactic acid) (PLA) is a synthetic aliphatic polyester with a hydrolysable backbone that is susceptible to degradation and uses starch as a renewable feedstock. Since its raw material is lactic acid, it can be obtained from renewable resources such

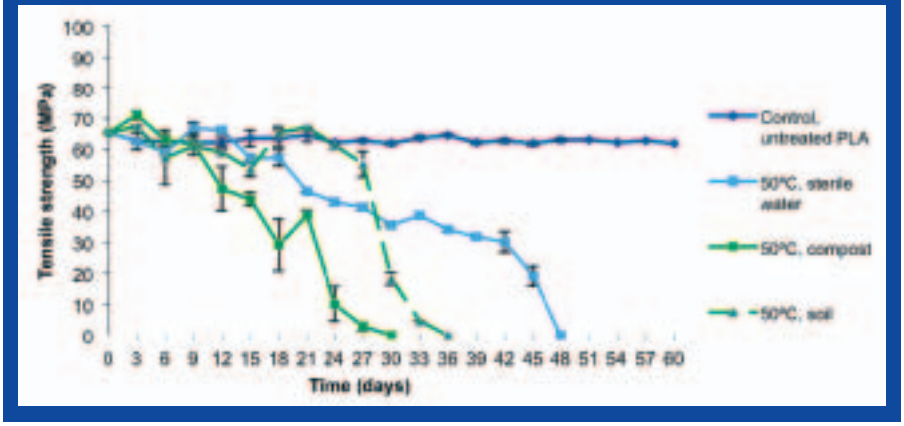
as starchy materials. PLA has favourable properties including ease of fabrication, no toxicity, biocompatibility, high mechanical strength and it is also compostable. Lactic acid, the precursor of PLA, can be produced by bacterial fermentation and it is much cheaper than producing PLA as a petrochemical-derived product. PLA has been preferred in the medical area and currently, food-packaging films have been produced from PLA for short shelf-life products.

The most accepted mechanism of PLA degradation involves a two-step mechanism involving chemical hydrolysis in the presence of water, followed by microbial degradation in which microorganisms mineralize polymer breakdown products generating carbon dioxide under aerobic conditions and methane under anaerobic conditions. This is a distinct feature of PLA because typically biodegradable polymers are degraded by microbial attack in a single step. However, there is some evidence to suggest that microbial enzymes exist capable of directly degrading high molecular weight PLA.

High molecular weight PLA degradation solely by microorganisms and enzymes is poorly understood and to date, most identified PLA degraders are actinomycetes. Sangwan and Wu (2008) suggested that there were likely to be far more PLA degrading microorganisms still to be identified, as the techniques employed to date were based on classical cultivation methods that favoured the fastest growing microorganisms by employing broth enrichment rather than solid material, and because the majority of environmental microorganisms cannot readily be grown on laboratory media. As a result of this study it is suggested that phyla Actinobacteria (especially those belonging to the genera *Thermomonospora* and *Thermopolyspora*) and Ascomycota (genus *Paecilomyces*) might play significant roles in the biodegradation of PLA under composting conditions.

Since PLA short shelf-life products are thrown away after their use (Figure 1), understanding the PLA degradation mechanism and monitoring the degradability of PLA, in different environment conditions, are the main concerns of this study. In addition, with the exception of *Tritirachium album*, no PLA degrading fungi have been identified (Jarerat & Tokiwa, 2001).

Figure 2. *Tensile strength changes of PLA incubated in compost, soil and sterile water at 50°C for 60 days*



Therefore, the aims of this study were to investigate the degradation of PLA in different environmental conditions; to determine the relative importance of biological and chemical factors in PLA degradation by comparing the rate of degradation in microorganism-rich compost and soil with the rate of hydrolysis in sterile water; identify the role of fungi as putative PLA degraders; and to determine the diversity of fungal communities growing on the surface of PLA buried in compost and soil by a non-culture based study.

The rate of PLA degradation in compost and soil was compared with sterile water at a temperature range to decide the role of hydrolysis and microorganisms in PLA degradation. Degradation was assessed by measuring tensile strength. The loss of tensile strength in microorganism-rich compost and soil was faster than hydrolysis in sterile water at 50°C, indicating a role for microbial degradation (Figure 2).

Putative fungal PLA degraders were isolated from the surface of PLA buried in compost and soil at 25 and 50°C, and identified by ribosomal DNA sequencing. Abundant fungal growth was observed on the surface of PLA recovered from compost at 50°C by environmental scanning electron microscopy (ESEM) and were the principle microbes recovered from the surface, suggesting thermophilic fungi play an important role in the degradation process. Terminal restriction fragment length polymorphism (TRFLP) was used as a non-culture based method for community analysis of PLA buried in compost and soil at 25 and 50°C. PLA buried in compost and soil either at 25 or 50°C had less fungal diversity with less evenness than compost and soil, with no PLA suggesting enrichment for PLA degraders on the surface of PLA.

The project will determine the ability of isolated and identified fungi to degrade PLA and also the impact of PLA on the quality and microbial diversity of compost by non-culture based methods, including TRFLP and next generation sequencing.

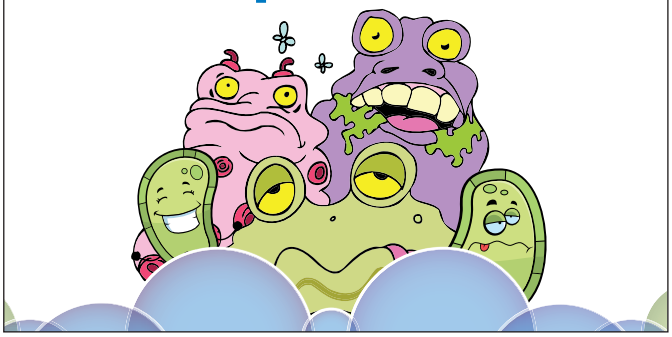
I would like to thank the Society for Applied Microbiology for the **President's Fund** award, which enabled me to attend the 14th International Symposium on Microbial Ecology in Copenhagen, Denmark, in August 2012. This gave me the chance to communicate with colleagues in my field and learn about the latest developments and methods in microbial ecology such as next generation sequencing. I also would like to thank my supervisor Dr Geoff Robson for his help and support throughout my project.

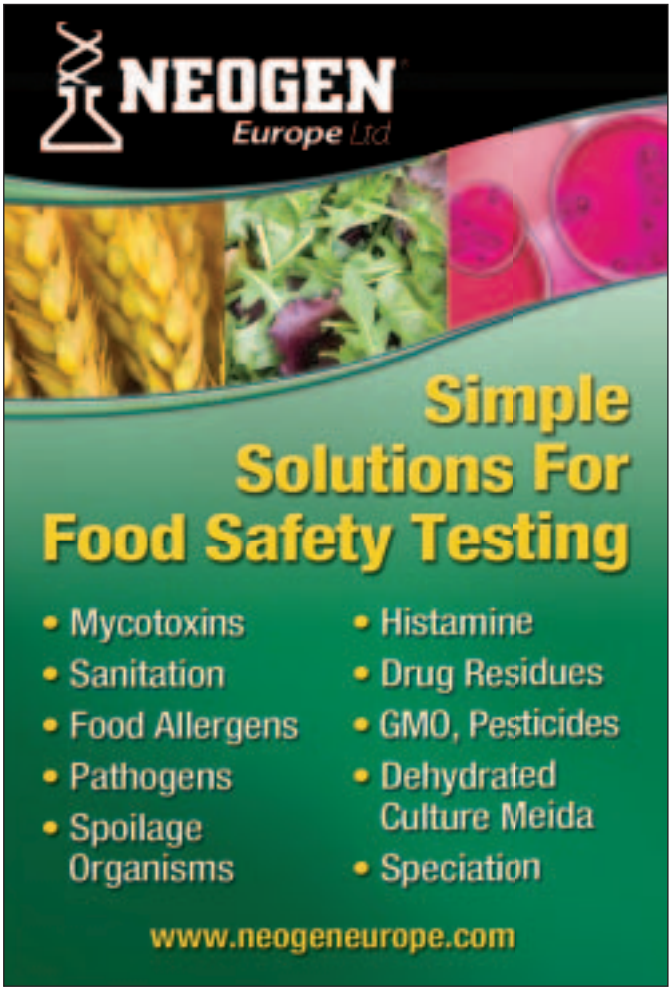
References

■ Jarerat, A., and Tokiwa, Y. (2001). Degradation of poly(L-lactide) by a fungus. *Macromolecular Bioscience*, **1**, pp136–140.

■ Sangwan, P., and Wu, D. Y. (2008). New insights into polylactide biodegradation from molecular ecological techniques. *Macromolecular Bioscience*, **8**, pp304–315.

Mehlika Karamanlioglu





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We are pleased to announce that we have achieved the Environmental Management System certification ISO 14001.

ISO 14001 is an international standard that requires an organisation to consider it's significant environmental aspects and to use these to develop and implement an environmental policy and environmental objectives.

It is designed to help businesses remain commercially successful without overlooking environmental responsibilities.

As a company we will continually strive to reduce our impact on the environment.

TCS Biosciences, your partner: For Life.

further information

Visit: www.tcsbiosciences.co.uk
Tel: +44 (0)1296 714222
Email: sales@tcsgroup.co.uk

corporate news

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

Biological back-up services at NCIMB

While most laboratories and research organisations will have an automated system in place for backing up information held on computers, systems for backing up microbial cultures and genetic material may be less rigorous. However, these collections can represent a lifetime's work and may be effectively irreplaceable in the event of accidental loss or damage.

The World Federation of Culture Collections produces guidelines for culture collections which include the use of two methods of preservation and having an off-site back-up storage facility. In order to minimise the risk of losing key biological resources, research organisations and laboratories can follow similar guidelines but preservation techniques such as freeze-drying are time consuming and the skills and equipment required may not be available in-house.

NCIMB offers a range of commercial off-site storage services for bacteria, yeasts, actinomycetes, bacteriophages, purified DNA, plasmids/cosmids and seeds that can help you to securely and confidentially preserve biological resources.

We can use a range of techniques to preserve cultures prior to storage or accept them ready prepared, and can store material with a hazard rating and physical containment level no greater than ACDP category 2 or ACGM class 1.

further Information

Visit: www.ncimb.com
Tel: +44 (0)1224 711100
Email: s.law@ncimb.com

Microbiologics introduces Shiga-toxin producing *Escherichia coli* QC microorganisms in ready-to-use quantitative format

Microbiologics has extended their offering of Shiga-toxin producing *Escherichia coli* (STEC) products to include Epower™. Epower™ is a ready-to-use QC microorganism product which delivers a specific number of colony forming units (CFU) and is used for quantitative microbiological quality control testing.

Under USDA regulation, *E. coli* serogroups O26, O103, O45, O111, O121 and O145, also commonly referred to as the 'Big 6 *E. coli*', are prohibited from raw ground beef, its components, and tenderized steaks. In addition to the Big 6 *E. coli* strains, Microbiologics also offers serogroups O157 and O104. Beef testing laboratories use Microbiologics QC microorganisms for validation, verification and routine quality control checks of their STEC testing processes, material, equipment and personnel proficiency.

Epower™ QC microorganisms are packaged in a vial of 10 lyophilized pellets consisting of a single enumerated microorganism strain. Also included is a peel-off Certificate of Assay detailing the identity and mean assay value of the pellets for quick and easy documentation. Customers especially like Epower™ because of the versatility the product offers; Epower™ pellets can be easily manipulated to deliver a wide range of CFU concentrations, or multiple strains can be combined for a mixed microorganism population.

further information

Visit: www.microbiologics.com
Tel: 00+1 320 253 1640
Email: info@microbiologics.com

Leatherhead Food Research: food safety & product integrity

Leatherhead's food safety portfolio provides a comprehensive range of products and services to help food and drink companies maintain the highest possible standards of safety and stability in their products. We provide a broad array of microbiological food testing, analysis and consultation covering microbiological food safety, training and advice, and bespoke testing, if required.

Our main focus areas include:

- Shelf life and challenge testing (including *Cl. botulinum*)
- Microbial inactivation kinetics (to aid food processing)
- Molecular diagnostics including speciation of bacteria, yeasts and moulds, and horsemeat
- Enteric virus research and detection
- Antimicrobial screening and alternative natural preservation technologies
- HACCP training and studies including troubleshooting and audits
- Biofilm study and control
- Method development and validation of rapid detection methods
- Validating and advice on cleaning and disinfection procedures

Additionally, our Food Safety & Product Integrity Department is supported by expertise

from across Leatherhead. For example, we can check the safety/shelf life of a reformulation, whilst ensuring that it meets the required sensory and nutritional properties. We can also provide regulatory advice so that the product meets the required legislation for the countries in which is it sold.

further information

Visit: www.leatherheadfood.com
Tel: +44 (0)1372 376761
Email: help@leatherheadfood.com

New video shows Lab M's new µPREP™ media format in action

Lab M's new video shows how quick and easy it is to prepare and use the company's µPREP™ line of bagged, ready-to-reconstitute microbiological culture media. µPREP™ Buffered Peptone Water ISO (BPW) is the first medium to be produced in this new format, which is designed for maximum convenience and ease of use. It saves laboratory time and resources in media preparation for high throughput testing while minimising storage requirements. The 5-minute video provides a step-by-step guide on how to prepare, use and store the pre-enrichment medium:http://bit.ly/LabMBPW

Formulated to ISO 6579, Lab M's Buffered Peptone Water ISO (BPW) supports the recovery of sublethally damaged salmonellae prior to selective enrichment. This nutrient medium is free from inhibitors and is well buffered to maintain pH 7.0 for the incubation period. Sublethal injury to salmonellae occurs in many food processes and such pre-enrichment steps greatly increase recovery of these organisms.

µPREP™ media take up minimal storage space, offer quick, convenient, time-saving reconstitution with no need to autoclave, and can be prepared with minimal training. The product is supplied sterile in boxes of 10 highly robust bags, each making 20 litres of complete media. To view the µPREP™ video visit: **http://bit.ly/LabMBPW**

further information

Visit: www.labm.com
Tel: +44 (0)161 820 3833
Email: info@labm.com

Same time and reduce errors when using MALDI–TOF

MALDI–Trace™ is a system created specifically for the traceability of organism identification tests performed using seeded target plates and Matrix-Assisted Laser Desorption Ionization — Time of Flight (MALDI–TOF) technology.

The system provides a platform that identifies which area on a MALDI target plate needs to be inoculated. This information is transferred to the MALDI–TOF and once identification has taken place this is registered directly onto the LIMS — no need to complete manual worksheets for the transfer of data. MALDI–Trace™ allows laboratory personnel to keep track of culture isolates without the risk of transcription errors.

- MALDI–Trace™ is designed to be conveniently used inside a laminar flow cabinet.
- Full traceability of information related to the seeded target plate (patient information, specimen description, presumptive culture isolate name and other patient identifiers).
- Accurate management of isolates and their correct placement on target spots.
- Automatic on-screen display of the number and location of target spots seeded.
- Different operational modes and integration with different systems: HighFlexX, WASPLab™ Image Recording.
- Open flexible system for future integrations with other laboratory Middleware or LIMS systems.
- Ergonomic target plate holder that prevents accidental contamination of perimeter target spots during transport prior to insertion into the MALDI–TOF.

further information

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

Swabs for every application

Medical Wire is the specialist in swab-based specimen collection. In addition to manufacturing Transwab®, the leading range of liquid and semi-solid medium transport swabs, it offers an exceptional range of **dry swabs** for every conceivable application. Whether swabbing frogs in the Amazon forests for chytrid fungus, chickens for avian flu, or pipework for biofilm, whether testing is conventional or molecular, Medical Wire has the device.

Dry swabs come with advanced bud materials including PurFlock® and HydraFlock® multifilament flocked fibres, Sigma-Swabs® with cellular polyurethane foam, or spun fibres rayon and polyester. Shafts are available in plastic or wire with varying flexibility or rigidity. Swabs with nylon bristles are used for cervical smears, while some very long swabs with bud or brush ends are used for larger animals.

Dry swabs are supplied in three formats. Labelled tubes with the swab mounted in the cap are self-contained and ideal for the transport of certain specimens. Individual swabs in sterile peel pouches are convenient when a test is performed immediately. Multiple packs may be suitable when samples are to be pooled.

further information

Visit: www.mwe.co.uk
Tel: +44 (0) 1225 810361
Email: sales@mwe.co.uk

NEW — rapid detection of Carbapenemase resistance mechanism in less than two hours.

Rapid Carbapenemase Screen is a simple, two hour, test that will detect the presence of carbapenem resistant organisms in fresh culture, blood culture and urine specimens.

Based on the Carba-NP as described by Norddmann, Poirel & Dortet and mentioned in the both the HPA (PHE) document on detecting carbapenemases and the Eucast draft guidelines for detecting resistance mechanisms. Rosco's Rapid Carbapenemase Screen has the required reagents in tablet form together with a negative control to help interpret borderline reactions (product code 98021).

Carba NP is a microtitre based method which (at the time of writing — September 2013) is not commercially available. However, promising evaluations have been published, both on plate cultures, and on pellets obtained by centrifuging blood cultures by laboratories with the facilities to reproduce the test method in-house. Although Rapid Carbapenemase Screen has yet to have published evaluations early results from a London Teaching hospital show the test is easy to perform and read and gave 100% correlation with known carbapenemases and non-carbapenemases.

To find out more about this new product and how they can help in your laboratory testing please visit the BioConnections website, alternatively contact us by email or by telephone.

further information

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

Comprehensive veterinary vaccines product development service

VLA Scientific offers a range of services for livestock pharmaceutical and vaccine research and development. Our services extend from data generation during initial research through to batch testing on finished products.

We have a wealth of experience of *in-vitro* and *in-vivo* techniques with expertise in infectious disease modelling, efficacy and safety testing. Benefits include access to comprehensive libraries of bacterial, viral and parasitic organisms and our extensive facilities enable us to work with organisms requiring containment ACDP level 3 and SAPO category 4.

In addition to these services, our clients have access to world leading livestock disease experts in pathology, epidemiology, microbiology, parasitology and virology who can advise on recent research findings as well as model development and study design.

Our vaccine development services include:

- Primary research
- Antigen development
- Antibody and antigen detection
- Testing for attenuation
- Extraneous agents testing
- Efficacy, safety and bioequivalence testing

Where necessary, our services are performed in accordance with Good Laboratory Practice, Good Manufacturing Practice and Good Clinical Practice (veterinary) with a minimum site standard for all activities of ISO 9001 and ISO17025 for most of the testing work.

further information

Visit: www.ahvlascientific.com
Tel:+44 (0)1932 357641
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information

Are you a Corporate Member of the Society? If so, this section of *Microbiologist* is for you. Here you can publish short press releases, acquisition notices, news of new staff appointments, technical developments and much more.

Each Corporate Member of the society may publish ***up to*** 200 words on a topic related to their field of activity in each issue of *Microbiologist*. For further information please contact Nancy Mendoza by email at: **nancy@sfam.org.uk**

Both Corporate Members and Ordinary Members of the Society will find a wealth of useful information and resources in this section.

sfam events in 2014

Save the dates!

Wednesday 15 January 2014

Winter Meeting

- **Food contamination: the food handler's role**
- **Biodefence**

  Including the Denver Russell Memorial Lecture

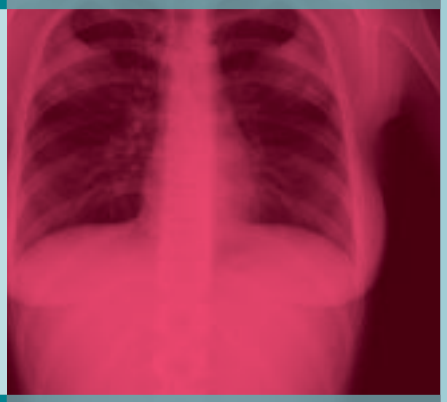
The Royal Society, London, UK

Wednesday 30 April 2014

Spring Meeting

8th broadening microbiology horizons in biomedical science meeting

- **Control of infection: current status and future prospects**



The Sheffield Hilton Hotel, Sheffield, UK

30 June – 3 July 2014

Summer Conference

- **Zoonoses**
  - In conjunction with the Med-Vet-Net Association
  - Including the *Journal of Applied Microbiology* (JAM) Lecture

The Grand Hotel, Brighton, UK

For further information on these events please visit www.sfam.org.uk/events
or contact Sally Hawkes ■ Email: sally@sfam.org.uk ■ Telephone +44 (0)1933 382191

PRO-LAB DIAGNOSTICS

Celebrating 21 years of unparalleled success!

Microbank™ Bacterial & Fungal Preservation System

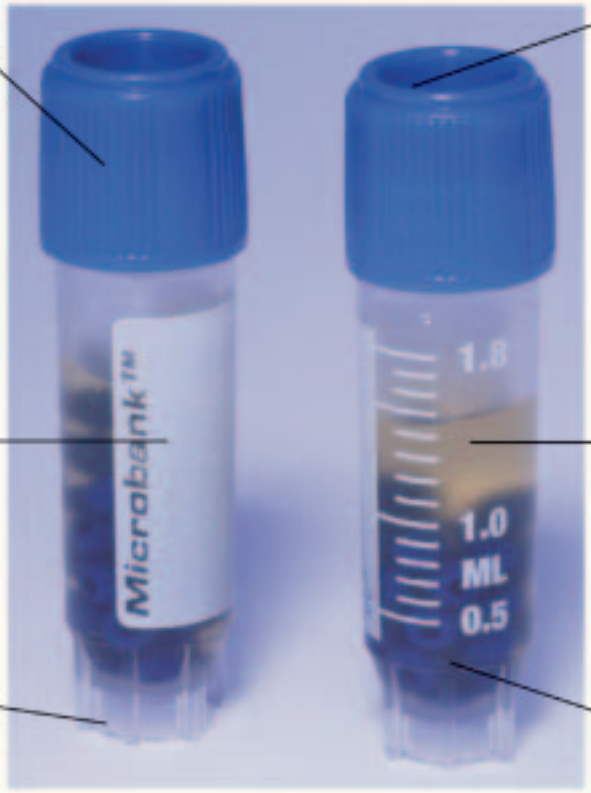
Microbank™ is a convenient, ready-to-use system designed to greatly simplify the storage and retrieval of bacterial cultures. It is composed of a unique cryovial system incorporating treated beads and a special cryopreservative solution.

Microbank™ has proven performance and is now the natural choice for microbiologists world-wide and for many specific reference culture collection centres. Microbank™ is a more reliable method for maintaining important cultures than repetitive subculture, which can result in altered characteristics, lost organisms, or contaminated cultures. Microbank™ is much simpler than traditional methods of lyophilization or glycerol broth.

Large 2 ml vials with triple depth external threaded cap which reduces the possibility of contamination. Wider tube diameter provides more room for mixing to ensure beads are properly coated.

Larger writing area allows for complete coding and reference data.

Industry-standard robust cryovial can withstand snap freezing with liquid nitrogen.



Available in five colours to provide laboratories with a system to colour-code different bacterial species.

Specially formulated preservative ensures longer survival of fastidious bacteria and higher quantitative recoveries.

Chemically treated beads improve bacterial adhesion.

Microbank™ World Wide Performance Portfolio

Microbank™ has enjoyed many years of success as the method of choice for storage and retrieval of bacterial and fungal cultures. Extensive reference data are available from customers, centres of excellence, and reference collection sites around the world detailing up to 21 year's successful storage of an extensive range of cultures. Full details can be obtained in the Microbank™ World Wide Performance Portfolio available on the Pro-Lab website.

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