microbiologist

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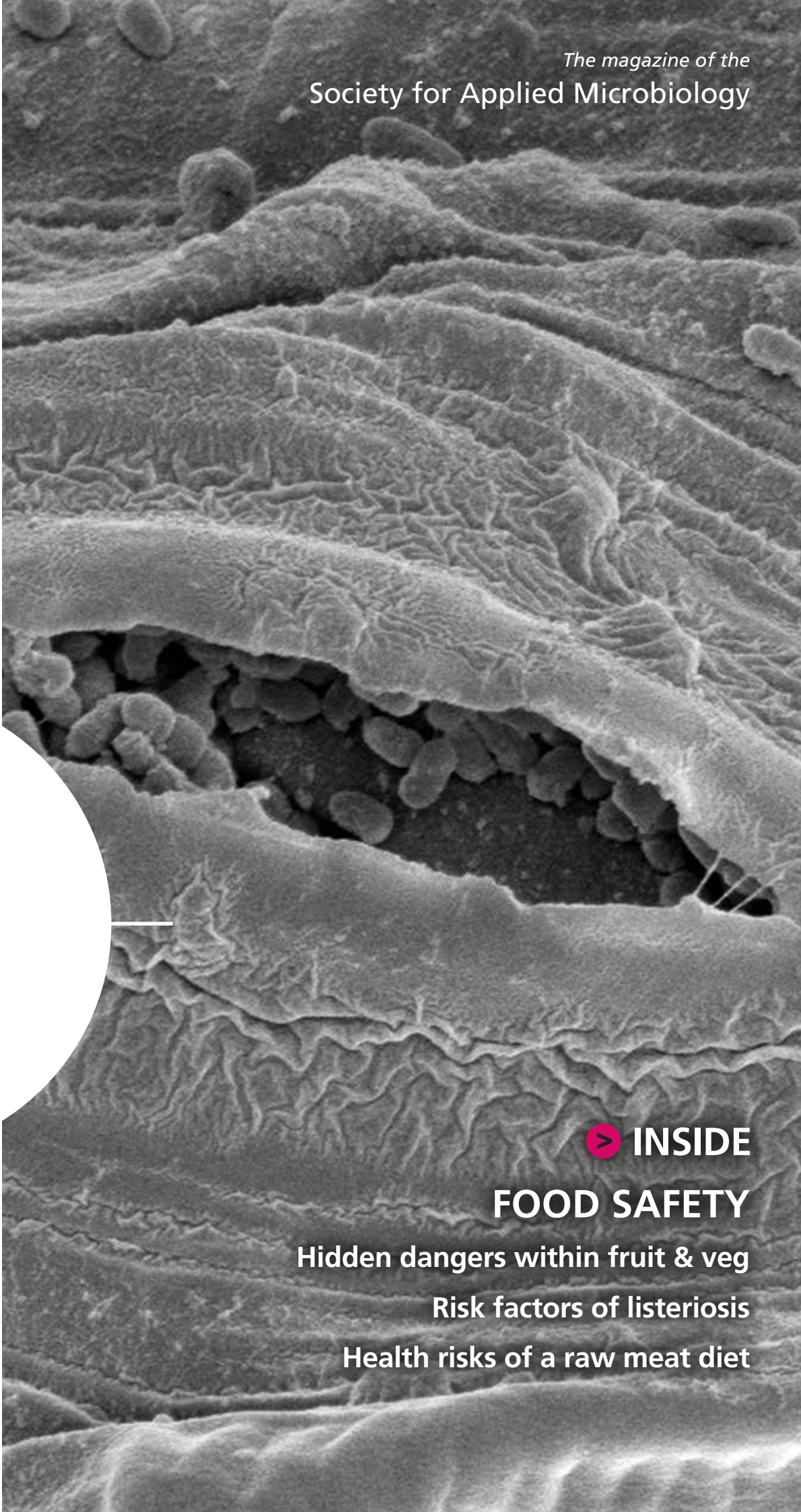

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Hidden dangers within fruit & veg

Risk factors of listeriosis

Health risks of a raw meat diet

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Paul Sainsbury reviews the content of this issue

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Food safety involves everybody in the food chain

In this issue of *Microbiologist* food safety takes centre stage. Many people who know me well will grimace at this Editorial, for I once poisoned an entire dinner party with *Campylobacter jejuni* after an "it'll be alright" attitude to some three-day old cooked chicken I put in their enchiladas. It took some of my friends and myself up to 10 days to clear an infection which was an extremely painful and unpleasant experience. With a background in microbiology, chemistry and toxicology you would have thought I wouldn't have been so crazy as to mess with the safety of food I was preparing for others. I guess in my case sometimes there's a huge gap between grasping something intellectually and applying it to one's life.

Now other than avoiding a home-cooked meal from me, when you think about the food you are going to eat, you are probably more concerned with the cost these days rather than whether the product is safe to eat. Certainly in the developed world we have a high standard of food safety, but not everyone enjoys this luxury. Statistics from the WHO in 2015 estimate that more than 2 million people die each year from diarrhoeal disease contracted from contaminated food and water. Even within the United Kingdom, with its many rules and regulations on food hygiene there are still more than 500,000 cases of food poisoning a year from known pathogens - with Government figures quoting a cost of more than £1.5 billion to the economy. So not only is a safe food supply one of life's fundamental necessities, essential for health and well-being, it is also vital for economic growth and development.

In our first feature Nicola Holden discusses how even the consumption of fruit and salad, important components of a healthy lifestyle can still put you at risk of some nasty pathogens. Ellen Evans provides us with a comprehensive review addressing risk factors associated with listeriosis in older-adults. Our ECS Chair, Sabrina Roberts, talks novel food policy and Nicola Williams and Vanessa Schmidt show us "*you are what you eat*" may not just be a saying we should apply to humans. A Historical perspectives looks at the life of Italian microbe hunter Lazzaro Spallanzani and Martin Adams brings us the first of a new series for 2016: "London's Microbiota".

I have also just received news that S*f*AM's annual Early Career Scientist conference for 2016 will be on *Bioethics* and held in October. The conference will be followed by the annual *Environmental Microbiology* (EMI) lecture and this year we are very excited to host Professor Margaret McFall-Ngai who is a pioneer and leader in the field on animal–microbe interactions. Make sure you check the events section of our website for the most up-to-date details on this and all the Society's events.

And finally, for those of you interested in the image on the front cover, this is a scanning electron microscopy image of *Salmonella* in lettuce stomata and winner of the 2015 image competition.

NEWS IN BRIEF

MicrobeBlog
The Society's blogging site was launched with some great features, opinion pieces and video content. Be sure to visit.
http://MicrobeBlog.org

Zika virus
The Zika virus, an alarming and disturbing infection spreads rapidly through the Americas.
http://bbc.in/1nOHCKP

Are beards good for your health?
Researchers find bacteria which appear to be producing a novel form of antibiotic in the beards of tested hospital staff.
http://bbc.in/1Jhm4jI

Paul Sainsbury, *Editor*

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Looking BACK and Looking FORWARD

Looking BACK

As I write this article, we're back at work after the festive holidays and I'm reflecting on 2015 and our achievements as a Society during the previous year. I'm struck by the fact that each new activity or result is about engagement. Each achievement has resulted in increased engagement – not only with current Members – but with the microbiology community more widely.

The first and most obvious achievement is the addition we've made to our meetings calendar. The first S*f*AM AMR meeting was held on 7 December 2015 (see page 34) as our first 'ad hoc' meeting. We added this new meeting to our repertoire to enable us to really demonstrate our agility and efficiency as an organization. In responding to the needs / wants of our Members, our Corporate Members, as well as the external environment, we went from initial discussion to a highly successful, one-day meeting – including an associated public engagement event – in less than six months. Feedback from that meeting has been very positive, with 96% of respondents saying that they'd attend another similar meeting if we were to hold one again in the future.

During 2015 we began the process of installing a new CRM system which will be close to go live as you read this piece. This will enable us as an organization to really get to know you, our Members – your interests and your priorities – and this will undoubtedly enable us to ensure we continue to provide relevant membership benefits. Not only will it allow us to engage with our current Members, it will also enable us to stay in touch with our friends, and bring others into the S*f*AM community.

We significantly increased our global reach and engagement through social media, with Facebook followers increasing from 1,017 to 21,655 (a nearly 2,100 % increase on the previous year), LinkedIn members increasing from 3,581 to 4,197 (up 17%) and our Twitter followers increasing from 4,039 to 5,635 (up 40%). And the new S*f*AM blog which I've already alluded to, continues to provide relevant, useful and sometimes not-so-serious content for Members and non-Members alike.

We continue to engage with early career scientists through our Early Career Scientists committee (ECS). As a demographic, early career scientists are a group with which we've held particularly strong relationships throughout the life of the Society. I often meet long-standing Members who joined the Society in their student days and have remained Members throughout their career. When I ask them what it is about S*f*AM that fosters such long-term commitment, nine times out of ten I'm greeted with a response which reflects the culture of the Society as one of openness, inclusivity and relevance. Our ECS committee are held up as an exemplar of how to truly engage with early career scientists. This group work extremely hard to ensure the Society as a whole remains relevant. A great example is their Autumn meeting and you will can read about last years' in this issue of the *Microbiologist*. But it's not just early career scientists who are supported by the work we do. When we're out and about and I'm talking to current Members, I often need to remind those at later stages of their career that our benefits are applicable to all Members no matter what stage of career they are at and where in the world they are located.

Engaging with the wider bioscience sector and relevant interdisciplinary communities is another achievement of 2015. Through the LeSPAR network we have worked to highlight the importance of interdisciplinary research into AMR and this work has involved scientists and engineers at all stages of their careers, in a wide variety of disciplines, through collaborative workshops. LeSPAR aims to provide a single, unified voice and mobilize the UK's collective research community in order to enhance understanding and knowledge-sharing between academia, industry and clinicians. The group is focused on taking action, championing best practice and raising awareness of the global challenge of AMR. Key objectives of the workshops were opportunities to network with researchers in other disciplines, keeping up-to-date with the latest AMR research and learning about AMR funding opportunities. 98% of delegates who completed the evaluation survey agreed that these objectives were met.

Looking **FORWARD**

In the last issue of *Microbiologist*, I asked the question: what does it mean to be an applied microbiologist in 2015? Thank you to those who took the time to respond. The responses were broad and varied, and have provided us with some good insights and a starting point for some interesting discussions.

The areas of commonality between responses describe applied microbiology as translational research with real-world applications which provide societal benefits in industry, the environment, food, and human and animal health. Being an applied microbiologist is about demonstrating the impact of research outcomes through, for example, the development of new technologies to provide point of care diagnostics, detection methods in food processing and manufacture, or effective bioremediation of pollutant chemicals. Of course these are just a few examples and there are a vast number of applications of microbiology which you, our Members, are taking forward. As a Society we look forward to remaining in touch with developments in these areas by continuing to engage our current and potential Members throughout 2016 and beyond.

Lucy Harper
SfAM *Chief Executive*

President's column

Some of you may have seen the media coverage that the University of Nottingham received before Christmas regarding the 46 year-old home-made Christmas pudding discovered in a house clearance and sent to our Microbiology Investigation Centre (www.microbe.org). It made the UK national news including yours truly unwrapping the pudding. I also did some radio interviews about it, including a very early Christmas Eve morning (their time) broadcast for Radio New Zealand. Most people were interested in what the pudding was like (i.e., food quality) but I was also asked about its safety. In the case of the Christmas pudding it was quite simple as the traditional recipes for these involve prolonged periods of boiling to cook them initially, and then the cooked puddings have very low water activity (due to the content of suet, dried fruit and alcohol amongst other things) and are sealed to exclude air, resulting in a very low risk of microbial growth. However, I guess for consumers used to best-before and use-by date information on all prepared foods then trying to decide if something would be safe to eat which lacks that information is quite difficult. This is often cited as the reason so much of our food is wasted as people throw away food because it is out of date when in fact it is fine to eat. I have previously done local radio items on food labelling and invariably someone comments that they have eaten out-of-date foods and they suffered no ill effects. It is then necessary to explain firstly the difference between best-before (quality) and use-by (safety) labelling which is a distinction many people do not make and means perfectly safe food can be wasted. However, the most

difficult aspect to get across is always that of level of risk and how that may vary, especially in relation to the individual person concerned. The best analogy I have devised so far is that of crossing the road and if you always use a controlled crossing and, if not (because you are fit and healthy and can readily judge if it is safe), if your actions would be influenced if you were crossing with a toddler or elderly person. I would be interested to know how other people approach explaining this to a lay audience.

Food safety and foodborne disease is of course a major issue in terms of the cost to health worldwide and is one of the areas of applied microbiology in which many of our Members have expressed an interest for future meetings via our Members' survey. We are, therefore, planning that the Summer Conference in 2017 will have a food safety theme and more details will be available later in the year.

The Summer Conference in 2017 will have a **food safety theme**

Christine Dodd
President of the Society

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Foodborne illness associated with fruit and veg

Fresh fruit and vegetables are an important component of a healthy lifestyle, associated with the reduction of chronic diseases. Indeed, increased consumption is promoted at Governmental and national health level. Plant-derived metabolites are known to have health benefits, some of which can be lost on processing and cooking, promoting their consumption as raw or minimally processed. In recent times, however, the image of fresh fruit and vegetables has become tainted with a darker side: the association of foodborne pathogens. Notable outbreaks of foodborne illness have arisen from a variety of foodstuffs that are eaten raw, such as sprouted seeds, leafy greens used in salads and fruit such as tomatoes and melons. There have been some very large-scale outbreaks, most recently from *E. coli* O104:H4 associated with sprouted seeds, and on a global scale, fresh produce can account for 25 to 30% of foodborne outbreaks.

Causative organisms

The pathogens most likely to contaminate fresh produce and subsequently cause disease are viruses, bacteria and some parasites. These include norovirus, hepatitis E, *E. coli*, non-typhoidal *Salmonella enterica*, *Listeria monocytogenes*, *Cryptosporidium* and *Cyclospora*. Although at first glance the list seems like the 'normal suspects' of foodborne illness, the life cycle of the pathogen impacts firstly how the plant becomes contaminated with the pathogen and subsequently, how the interaction between plant and pathogen develops. Norovirus is one of the major culprits, responsible for probably the greatest number of cases (although it is always hard to quantify the true number of short-lived and self-limiting illnesses). It is hardy and easily transmitted by contact and so is often associated with soft fruit that are picked by hand. The oocysts of parasites such as *Crytosporidium* are also hardy and can be very long-lived in the environment. They are normally associated with water and this is presumably the main route of transmission via irrigation water, onto for example, leafy greens.

Plant–microbe interactions

An important aspect to both viruses and parasites is that they require animals for replication and so their association with plants is purely passive: it is an unfortunate event that transmits them onto the plant that ends up on a plate. On the other hand, some

bacterial pathogens have quite a different relationship with the plant. They are transmitted via similar pathways, from irrigation water, or where the pathogens have an association with farm animals, from manure. However, once the bacteria contact the plant surface, they can undergo a series of very specific molecular interactions and assuming there are sufficient nutrients available, they can replicate and use the plants as alternative or secondary hosts. This has been well demonstrated for *Salm. enterica* and pathogenic *E. coli*, and to some extent for the environmental-associated pathogen *L. monocytogenes*. Regardless of the pathogen type, assuming it is present in sufficient quantities to cause disease to humans at the end of the food chain, horticultural plants can be considered a reservoir, albeit a temporary one, and, therefore, a risk of foodborne disease.

Attachment

Contact with the external tissues of the plant either occurs on the leafy tissue or with the roots below ground. Bacteria can undergo intimate attachment through surface appendages, including flagella and fimbriae. For *E. coli* these interact with the plant cell membrane and carbohydrate molecules in the cell wall, respectively, e.g., flagella-mediated attachment of *E. coli* O157:H7 to charged plasma membrane lipids in *Arabidposis thaliana* cells (Figure 1, (Rossez *et al*., 2014a; Rossez et al., 2014b)). The attachment mechanisms bear resemblance to that seen with animal hosts, and bacteria that lack these attachment mechanisms are impaired in their ability to colonize.

Establishment and growth

Adherent bacteria are able to grow and form colonies on plant tissue, and for those that have been investigated in detail, roots appear to be the preferred site for colonization (Figure 2). Although colonies can develop on leafy tissue, they are not as extensive because this represents a harsher environment, with exposure to UV and lack of water and/or nutrient availability. In contrast, the roots and surrounding zone (termed the rhizosphere) represent a nutrient-rich environment as a result of exudation of plant-derived carbohydrates and amino acids. Indeed, the rhizosphere is richly inhabited by a microbial community that can equal that found in the animal gut in terms of density and diversity. It is perfectly possible for *E. coli* and *Salm. enterica* to succeed in this environment, taking advantage of their wide metabolic capability and mesophilic nature.

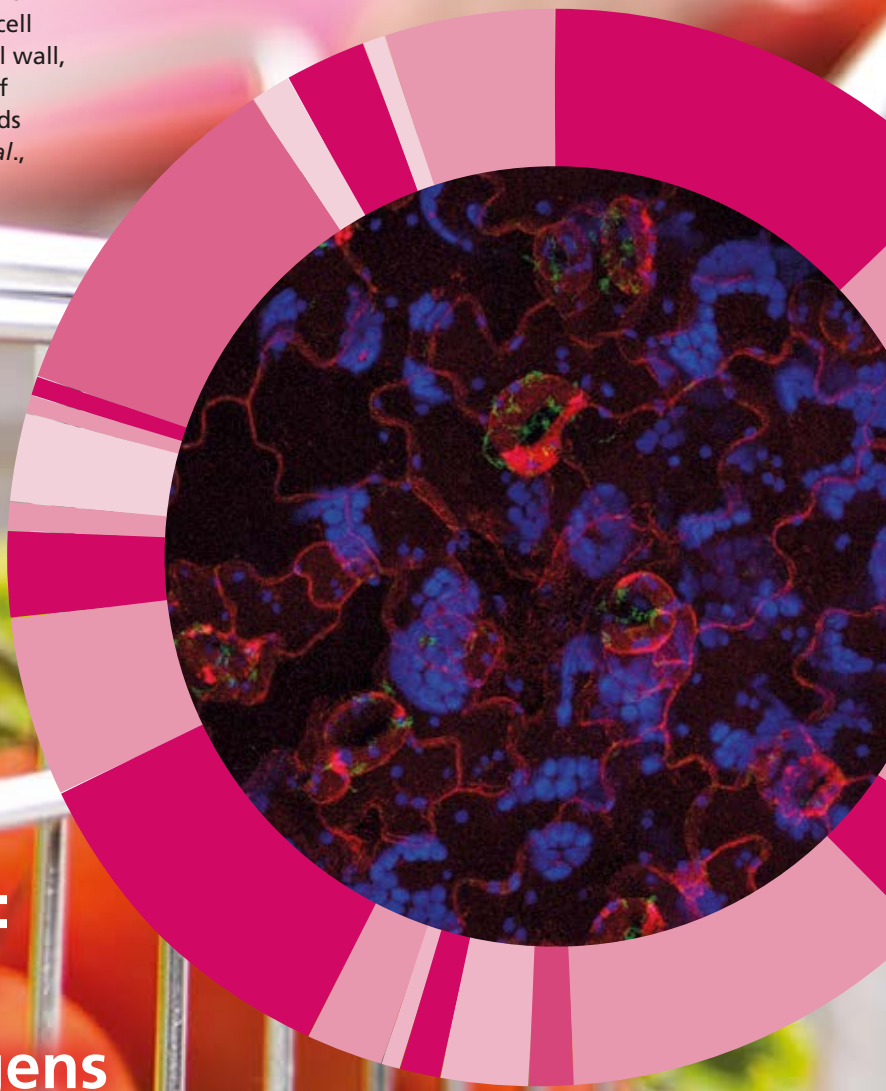

Figure 1 *(right) Flagella of E. coli* O157:H7 *(coloured green) mediate attachment to charged lipids present in cell plasma membranes (red) of Arabidposis thaliana (chloroplasts in blue).*
Yannick Rossez, James Hutton Institute.

The image of fresh fruit and vegetables has become tainted with a darker side: the association of foodborne pathogens

Those bacteria that do venture inside will need to be prepared to withstand a robust defence response

Figure 2 *E. coli O157:H7 (coloured green) colonize the area surrounding an emerging lateral root on spinach (Spinacia oleracea) plants (purple). Kathryn Wright, the James Hutton Institute*

Host defence and microbial competition

However, in order to succeed in this environment, the bacteria need some extra tricks in their armoury. Plants have an active immune system based on recognition of microbe-associated molecular patterns (MAMPs), which works at a basal level akin to innate immunity in animals, and triggers resistance against a broad spectrum of microbes. There is a second, more complex layer of resistance that is based on specific recognition of effector molecules, delivered by the 'professional' plant pathogens. This ultimately triggers a localized cell death response in the host in an attempt to contain the pathogen and prevent its spread. *E. coli* and *Salm. enterica* both trigger the MAMP-based response, through recognition of common motifs like those found in flagellum proteins. There is some evidence that *Salm. enterica* can subvert this first layer of host response, in some cases by targeting defence pathways that are shared in animal hosts (Brunner and Fraiture, 2014). The precise mechanism of this counter-defence strategy has still to be elucidated, as does characterization of and differences between foodborne bacteria.

Established colonies on plant tissue do appear to have some aspects of physical protection, since various biofilm components are often linked to successful colonization. This would make sense as a strategy to cope with antimicrobial compounds produced by the plant host, but also from other microbial competitors. Components of curli and cellulose have both been associated with promoting colonization, although there are apparent differences that are dependent on the bacterial species and probably plant factors too.

An interesting aspect to plant colonization by *E. coli* and *Salm. enterica* is that they can invade plant tissue, in a similar manner to their plant-associated cousins (e.g., *Serratia* or *Pectobacterium* species). This allows the development of colonies in extracellular spaces, which may provide a two-fold advantage compared with the external tissue: better access to plant-derived nutrients and greatly reduced microbial competition. Of course, those bacteria that do venture inside will need to be prepared to withstand a robust defence response from the plant.

What is the real risk and what are we doing about it?

The interactions between foodborne bacteria and plant hosts although fascinating, is a serious threat to food safety. Thus, it is important to determine the real risk for the growers and producers, and to the consumer. Although pathogenic *E. coli*, such as the verocytotoxigenic (VTEC) pathotypes like O157:H7 can persist in soil and manure for many months, transmission to and successful colonization of plants in the field appears to be relatively rare. This is up-held by the relatively low number of cases as seen in the context of the amount of fresh produce consumed on a daily basis. The largest foodborne outbreak of VTEC O157:H7 in the UK occurred in 2011 and was associated with soil-contaminated vegetables (Launders *et al*., 2016), resulting in 254 reported cases. We need many more studies in order to definitively assess and quantify the risk, and there are numerous unanswered questions. For example, it is hard to assess the viability of the bacteria at each stage of its life cycle within environmental compartments, and how that impacts the outcome on harvestable plants.

Implementation of guidance for growers and critical control points during production help to reduce the risk. However, the face of farming and horticultural practice is changing: every aspect of agriculture is under increasing pressure to intensify production, cut margins and to provide innovative products for the consumer. The impact of these changes on the likelihood of successful plant colonization by foodborne pathogens needs to be taken into account, to assess the potential risk. What is clear though is that new light has been shed on a hitherto under-appreciated aspect of the life cycle of these pathogens, greatly broadening our narrow view beyond their animal-associated interactions.

FURTHER READING

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Nicola Holden
James Hutton Institute

Domestic kitchen **risk factors of listeriosis** among older-adult consumers

Listeriosis associated with older-adult consumers

Listeria monocytogenes, the causative agent of human listeriosis, is reported to be associated with the highest hospitalization (<95%) and mortality rates (<41%) of foodborne pathogens in the UK. Due to its characteristics of being a psychrotrophic mesophile and a facultative anaerobe, *L. monocytogenes* has the ability to survive and grow at refrigeration temperatures in vacuum packed food. Extended storage times may allow high numbers to be reached. Consequently, ready-to-eat (RTE) food products that have refrigerated extended shelf-life are commonly associated with listeriosis.

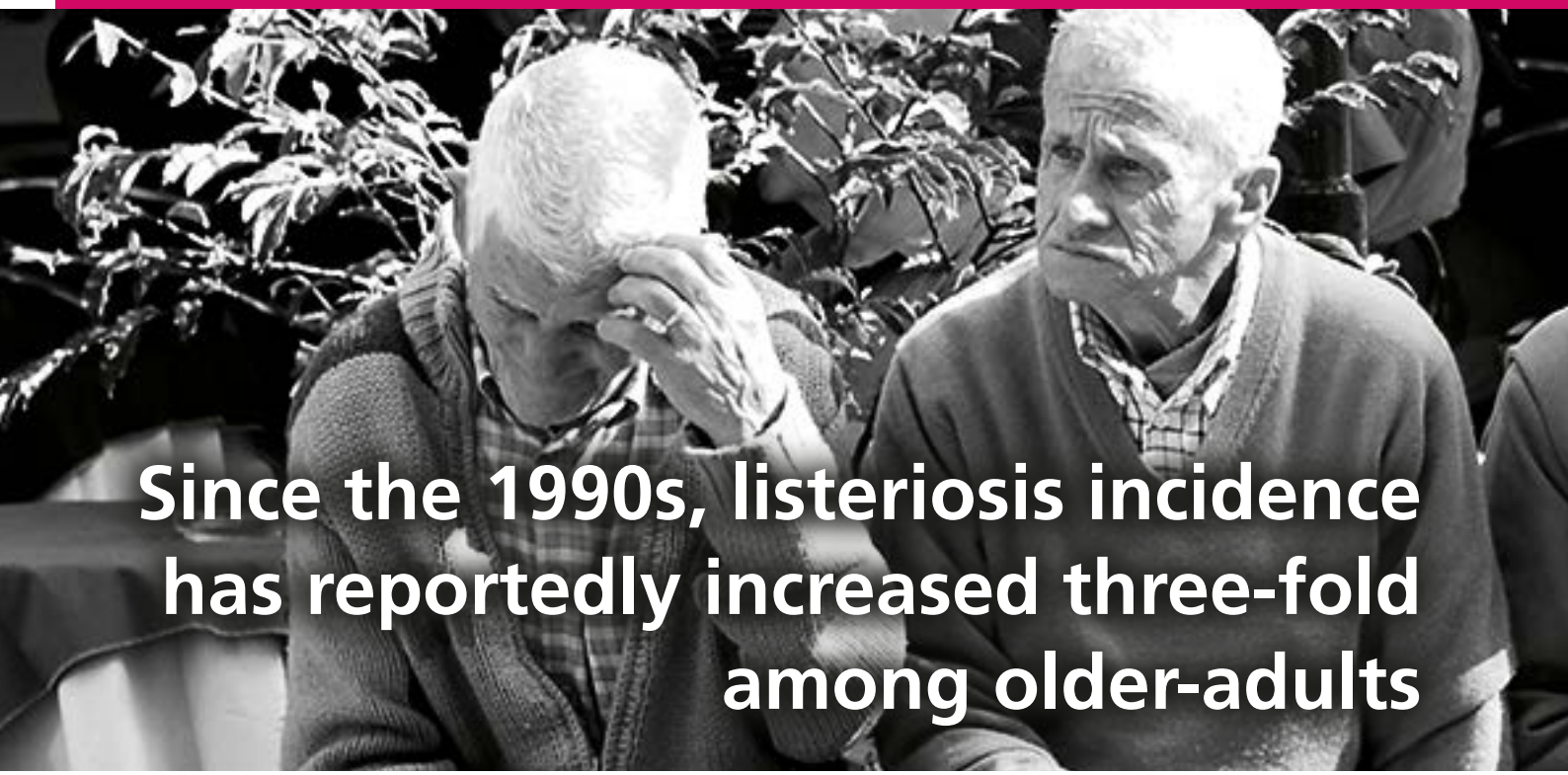
Subsequently, consumers need to ensure practices that prevent the growth of *L. monocytogenes* are followed when storing RTE foods in the domestic kitchen. Thus, safeguarding food from microbial growth and reducing the potential risk of listeriosis. Consumer food safety recommendations to reduce the risk of listeriosis at home include:

a) following 'use-by' dates on unopened pre-packed RTE food products.

b) consuming RTE foods within two days of opening.

c) ensuring the safe operating temperatures of domestic refrigerators (≤5˚C).

Since the 1990s, listeriosis incidence has reportedly increased three-fold among older-adults (aged ≤60 years), with the majority of illness and fatalities associated with this 'at-risk' consumer group, whereas listeriosis was previously associated with pregnant women (Gillespie *et al*., 2006). Granted, older-adults are at an increased risk of foodborne illness due to age-associated weakened immunity; however, this alone is not believed to explain the substantial increase. Incidentally, market intelligence suggests that older-adults are the greatest consumers of some RTE foods associated with *L. monocytogenes*. As the reasons for the increase remain unclear, the Advisory Committee on the Microbiological Safety of Food (ACMSF)



Since the 1990s, listeriosis incidence has reportedly increased three-fold among older-adults

recommended the need to determine the food storage and consumption behaviours of older-adults to ascertain contributing factors to the risk of listeriosis (ACMSF, 2008).

In light of such recommendations, recently published consumer food safety research from the Food Industry Centre has focused upon the cognitive and behavioural risk factors of older-adults associated with the risk of listeriosis in the domestic kitchen.

Review of consumer food safety studies to identify listeriosis risk factors

An in-depth review of cognitive and behavioural data relating to risk factors associated with listeriosis, as reported in 165 consumer food safety studies, was conducted. The review findings determined that less than half (41%) of studies included assessment of consumer cognitive or behavioural data associated with listeriosis; of these, 59% included data on safe refrigeration, 54% included data on storage of RTE foods and 49% included data on adherence to 'use-by' dates. In most studies (83%), survey-based data collection methods (questionnaires/interviews) were used; thus, the majority of findings were based on self-report (74%) and knowledge (44%). Observation (31%) and focus groups (12%) were less commonly used, resulting in a lack of actual behavioural and attitudinal data relating to listeriosis risk factors. Only 7% of studies included food safety data for older-adults. Completion of this review reveals a need for in-depth research to determine attitudes and actual behaviours of older-adults in conjunction with

knowledge and self-report of practices associated with listeriosis. Combining cognitive and behavioural data can achieve a cumulative multilayered in-depth understanding of consumer food safety behaviour and cognition.

Cognitive risk factors associated with listeriosis in the domestic kitchen

As a result of the review findings, a study was conducted to ascertain the cognition of older-adults in relation to domestic food handling and storage practices that may increase the risks associated with *L. monocytogenes*. An interview and questionnaire were designed, developed and conducted with 100 older-adults to determine knowledge, self-reported practices and attitudes towards recommended practices to reduce the risks associated with listeriosis. Although the majority of older-adults (79%) had positive attitudes toward refrigeration, 84% were unaware of

recommended temperatures (5˚C) and 65% self-reported to "never" check the operating temperature of their refrigerator. Although most older-adults in the study (72%) knew that the 'use-by' date on food products indicated food safety and 62% reported "always" taking note of 'use-by' dates, neutral attitudes were held, with 67% believing it was safe to eat food beyond 'use-by' dates and 57% reporting doing so. Attitudes toward consuming RTE foods within the recommended two days of opening were neutral, with 55% aware of recommendations and 84% reporting that they consume RTE foods beyond recommendations.

Although knowledgeable of some key practices, the older-adult consumers in this study self-reported potentially unsafe practices when storing RTE foods at home, which may increase risks associated with *L. monocytogenes*. The study determined that older-adults' food safety cognition may affect their behaviours; understanding consumer food safety cognition is essential for developing targeted food safety education. However, this study determined the need to establish the actual behaviours of older-adults that may increase the risks associated with listeriosis in addition to the cognitive risk factors.

Behavioural risk factors associated with listeriosis in the domestic kitchen

Given that the home kitchen is recognized as a significant location where foodborne illnesses are acquired, it is important to gain insight on the actual behaviours of consumers in their own homes that can impact on the safety of food.

Consequently, observation and microbiological analysis were utilized to determine actual food storage practices to identify behavioural risk factors. A domestic kitchen survey was conducted in the domestic kitchens of the older-adults (n=100). Forty-one per cent of foods in home refrigerators were observed to be beyond the 'use-by' date, of which 11% were unopened RTE food products commonly associated with listeriosis. Sixty-six per cent of opened RTE foods had been or were intended to be stored beyond the recommended two days after opening. It was also established that many older-adults failed to ensure safe refrigeration temperatures, as illustrated in Figure 1, 50% of central food storage areas and 85% of door storage areas were operating at temperatures exceeding recommendations (5˚C). Furthermore, statistical analysis established that older domestic refrigerators operated at significantly (p<0.05) higher temperatures.

L. monocytogenes was isolated in 2% of older-adult home kitchens, these included hand-contact sites such as a tap handle and a refrigerator door handle.

Consequently, these findings suggest that storage malpractices may have a greater effect on the potential risk of listeriosis than its presence alone in domestic kitchens. The study has determined that many older-adults fail to adhere to recommendations and subject RTE foods associated with *L. monocytogenes* to prolonged storage at unsafe temperatures which may render food unsafe for consumption.

Cumulative comparison of cognitive and behavioural risk factors associated with listeriosis

Food safety malpractices associated with listeriosis were determined to be greater among older-adults than literature suggests for consumers from the general population. A cumulative comparison of older-adult consumers' knowledge, attitudes, self-reported practices and observed behaviour data of listeriosis risk factors is presented in Table 1. It can be seen that although some older-adults were knowledgeable of recommendations, failure to implement was widespread. Additionally, statistical analyses have determined that significant associations exist according to cognition and behaviour.

Following 'use-by' dates on unopened pre-packed RTE food products

A significant association (p<0.001) was identified between older-adults' attitude and self-reported practices relating to 'use-by' dates, whereby older-adults with a negative attitude towards 'use-by' dates were significantly more likely to report consuming foods beyond the 'use-by' date than those with a positive attitude.

Ensuring refrigerator operating temperature is ≤5.0˚C

Older-adults with a positive attitude towards the importance of checking refrigeration temperatures were significantly more likely (p<0.001) to report 'always' checking the temperature of their refrigerator. Older-adults aware of recommended refrigeration temperature were significantly more likely (p<0.05) to report to 'always' check the refrigerator is cold, than those that were unaware. Furthermore, the self-

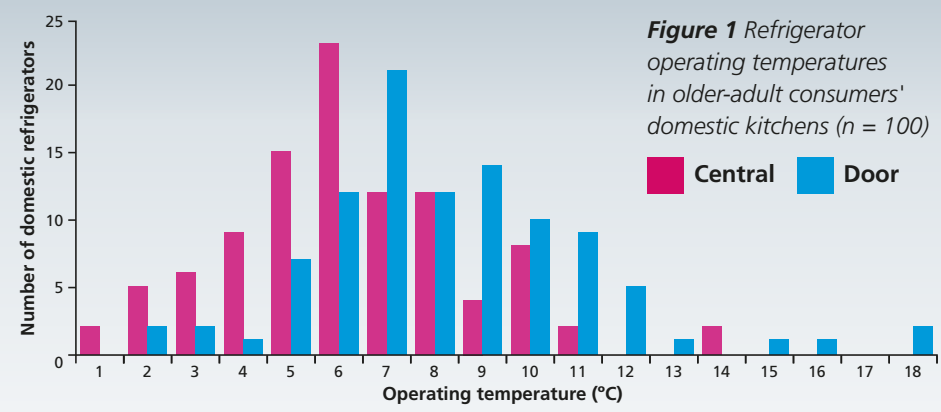


Figure 1 *Refrigerator operating temperatures in older-adult consumers' domestic kitchens (n = 100)*

reported frequency of checking the refrigerator temperature was significantly associated (p<0.05) with actual refrigerator operating temperatures, those reporting to not check the temperature were more likely to have refrigerators operating at temperatures exceeding recommendations (5.0˚C).

Consuming RTE food products within two days of opening

Older-adults with a positive attitude towards consuming foods within two days of opening were significantly more likely (p<0.005) to report 'always' implementing the practice. Older-adults' knowledge of recommended storage length was significantly associated (p<0.05) with self-reported frequency of consuming food products within the recommended two days after opening.

Three key practices associated with the risk of listeriosis

Cognitive and behavioural findings	Adequate refrigeration temperature (≥5.0 °C)	Following 'use-by' dates on RTE foods	Consuming RTE food within two days of opening
Attitudes	52% had a positive attitude towards checking the operating temperature of the refrigerator.	66% had a negative attitude towards consuming food with expired 'use-by' dates.	68% had a positive attitude towards the importance of consuming RTE food within two days of opening.
Knowledge	87% did not know the recommended refrigeration temperature (5.0 °C).	72% knew that the 'use-by' date was the best indicator of food safety.	16 – 44% aware that RTE food should be consumed within two days of opening.
Self-reported practice	65% reported to 'never' check refrigerator temperature.	57% reported keeping and consuming food beyond the 'use-by' dates.	72% failed to report that RTE food would 'always' be consumed within two days of opening.
Actual behaviour	<85% of domestic refrigerators were operating at temperatures ≥5.0 °C.	41% of domestic refrigerators contained RTE food products with expired 'use-by' dates.	30% of refrigerators that had opened RTE foods had been opened longer than the recommended two days.

Table 1 *Cumulative comparison of older-adults' knowledge, attitudes, self-reported and actual behaviours relating to the three key practices associated with the risk of listeriosis*

In conclusion

Overall, the research conducted at the Food Industry Centre has taken a novel approach to address the identified lack of older-adult data relating to the risks associated with listeriosis. An innovative combination of data collection methods and measures, which allowed for a cumulative comparison of cognitive, behavioural and microbiological data, has determined potential listeriosis risk factors in older-adults' domestic food safety practices. The findings provide an important insight on domestic food safety practices of a susceptible consumer group. Given that unsafe refrigeration temperatures and prolonged storage of RTE foods were identified, and that such storage malpractices were determined to be more widespread than the isolation of *L. monocytogenes*, findings suggest that storage malpractices may be a greater risk factor for listeriosis than the presence and potential cross-contamination of the pathogen.

Following completion of this consumer-based research, a laboratory-based re-enactment of identified storage malpractices has ascertained that such practices significantly increase the growth of *L. monocytogenes* in RTE food, thus increasing the relative risk of listeriosis, the findings of which are currently being prepared for publication.

Future targeted food safety education for older-adult consumers needs to increase awareness of listeriosis risk factors and improve attitudes towards associated food safety practices, particularly as it was established that both knowledge and attitudes were significantly associated with self-reported practices.

Consequently, these research findings have established that older-adult consumers' domestic kitchen food safety cognition and behaviour may contribute to the increased incidence of listeriosis among older-adult consumers in the UK.

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NOVEL FOOD POLICY

Food is an area that is always changing and progressing, and similarly to how Louis Pasteur found a way to kill bacteria in beer using heat over a hundred years ago, with the help of modern technology we still continue to develop innovative foods and food processes. This has given rise to a new area of foods called "novel foods".

Novel foods are foods which have not been consumed to a significant degree within the EU before 15 May 1997, when the first regulation on novel food came into force. All novel foods are required to undergo a mandatory pre-market safety assessment and authorization under the Novel Foods Regulation (EC) 258/97 before they can be legally marketed in the EU. With foods that have been consumed in at least one Member State before 15 May 1997 the Novel Foods Regulation does not apply and they can be marketed across the EU under the principle of "mutual agreement".

Novel foods can vary from newly developed and innovative food; food produced using new technologies and production processes as well as food traditionally eaten outside of the EU. These foods might be agriculture products such as seeds previously consumed by small populations in South America or lab-cultured meat which could provide a resource-efficient alternative protein source. Novel foods can be new sources of health-enhancing nutrients, new protein sources like edible insects, or processes such as nanotechnology. A food may be novel if the processing significantly changes the structure or nutrition. High pressure processing (HPP) (compressed water) used to control listeriosis bacteria in treated meat can make a product novel if it gives rise to significant changes in the food product.

Such foods considered to be novel are subject to a pre-market safety assessment before a decision is made on EU-wide authorization

Novel foods can vary from newly developed and innovative food; food produced using new technologies and production processes as well as food traditionally eaten outside of the EU

Such foods considered to be novel are subject to a pre-market safety assessment before a decision is made on EU-wide authorization. Companies need to provide evidence that the novel foods they intend to sell are safe for consumption. In the UK, the assessment of novel food is carried out by an independent committee of scientists appointed by the Food Standards Agency, the Advisory Committee on Novel Foods and Processes (ACNFP).

An important part of the novel foods assessment carried out by the ACNFP is evaluating undesirable substances which cover any microbiological risks that the novel food might have for those who might consume it. For the experts, this will include looking at parasites, viruses, bacteria, fungi and their toxins in relation to the proposed novel food.

Pathogens such as *Pseudomonas, Enterococcus*, *Bacillus* and *Clostridium* can get into foods from soil. High microbial counts can be present in foods grown in soil that has been contaminated by sewage. Therefore, storage and processing is an important factor that is considered in the assessment as this can be used to considerably reduce the microbial load. There may be spoilage organisms that need to be considered, for example, various spices can contain very high populations of mould and bacterial spores. Considering insects as novel foods, whilst it is known that bacterial species that may infect insects pose no risk to humans or animals there are bacteria that are introduced through carriage, rearing, handling, processing and preservation that can cause threat to the safety of consumers. Fungi, especially those producing mycotoxins and aflatoxins, can cause contamination directly or through the drying and storage conditions of insects.

As companies continue to develop new food products and processes, microbial assessment continues to be an integral part of the assessment of the safety of novel foods.

Sabrina Roberts
Novel Foods Scientific Policy Officer

Do **raw meat diets** pose health risks for our pets and us?

Raw meat can contain zoonotic enteric pathogens and may also act as a vehicle for transmission of AMR

Feeding raw meat diets to companion animals, although a long-lived practice has recently become popular due to the wide availability of commercial raw meat based diets. Despite a complete lack of evidence to support such claims there is a belief they are more 'natural' and provide health benefits to dogs as a raw meat diet is more reflective of the domestic dog's wild cousins, the wolf. However, foraging patterns and nutritional requirements of the domestic dog differ markedly from that of the wolf and a purely raw meat diet may be actually suboptimal for pets. The current evidence supporting the nutritional benefit of a raw meat diet is weak with the majority of available information being in the form of non-peer reviewed articles, testimonies or opinions on social media.

Regardless of the perceived benefits of raw meat diets, the question is whether the feeding of raw meat diets in a domestic environment poses a zoonotic risk? Recommendations to feed raw meat diets are of concern, as it is well reported that raw meat can contain zoonotic enteric pathogens, and may also act as a vehicle for transmission of antimicrobial resistance (AMR) with associated potential animal and public health risks, particularly for those at higher risk, e.g. the young, elderly or immune-suppressed. Furthermore, the sharing of bacteria e.g. *Escherichia coli* between people and pets in the household is well reported.

Carriage of *Campylobacter spp*. in dogs is common (c.40%), but is usually *C. upsaliensis* (c.96% of isolates) and asymptomatic. *C. jejuni* and *C. coli* may also be carried asymptomatically, but potentially could cause clinical campylobacteriosis; in comparison the carriage of *Salmonella* in healthy household dogs is low (c.3%). The carriage prevalence of faecal multidrug resistant (MDR) *E. coli* is common (10-30%), while carriage of extended spectrum beta-lactamase- (1-4%) or AmpC-producing (3-16%) *E. coli* that are resistant to third generation cephalosporins (3GCR) is less common in healthy dogs.

Our preliminary findings suggest that dogs eating raw meat diets are more likely to shed enteric pathogenic and AMR bacteria, however, how that translates into human risk and transmission requires further study. Raw meat and animal body parts, e.g., pigs' ears, may contain *Salmonella* spp., *Campylobacter* spp., *Clostridium difficile*, *Cl. perfringens*, ESBL/AmpC-producing *Enterobacteriaceae*, and enterohaemorrhagic strains of *E. coli* such as O157:H7, *Listeria monocytogenes*, *Yersinia enterocolitic*a, as well as parasites such as *Neospora caninum* and *Toxoplasma gondii* and helminthes.

Some commercial raw meat products claim to use high-pressure-pasteurization (HPP). Theoretically this method should destroy bacteria, but a recent recall of raw meat products contaminated with *Salmonella* and *L. moncytogenes* had undergone this sterilization method (FDA), so further evidence is required. Furthermore, not all owners buy commercial raw meat diets and may opt for buying raw meat direct from butchers, for example, to prepare themselves at home. Freezing of raw meat should also inhibit/kill some bacteria, but a recent examination of 45 samples of commercial frozen 'raw' food available in the UK found *Campylobacter* spp., *Salmonella* spp., methicillin-resistant staphylococci and MDR enterococci and *E. coli*. Hand hygiene should be strongly recommended and intense disinfection of all in-contact items as per normal handling of raw meat in a domestic kitchen although some studies suggest that *Salmonella* may be resistant to standard cleaning and disinfection.

Salmonella and *Campylobacter* infection in dogs is largely subclinical, with dogs shedding the infectious agent in their faeces without displaying any clinical

Contact with farm animals has been recognized as a risk factor for human carriage of AMR

signs of disease. Colonized individuals can act as a source of infection to other pets and humans, particularly where proper hygiene protocols are not practiced. There have, however, been some reports of *Salmonella* being a significant cause of gastroenteritis amongst kennelled greyhounds eating raw meat diets (Chengappa *et al*., 1993). There have been numerous reports of zoonotic salmonellosis in people (within veterinary facilities and households) originating from pet dogs and/or cats, including Salm. Typhimurium, Salm. Enteritidis and Salm. Paratyphi B serovars in Europe and the USA, highlighting the high potential for transmission of this bacterium. Human campylobacteriosis has also been attributed to dogs, in particular, contact with diarrhoeic or new pets, or contact between puppies and young children, although humans and dogs may share strains the direction of transfer cannot be proven.

Dog treats derived from animal parts are popular and may be a potential source of AMR or pathogenic bacteria. In particular *Salmonella*, including canine and human pathogenic and MDR serovars, can be found in canine treats, such as pigs' ears and other animal parts, and from commercial raw meat diets. Even in the last three months, the U.S. Health and Human Services (FDA) have recalled supplies of raw meat due to *Salmonella* and *L. monocytogenes* contamination. Eating raw meat is a reported risk factor for the detection of canine faecal *Salmonella*; Salm. Typhimurium, Heidelberg and Kentucky have been predominant. Furthermore, in a controlled laboratory study, dogs fed a single *salmonellae* contaminated commercial raw meat meal shed the organism in their faeces for up to 11 days (mean 4 days), although they were asymptomatic; prolonged shedding could therefore be expected with regular raw meat feeding.

Contact with farm animals has been recognized as a risk factor for human carriage of AMR. Faecal contamination of carcasses during processing is important for the dissemination of AMR and pathogenic bacteria. Food, particularly chicken meat, has been reported as a possible source of AMR bacteria (including Extraintestinal Pathogenic *E. Coli* [ExPEC] that are more likely to carry virulence factors and cause infections of the urinary tract for example) for humans and dogs. Eating raw meat was associated with clavulanate-amoxicillin, 3GCR, MDR and ESBL/AmpC producing faecal *E. coli* and ExPEC phylogenetic group D in dogs.

We recently detected faecal *E. coli*, *Campylobacter* spp. and *Salmonella* spp. from dogs eating raw meat versus cooked diets in a case-control study (n = 189). Dogs eating raw meat were much more likely to carry all investigated bacteria compared to the control group, including MDR and 3GCR *E. coli*. Further evidence on the risk of raw meat feeding from large cohort studies are required, in particular to determine the nutritional benefits or risk and to further examine the pet and human risk from bacterial faecal shedding.

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Acknowledgements: Ellyn Groat, Elizabeth Whitton, Claire Woods and Helen Easton

Food contamination

Food contamination is usually caused by bacteria, but it can also be caused by viruses, pesticides, natural toxins, moulds, parasites, and more.

Some of the main bacterial culprits of contamination are described here.

Bacillus cereus

Cooked rice and pasta, meat products, vegetables

Neonates are particularly vulnerable, as those receiving total parenteral nutrition contaminated with *B. cereus* can develop septicaemia, with a 50% mortality rate.

Campylobacter jejuni

Undercooked meat and poultry, raw milk and cross-contaminated food

This species of pathogenic bacteria is one of the most common causes of human gastroenteritis in the world.

Clostridium botulinum

Faulty processed canned meat and vegetables, cured meat and raw fish

Honey can contain the bacteria that causes infant botulism, so it is advised that children younger than 12 months should not be fed honey.

Clostridium perfringens

Large joints of meat, reheated gravies

The third most common cause of foodborne illness, however many cases of *Cl. perfringens* food poisoning likely remain subclinical, as antibodies to the toxin are common.

***E. coli* O157:H7**

Contaminated water, milk, inadequately cooked meat and contaminated raw leaf green vegetables

It is highly virulent, with a low infectious dose and an inoculation of fewer than 10 to 100 CFU of *E. coli* O157:H7 is sufficient to cause infection.

Listeria monocytogenes

Soft cheeses, paté, pre-packed salad, cook-chill products

The elderly are particularly at risk for listeriosis and due to its frequent pathogenicity, causing meningitis in newborns, pregnant mothers are often advised not to eat soft cheeses, which may be contaminated with *L. monocytogenes*.

Salmonella (over 2,300 types)

Poultry, eggs and raw egg products, vegetables

Infants and young children are much more susceptible to infection, easily achieved by ingesting a small number of bacteria. In infants, infection through inhalation of airborne bacteria particles is also possible.

Staphylococcus aureus

Cured meat, milk products, unrefrigerated handled foods

Staphylococcus is commonly found on humans and can cause food poisoning when the food handler contaminates food and then the food is not properly refrigerated. *Staphylococcus* is killed by cooking and pasteurization.

Shigella (over 30 types)

Any food that has been washed in contaminated water

Shigella bacteria are generally transmitted through a faecal–oral route. Handling babies' nappies, eating vegetables contaminated with sewage, or drinking swimming pool water are all activities that may lead to shigellosis.

Vibrio vulnificus

Uncooked or raw seafood (fish or shellfish), oysters

In healthy people, *Vibrio vulnificus* food poisoning can cause vomiting, diarrhoea and abdominal pain. In people who have weak immune systems, the bacteria can infect the bloodstream, causing septicaemia.

Yersinia enterocolitica

Insufficiently cooked pork or contaminated water, meat or milk

Infection with *Y. enterocolitica* occurs most often in young children under 5-years-old.

BIOFOCUS

Supporting bioscience in higher education

The Royal Society of Biology education policy team had a busy start to 2016 gathering evidence from a number of our member organizations on teaching in higher education (HE). We submitted a consultation response to the January green paper which included issues on changes to university structure and fees, and their impacts on social mobility, and how to measure teaching excellence.

The proposed new Teaching Excellence Framework (TEF) is being developed by the Government to monitor and assess the quality of teaching in England's universities. Its aims include: ensuring all students receive an excellent teaching experience that prepares them for the world of work, building a culture where teaching has equal status with research and providing students with the information they need to judge teaching quality.

The education community and learned societies have a vital role to play in ensuring that this framework is effective whilst minimizing bureaucracy. We all want to see great teaching recognized in our universities but the metrics used must be right. It cannot all be about the number of top performing students universities deliver. Rather, we need to look at relative improvement (amongst other measures). Whatever the ranking or threshold process, it is clear that linking differential fees to TEF scores could have perverse outcomes that limit choice and restrict social mobility. We will be watching this closely.

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We are also working to support excellent biology teaching through our HE Biology Teacher of the Year Award. The award seeks to identify and recognize the invaluable role the UK's leading HE bioscience teachers play in educating and inspiring the next generation of biologists. It rewards individual excellence and innovation in approaches to teaching, scholarly and professional development, and support of colleagues beyond their own department and institution. The winner of the 2016 award will be announced in May at the Heads of University Biosciences Spring Meeting.

The latest stats from UCAS showed that there was an increase of 8.9% in applications accepted for HE biology courses last year (increased from 6,435 in 2014 to 7,005 in 2015). This was a much larger increase than enjoyed by chemistry (4.3% increase to 5,495) and physics (2.0% increase to 4,990). It is welcome news but employment expectations need to be managed as many will not enter lifelong careers in bioscience. This means that their overall employability skills as well as their bioscience skills need to meet the needs of a range of employers.

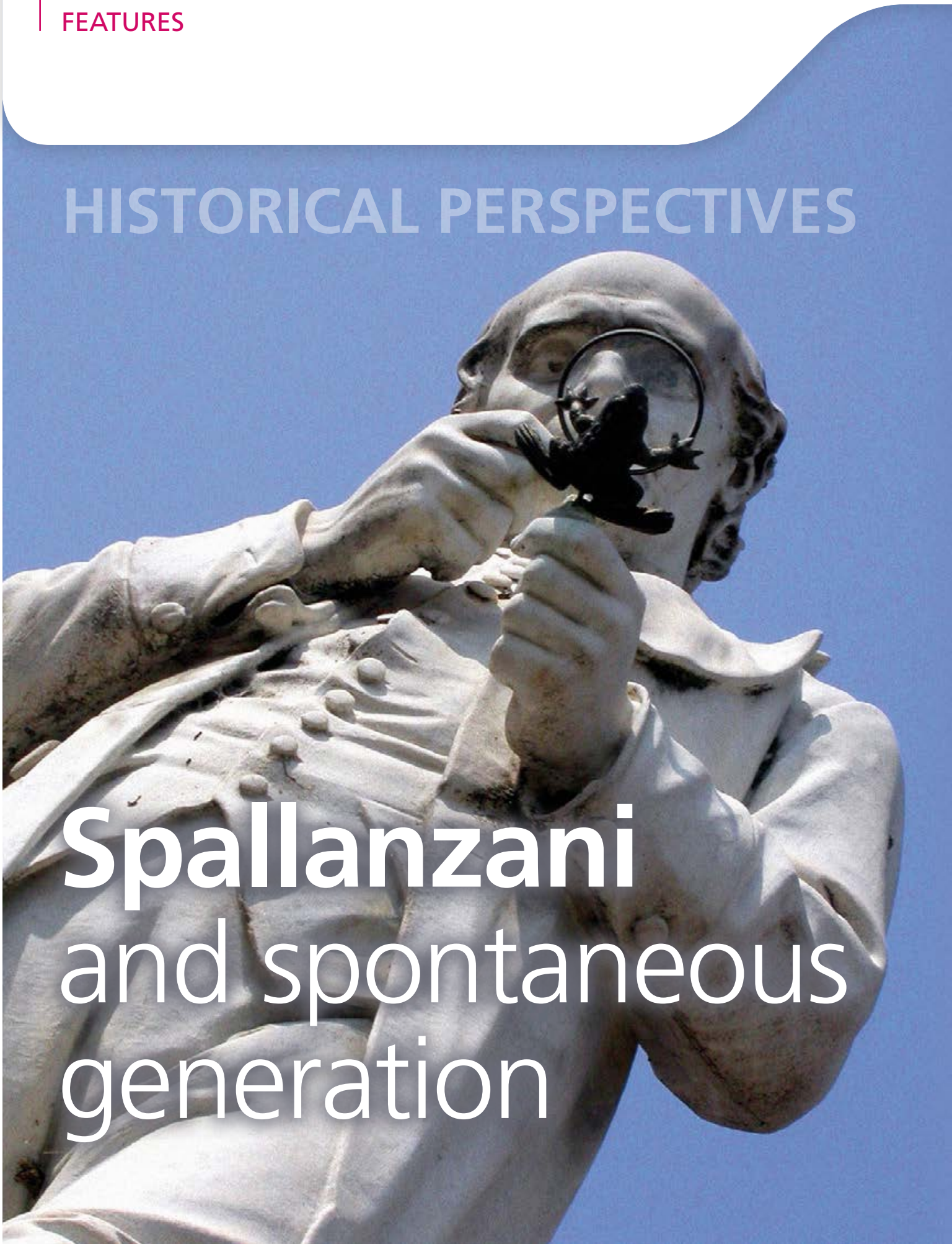
This is a key theme for our degree accreditation programme. This continues to recognize degrees which contain a solid academic foundation in biological knowledge and key skills, and prepares graduates to address the needs of employers. We now have 94 degree programmes from 14 HEIs with Accreditation (giving graduates a solid academic foundation in biological knowledge and key skills) and 203 degree programmes from 23 HEIs with Advanced Accreditation (preparing graduates for a career in research).

Our aims through this programme include: recognizing academic achievement, driving up standards of learning and teaching in the biosciences, providing industry with an assurance of the level of employability skills, and maintaining and improving the UK's position as a premier location to develop the life scientists of the future.

The CSciTeach register which we operate under license from the Science Council aims to support teachers at all levels by recognizing those who demonstrate excellence, leadership and integrity in both HE and schools. Registrants must commit to continual professional development in order to maintain their inclusion on the register and the first successful applicants from universities and schools are now being announced quarterly. If you are involved in teaching, please do consider this opportunity for professional recognition and support.

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

HISTORICAL PERSPECTIVES



Spallanzani and spontaneous generation

Spallanzani's first biological work was when he tried to disprove the theory of spontaneous generation, which was the hypothesis that some vital force contained in or given to organic matter can create living organisms from inanimate objects

Introduction

In 1723 ripples ran through the learned societies of Europe when Antonie van Leeuwenhoek died, with many scientists wondering who would carry on his work. Luckily the void was to be filled six years later with the birth of Lazzaro Spallanzani (1729–1799) in Scandiano, Northern Italy. Spallanzani was the son of the distinguished lawyer Gianniccolò and his wife Lucia Zigliani. Like the great Leeuwenhoek before him, the young Lazzaro was often at odds with his father who wanted him to enter a rather different profession than that of microbe hunter. But even as a child he explored the natural world around him to try and find out why things worked, often using his own form of experimentation. Much of this would be considered cruel and unnecessary today.

He entered a Jesuit seminary at the age of 15 and later studied law at Bologna but continued to have an interest in physics while developing an overall knowledge of nature. At one point he went to see the noted scientist Antonio Vallisnieri (1661–1730) to talk about his ideas. Vallisnieri immediately went to see Spallanzani's father to persuade him to allow the young Lazzaro to attend the University of Reggio and pursue his love of natural sciences.

Father Spallanzani

Around 1753 Spallanzani took minor orders and became an ordained priest some years later. He took the title "l'Abate Spallanzani" and became attached to two congregations in Modena. These priestly duties were, however, performed irregularly, mainly for monetary remuneration. His career was almost totally academic, although even in later life he still officiated at Mass. At the age of 26 he became Professor of Logic, Metaphysics and Greek at the University of Reggio. His scientific accomplishments and reputation as an eloquent speaker drew increasing enrolment onto his natural history courses.

By 1765 Spallanzani had begun publishing his numerous scientific works. Most of them were motivated by a philosophy of science which nowadays could be called reductionist; namely, a belief that most phenomena are reducible to physical and chemical explanation.

In 1769 he accepted the Chair of Natural History at the University of Pavia, remaining in this post until his death in 1799. It was during this time that he was involved in the scandal of 'stealing samples from the University of Pavia and hiding them at the museum in Scandiano'. This scandal was perpetuated by an old adversary Canon Serafino Volta (1764–1842), an Italian priest, naturalist, and palaeontologist who had visited the museum while Spallanzani was on a field trip and found specimens labelled with red tags from the University of Pavia. Volta enlisted the aid of some fellow scientists who held grudges against Spallanzani and together published a letter which they circulated to every learned society in Europe. Spallanzani could see his career being ruined so he immediately requested a judicial enquiry in front of the Royal Imperial Council. After reviewing his evidence, both written and verbal, the council exonerated him completely of any wrongdoing. The conspirators were not so lucky; Volta was dismissed from the university and the other parties received reprimands and ordered to desist from troublemaking.

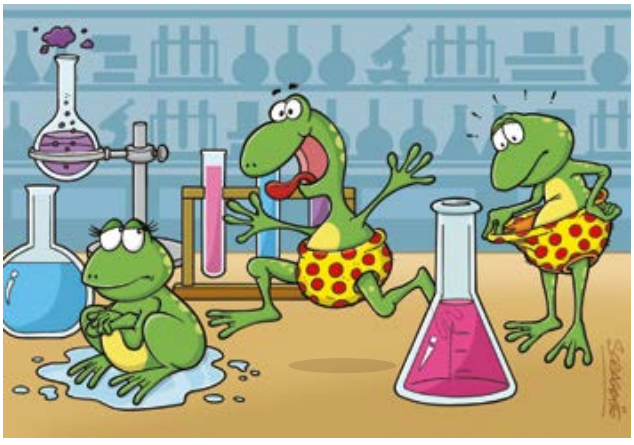
Boiled gravy and the little animals

Spallanzani's first biological work was when he tried to disprove the theory of spontaneous generation, which was the hypothesis that some vital force contained in or given to organic matter can create living organisms from inanimate objects. Aristotle (384–322 BC) was certainly an advocate of this theory and in the 1600s the scientist Jan Baptista van Helmont (1580–1644) set out to prove it. He gathered some wheat, put it in an open jar with some sweaty underwear, and in three weeks mice appeared. The conclusion and 'obvious' proof was that the mice had come from the wheat and dirty underwear. During the 18th century this debate was further pursued by the naturalist and Roman Catholic priest John Turberville Needham (1713–1781) and the French naturalist Georges-Louis Leclerc, Comte de Buffon (1707–1788). Needham had boiled a meat infusion, placed it in a well-stoppered bottle, and found that it putrefied some days later. As boiling must have destroyed any '*animalculae*' in the infusion, and as no others could have entered the tightly stoppered bottle, he argued that the living beings which made their appearance must have owed their origin to a special vegetative force. He held that this force was a kind of energy, sometimes latent, but at other times and in favourable conditions calling new beings into existence. Spallanzani, however, maintained that life could never spontaneously generate from dead matter and began experiments to disprove Needham's theory. Initially he found that living organisms did appear in boiled infusions introduced into stoppered bottles and he also found that they appeared even when the air was excluded from hermetically sealed flasks into which boiling infusions had been poured.

All of this seemed to confirm Needham's conclusion. Not discouraged, Spallanzani suspected that organisms might exist on the inner surface of the flasks. He heated the flasks in a flame and then introduced the infusion. Still the organisms grew to putrefy the broth. Surely, then, they must have entered with the air during the process of cooling. He took hermetically sealed flasks containing various vegetable infusions and kept them in boiling water for one hour. The result was that no organisms could be detected, but if the seal was tampered with so that a few bubbles of air got into the flask, organisms were soon found to be present in the broth. His experimentation was exact and he proved that some organisms can live in a vacuum for many days (anaerobiosis) but from this Spallanzani concluded that the microorganisms did not come from the broth, but were in the air that entered the flask and therefore, not even microorganisms came from non-living things. He published his results and conclusions as the first volume in the 1776 '*Opuscoli di Fisica Animale, e Vegetabile*'. Unfortunately, many scientists were still not convinced by his experiment; they believed that Spallanzani had deprived the closed bottle of air, and air was necessary for spontaneous generation. So although his experiment was successful, a strong rebuttal blunted his claims. It was not for another 100 years that Spallanzani was proved correct when Louis Pasteur (1822–1895) repeated these experiments and proved that there was no spontaneous generation since the boiled broth, if never re-exposed to air, remained sterile. This not only settled the philosophical problem of the origin of life at the time but also placed on solid ground the new science of bacteriology, which relied on proven techniques of sterilization and aseptic manipulation and finally refuted the theory of spontaneous generation that scientists had believed for over 2,000 years.

Frogs in pants

Spallanzani also carried out important work in embryology and as an ovarian preformationist believed that all parts of a new individual were preformed within the ovum and that the semen simply provided a



He took some male frogs and **dressed them in tight-fitting taffeta pants and then let them seek females** (he had tried different materials but taffeta seemed to be the most suitable)

stimulus for the development. He took some male frogs and dressed them in tight-fitting taffeta pants and then let them seek females (he had tried different materials but taffeta seemed to be the most suitable). Although they mated with equal vigour as their nude counterparts, their modest attire prevented fertilization. These experiments, along with his successful attempts at artificial fertilization using filtered semen, showed the need for the physical contact between the spermatozoa and the egg for fertilization to occur.

Legacy

Lazzaro Spallanzani died peacefully in his sleep aged 71-years-old suffering from an enlarged prostate complicated by a bladder infection. He was a physiologist who had made important contributions to the experimental study of bodily functions and reproduction. His interests in biology, physics, chemistry, geology and meteorology had given experimental proof on the circulation, gastric digestion, respiration and the hearing of bats. In 1888, local authorities and leading scientists from around the world gathered in the Piazza Maggiore in Scandiano (later to be renamed the Piazza Spallanzani Lazzaro) to see the unveiling of a statue dedicated to Spallanzani. It shows the scientist standing dressed in his clergyman's clothes holding a magnifying glass in one hand while he examines a frog in the other. But perhaps the most fitting tribute can be seen in the house where he was born: a simple marble bust bears the inscription: *Natus Scandiani Clarus Ubiqu* (born in Scandiano, renowned everywhere).

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Stephen Mortlock
Global Infectious Diseases and Microbiology Liaison, Q² Solutions

Call for nominations for the W H Pierce Prize

Do you know a young microbiologist (under 40 years of age) who has made a substantial contribution to microbiology? If so why not nominate them for this prestigious and substantial award which is worth £3000.

The award was instituted in 1984 by Oxoid to commemorate the life and works of the late W. H. (Bill) Pierce, former Chief Bacteriologist at Oxoid Ltd. and a long-time Member of the Society. The prize is presented annually at the Summer Conference.

Full Members wishing to make a nomination should write in confidence to the General Secretary, Dr Clare Taylor, at the Society Office in Bedford, including a full CV of the nominee and a letter of support. Please note that application is through nomination by Full Members of S*f*AM only and that there are no official forms for this award.

Closing date for nominations is Friday 22 April 2016.

Call for nominations to the Executive Committee

There will be a number of vacancies on the S*f*AM Executive Committee in July 2016. Nominations are invited from all Full Members of the Society for these vacancies.

Nominations must be made in writing and received by the Society Office by Monday 2 May 2016.

Should nominations exceed vacancies, election will be by a system of voting arranged by the Executive Committee.

London's MICROBIOTA

An occasional series on applied microbiology themes in the capital

Night and day a light burns brightly in Carting Lane, a quiet street between the Strand and Savoy Place. Its purpose is to protect Londoners from bacterial metabolites. The light belongs to Webb's Patent Sewage Gas Destructor lamp, the last of its kind in London, patented in 1895 by a Birmingham builder, Joseph Edward Webb, to improve "*the extraction from sewers of the gases or vapours collected or generated therein, and the destruction of such gases prior to their passing into the atmosphere*".

The problem of London's sewage was notorious in the 19th century when all the city's effluent found its way into the Thames, where it made its way sluggishly down to the sea, ebbing and flowing with every tide. As a result, the river became an open sewer: the source of foul smells and pathogens. This shameful situation was eventually dealt with, not by microbiologists but by engineers, most notably Joseph Bazalgette, Chief Engineer to the Metropolitan Board of Works, who transformed London by building a number of east-west sewers to intercept the waste before it reached the Thames, and carry it eastwards for discharge downstream.

Plans for dealing with the scandal of London's sewage had been grinding very slowly through the system for many years but famously received their final impetus from what is known as the Great Stink of 1858 when, in a very hot summer, the smell outside the Houses of Parliament was so severe it caused a wholesale retreat of Lords and MPs from rooms bordering the Thames and serious discussion of the possibility of temporarily abandoning the Palace of Westminster altogether. It seems that, apart from the will of the electorate, nothing galvanizes politicians into action more than the smell of over-ripe sewage on a hot summer's day

Webb's Patent Sewage Gas Destructor lamp

because by the following year Bazalgette had begun to build. His system of 83 miles of new sewers was essentially complete by 1865 and still plays a major role in dealing with London's sewage to this day.

Removal of the sewage from public water courses into a closed system was obviously a major step forward, but some problems still remained, most notably the absence of any biological treatment of the sewage downstream, which came later at Beckton, now the largest sewage treatment works in Europe. Another was from the bacterial decomposition of sewage which occurred while it was still in transit in the system. Since this is a largely anaerobic process, the sewage gas it produces contains a cocktail of reduced compounds such as methane, a potential explosion risk, and unpleasantly malodourous (and toxic) compounds such as hydrogen sulfide arising from sulphate reduction. Fortunately,

The problem of London's sewage was notorious in the 19th century when all the city's effluent found its way into the Thames, where it made its way sluggishly down to the sea, ebbing and flowing with every tide

their low oxidation state means that they can be oxidized by burning in air thus removing the explosion and nuisance risk, and this is the basis of Webb's invention. The presence of methane in sewage gas has led to the common misconception that it also fuels the Webb lamp and has led some to refer to Carting Lane with a name that rhymes and is somehow felt more appropriate. In fact the lamp is powered by natural gas (originally coal gas), the sewage gases are drawn up a tube from the sewer below by the heat in the lamp and are incinerated at the high temperatures created in the specially designed lamp head.

Though the last in London, many Webb lamps were erected around Great Britain and abroad and several are now officially listed and preserved as historic monuments. Recognizing this, the Carting Lane lamp was in fact rebuilt a few years ago after a lorry backed into it. The largest number of lamps appears to have been in the city of Sheffield where there are more than 20 still in existence. In a less august forum than S*f*AM, this might lead to unseemly speculation as to whether this is due to some special feature of the gut microflora or the diet of the residents of Sheffield. I am reliably informed that the local surfeit of sewage gas is in fact a result of the topography of Sheffield where the number of hills means there is a greater chance of pockets of gas accumulating in the system. To suggest anything else is a calumny on the noble burghers of Sheffield.

Martin Adams
SfAM President 2011–2014

REPORT 2015: Autumn Meeting ECS Conference on **IMPACT**

The 4th Early Career Scientist meeting was held on 13 October at the Royal Society of Medicine in London on the topic of 'Impact'. There was a really good turnout of delegates for the event which took place before the Annual *Environmental Microbiology* lecture presented, this year, by Kenneth Nealson.

The day started off with the first session of Early Career Scientist presentations chaired by S*f*AM General Secretary, Clare Taylor. The first speaker Chloe Hutchins, from Public Health England, presented her PhD work on studying the survival of *Pseudomonas aeruginosa* on tap outlet fittings and contamination in hospital tap water. The second talk was by Zara Gerrard, a PhD student from the University of Nottingham, on new diagnostic tools for Johne's disease in cattle using bacteriophages. The last talk of the morning was given by Jana Hiltner from the University of Strathclyde presenting her PhD work on the interaction of primary and specialized metabolism in *Streptomyces*.

After lunch the second oral presentation session, chaired by Sabrina Roberts, took place, starting with a talk from Stewart Barker, a PhD student based at the University of Sheffield. Stewart presented his PhD project on the functional characterization of the SH3b domain of lysostaphin, a bacterial hydrolase specifically targeting *Staph. aureus* peptidoglycan. The following talk was given by Charlotte Marshall, who presented her work carried out during a Students into Work Grant from S*f*AM at Rothamsted Research. During her 10-week research project Charlotte investigated the presence and growth of denitrifying bacterial communities in soil in response to fertilizer treatment and the connection to greenhouse gas emission.

The third session was comprised of an attended poster presentation, in total 17 posters were displayed covering a wide range of microbiological topics from Early Career Scientists across the UK and as far away as South Africa.

In the afternoon a panel discussion on Impact, chaired by Ali Ryan, took place covering the topic of impact in the various areas covered by a range of experts including: Susan Brown (publishing), Sabrina Roberts (policy), Helen Frost (Impact as a PhD student), Aled Roberts (Impact in social media), Mark Fielder (Impact in academia) and Alice Kay (Impact in the media). The discussion was lively and covered all aspects, making clear that impact is an important part of science no matter from which perspective it is looked at. Impact is about making research matter to the general public and changing misconceptions as well as to convey the newest findings to society.

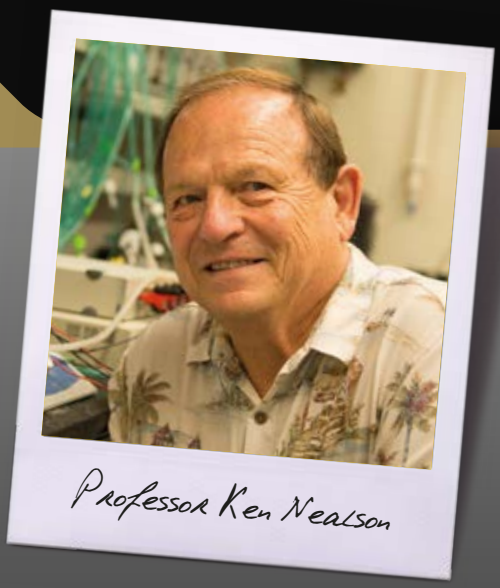
The session was closed by S*f*AM President Christine Dodd with the announcement of the best oral presentation, the prize was awarded to Charlotte Marshall. The best poster prize was won by Rachael Nicholson from the University of the West of England for her work on the effects of DNA damaging agents on growth and bioluminescence of the novel whole cell biosensor *E.coli* HA1.

The conference ended with refreshments and networking and everyone looking forward to the upcoming ECS meeting in 2016.

Jana Hiltner
ECS Secretary

EMI LECTURE

Professor Ken Nealson



Ken Nealson, Professor of Chemistry at the University of Southern California–Berkeley, was the honoured speaker at the *Environmental Microbiology* Lecture which was hosted by S*f*AM at the Royal Society of Medicine, London. Professor Nealson's lecture titled, **Extracellular electron transport (EET): opening new windows of metabolic opportunity for microbes**, explained how his group discovered bacteria that can use electricity as an energy source – defying previous assumptions of how bacteria should behave.

Professor Nealson started his lecture quoting the Nobel Prize winning scientist Albert Szent Gyorgi: "*Life is nothing but an electron looking for a place to land*" and informed us how Szent Gyorgi and another Nobel Prize winning hero of his, Peter Mitchel, literally changed his view on life and the world.

The flow of electrons from a source (electron donor) to a destination (electron acceptor) is the basis for all metabolism. Nealson discussed how bacteria abundant in the geological environment can use not only organic carbon as a fuel for life but also a wide array of other electron donors from hydrogen to manganese and that the oxidants of life include not only oxygen, but almost anything willing to steal an electron from the donor.

The bacteria Nealson has spent many years studying is *Shewanella* – named after a past president of S*f*AM, Professor J. M. Shewan (President 1969–1971). *Shewenella* is unique in its ability to use iron, manganese, chromium or uranium as its electron acceptor.

Early on in his research Professor Nealson found it almost impossible to obtain a grant as scientists used to believe it impossible for organisms to extract energy from metals because, as solids, metals cannot be accessed by the enzymatic machinery inside the bacterial cell wall. Nealson discovered and discussed in-depth the unique mechanistic processes *Shewanella* used to overcome this problem. Instead of bringing pieces of metal inside the cell, *Shewanella* bacteria used extracellular respiratory multi-heme enzymes to latch on to a chunk of metal and extract energy from it.

Nealson then explored how the logical use for these organisms' unique abilities would be new technologies for producing energy (microbial fuel cells), cleaning up waste, fighting corrosion and the larger context of what it means when engineering and microbiology combine. For example, Nealson and his colleagues have already developed microbial fuel cells that take advantage of the electron flow from the bacteria by coupling it to an anode, which the bacteria then use as an electron acceptor as they would use iron or manganese in their natural habitats.

As the energy source in these microbial fuel cells is organic carbon, the bacteria can then potentially make energy and clean water from industrial or domestic waste – an exciting prospect for Southern California.

Ken Nealson is the holder of the Wrigley Chair in Geobiology and Professor of Earth Sciences at the University of Southern California. His current research focuses on the evolution of life in the universe and microbial life in extreme environments.

He gained recognition in the 1970s with his groundbreaking PhD by discovering the mechanism by which bacteria communicate with each other. But Nealson's collective body of research has become even more acclaimed since the discovery of quorum sensing. He has revealed new organisms and even spent time advising NASA on how to detect life on other planets.

The lecture was recorded by our friends at Wiley-Blackwell and is available via the S*f*AM website or our new blogging site **MicrobeBlog.org**.

Antimicrobial Resistance 2015

PREVENTION › CONTAINMENT › CONTROL

On 11 December 2015 the Society for Applied Microbiology convened its first conference on the rapid growth of antimicrobial resistance (AMR) and the urgent need to formulate prevention and control strategies.

Antimicrobial resistance to all known antibiotics could be just a few short years away. Already there are reports that bacteria that resist the most common antibiotic of last resort – colistin – have been discovered in China, Europe and North America. The flood of new information from experts in AMR is also changing the ways we think about health and disease and in the way medicine is practiced. The AMR 2015 conference outlined the current situation, origins of resistance, and how a new focus on developing countries and veterinary medicine could be the key to sustainable antimicrobial drugs.

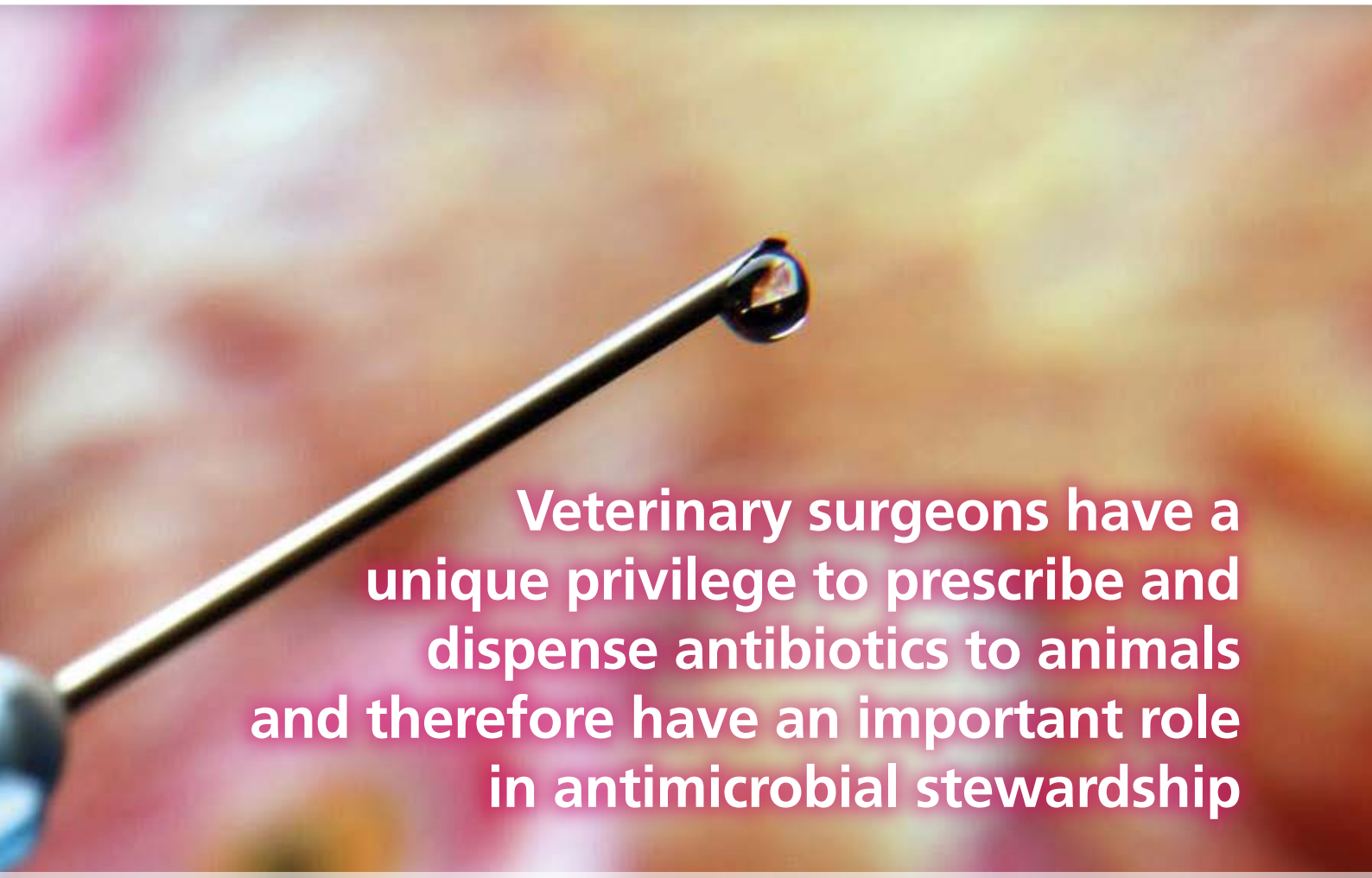
Professor Mark Fielder, chairing the conference stated: "*While it may be many years, even decades, before all bacteria are resistant to current available medicines, the impact of AMR is already being felt. Reports of new genes conferring resistance to antimicrobial drugs are rapidly becoming a monthly occurrence and with each new report, it becomes increasingly clear that AMR is now no longer simply rare, but an urgent threat to global health.*"

The first speaker, Professor Tim Walsh (Cardiff University) outlined the current situation with the most pressing challenge to physicians being antimicrobial resistant Gram-negative bacteria. Walsh also raised the uncomfortable suggestion that lack of international discipline and accountability is the major driver of AMR. Statistics included estimates of 1.8 billion people carrying carbapenem-resistant genes in their natural flora in South Asia alone and that Africa was a continent of completely unknown AMR burden. Many of these facts outlined how antibiotics available without prescription, now confounded by the ability to buy directly from the Internet, will haunt us into the next decade.

The audience were also very eager to hear an update from Anthony McDonnell (AMR Review) who gave a fascinating discussion on the economic burden of AMR. McDonnell summarized reports by economist Jim O'Neill commissioned by the UK Government which can be accessed through the S*f*AM website. McDonnell ended with the alarming estimate that 10 million will die of AMR in 2050 if serious action is not taken now.

Dr Will Gaze (University of Exeter) then highlighted the key to stopping emergent AMR-resistant infections is to understand what is going on in the environmental microbiome. Walsh stated that horizontal gene transfer – the main mechanism by which bacteria pass on AMR ability – is not the exception but the rule and that bacteria are more promiscuous than previously thought.

A stand out talk followed by Dr Jon Otter (Imperial College London) on the dramatic and worryingly rapid



Veterinary surgeons have a unique privilege to prescribe and dispense antibiotics to animals and therefore have an important role in antimicrobial stewardship

emergence of Gram-negative bacteria with resistance to carbapenem antibiotics. Otter also described how the various acronyms employed to describe the problem are a minefield for the uninitiated. Do you know your CRO from your CPO from your CRE from your CPE?

Nicola Williams, a Professor in Zoonotic Bacteria Disease (University of Liverpool) spoke about AMR in companion animals and how they are an important link in the transfer of AMR. With 44.8% of dogs carrying at least one AMR *E. coli* strain, we will certainly be thinking twice before letting a dog lick our face. Professor Williams also mentioned the much higher prevalence of multidrug resistant bacteria found in dogs fed raw meat – a worrying statistic in the face of the rising trend to feed pets raw meat.

Dr Tim Potter and Dr Matt Dobbs (Westpoint Farm Vets) then gave an honest view from a veterinary perspective. Veterinary surgeons have a unique privilege to prescribe and dispense antibiotics to animals and therefore have an important role in antimicrobial stewardship. As 75% of revenues for the average veterinary surgeon come from prescribing medicines, education is vital to communicate the need for responsible medicine use in animal welfare.

These current and impending AMR issues all point to the need to prepare future physicians with the need to meet both the known and unforeseen challenges of a potentially AMR common era. Recognizing the growing need for alternatives to traditional antimicrobials was Dr Katie Hopkins (PHE) who called for a more optimal use of antibiotics by developing rapid diagnostic assays. She also called for further research into novel alternatives to antibiotics.

Professor Fielder then closed the conference by repeating some of the key points to come from the day:

1) **pay now don't wait for disaster,**
2) **fund early stage research,**
3) **lump sum payments for antibiotic discovery** and
4) **harmonize regulation.**

Not all germs are created equal

Many of the delegates also attended a special screening of **RESISTANCE: THE FILM** followed by Q&A's with the Director Michael Graziano at Covent Garden's London Transport Museum. The screening was sponsored by S*f*AM and hosted by Dr Adam Roberts (UCL).

We are offering a FREE DVD copy (UK mainland only) or download of **RESISTANCE: THE FILM** to all S*f*AM Members who introduce a new Full Ordinary or Student Member to the Society during March 2016.

A SHORT HISTORY OF antibiotics & resistance

According to the WHO, antibiotic resistance is "*one of the three greatest threats to human health*." In the EU, Norway and Iceland, between 5% and 12% of patients acquire an infection while they're in hospital; 400,000 people a year are infected with a resistant strain of bacteria, 25,000 of whom die. Multidrug-resistant bacteria are estimated to cost the EU more than €1.5 billion every year.

Despite the relatively recent growth in the attention given to antibiotic resistance, it is not a new phenomenon; bacteria have developed resistance to antimicrobials for as long as they have been in use. So what has led up to the current crisis in antibiotic resistance and the challenge of finding new alternatives?

Fighting microbes for thousands of years

Humans were already reaping the benefits of antibiotics almost 2,000 years ago. In 1975, George Armelagos, who was a Professor of Anthropology at Emory University, noticed fluorescent bands on the skeletal remains of people from Nubian villages on the banks of the Nile, providing the first evidence that they were consuming tetracycline. He described the moment he first realized what he was seeing, "*My heart stopped. It's like if you were unwrapping a mummy and you saw Ray-Ban sunglasses*."

More than 4,000 miles away, Chinese herbalists were also prescribing antimicrobials. *Artemisia* plants, which include wormwood and Chinese mugwort, had been used frequently for thousands of years to treat many illnesses, particularly skin disorders caused by parasites. Today, these plants are the source of most antimalarial treatments, resistance to which may be down to its long-term use in Chinese medicine.

Antibiotic pioneers

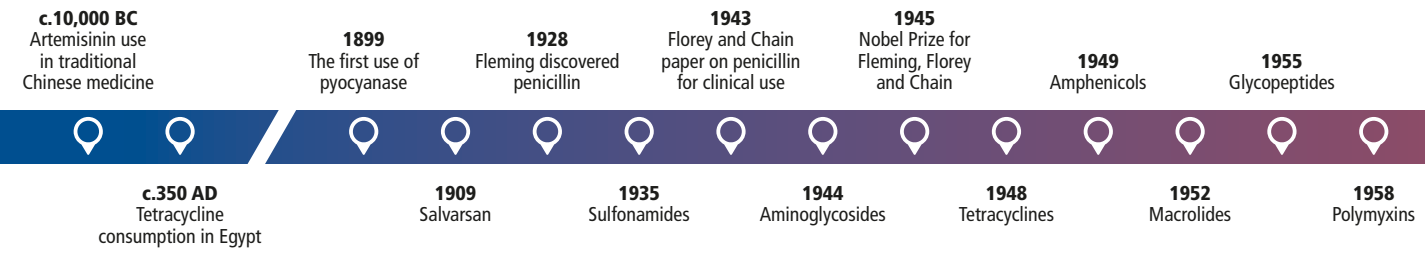
An antibiotic was first used in a hospital in 1899, long before penicillin hit the radar. Pyocyanase, made by German physicians Emmerich and Löw using *Pseudomonas aeruginosa*, was indeed bactericidal but also toxic to humans so it was swiftly abandoned. (Later investigations suggested the active ingredients were quorum-sensing molecules 2-alkyl-4 quinolones).

At the turn of the 20th century, a syphilis epidemic was sweeping Europe, and the standard treatment – mercury and isolation – was almost as dangerous as the disease itself. In 1904, another German physician, Paul Ehrlich, launched a wide-scale screening programme to find a better treatment for syphilis. He synthesized and tested hundreds of drugs on rabbits in his lab before landing on one that cured infected rabbits in 1909 – the sixth drug in the 600th series tested, numbered 606: Salvarsan (now called arsphenamine).

Ehrlich's approach inspired Josef Klarer, Fritz Mietzsch and Gerhard Domagk, who discovered sulfonamidochrysoidine, or Prontosil, in the 1930s. However, since the active part of the drug, sulfanilamide, had been used in the dye industry for years, it was not patentable and the subsequent mass-production resulted in drug resistance.

Entering the golden era of antibiotics

In the meantime, Fleming was busy developing penicillin, having made his serendipitous discovery on 3 September 1928. Twelve years later, Howard Florey and Ernest Chain published a milestone paper describing the purification of penicillin for clinical use, and shared the Nobel Prize in Medicine with Fleming in 1945. Fleming himself warned against the dangers of potential resistance to penicillin, but the snowball had



started rolling and was heading for the biggest wave of antibiotic discoveries the world would ever see.

Between the 1940s and 1970, most of the antibiotics in use today were discovered, mainly derived from soil *Actinomyces*. The 1940s saw the discovery of three new classes of antibiotic: aminoglycosides, tetracyclines and amphenicols. This trend continued in the 1950s, with the first of the macrolides, glycopeptides and polymyxins, and through the 1960s, with the first nitroimidazoles and dihydrofolate reductase inhibitors, cephalosporins and quinolones, and the second lincosamide.

In total, 66 antibiotics were discovered between 1940 and 1970, then the discovery of new drugs decelerated; no new families of antibiotics were discovered until carbapenem in 1988. But evidence was already emerging for resistance: J. Olarte found strains of *Shigella dysenteriae* in his collection that were resistant to chloramphenicol, streptomycin and tetracycline. As discovery declined, resistance started to increase, which led researchers to focus on improving existing treatments rather than discovering new ones.

The arms race against resistance

Antibiotic resistance increases if antibiotics are widely used, because of the positive selection for the resistance in bacteria. It seems logical, then, that if the antibiotic is discontinued, resistance will decline. This was the assumption behind two attempts to tackle resistance in the UK and Sweden. Between 1991 and 1999, the number of sulfonamide prescriptions in the UK was reduced from 320,000 to 7,000, but resistance increased from around 40% in 1991 to 46% in 1999, suggesting that reducing antibiotic use may not be an effective approach in all cases. Similarly, an 85% reduction in the use of trimethoprim-containing drugs in Sweden saw an increase in resistance.

According to Dr Jan-Ulrich Kreft from the University of Birmingham, resistance will remain an issue, regardless of the action we take on reducing the use of antibiotics. "*There will always remain a reservoir of resistance due to diversity, heterogeneity and variation*," he said in a guest lecture at SfAM's LeSPAR workshop.

In 1998, the House of Lords undertook an enquiry into antibiotic resistance, issuing recommendations to limit resistance, such as education for doctors and the public, better infection control in hospitals and priority funding for research. The WHO developed the Global Strategy for the Containment of Antimicrobial Resistance in 1999, launching it in 2001 and reviewing and identifying gaps in the implementation in 2002. Recommendations included education, regulation of prescription, hospital management and control of the use of antibiotics in livestock.

Since then there has been an international wave of action on antibiotic resistance, with initiatives in Asia, Africa, Europe and the Americas. In 2012, the European Parliament resolution on the Microbial Challenge – Rising Threats from Antimicrobial Resistance highlighted that the "Commission's Action Plan goes in the right direction, it does not go far enough to contain the rising global threat from antimicrobial resistance." It once again made recommendations on the prudent use of antibiotics, prevention and monitoring, education and the development of new antimicrobials.

Tackling antibiotic resistance is not a simple challenge. As John Denham commented in the UK Antimicrobial Resistance Strategy and Action Plan, "Microbes are dynamic organisms. And so our approach to tackling their resistance to antimicrobial agents must also be dynamic." Recent research into the improvement and development of antimicrobials has been taking new approaches. By harnessing bacteria-targeting microbes such as *Bdellovibrio bacteriovirus* and phages, researchers hope to find new ways to avoid the resistance problem. They are also looking at new environments, such as the oceans, and exploring the microbiota for novel compounds.

As we go forward, collaboration, education and surveillance will be key; researchers, doctors, politicians and the general public will need to work together to find a new path to more effective treatments and reduced mortality. In his review of the antibiotic era, Rustam I. Aminov from the University of Aberdeen concluded: "… *this should be of everyone's concern, because, in the end, there is always a probability for any of us at some stage to get infected with a pathogen that is resistant to antibiotic treatment*".

Lucy Goodchild van Hilten

1960 Nitroimidazoles

1961 Dihydrofolate reductase inhibitors

1964 Cephalosporins

1967 Quinolones

1968 Second lincosamide

1977 J. Olarte identified multidrug resistant *Shigella dysenteriae*

1980s Mupirocin (topical)

1988 Carbapenems

1990s Streptogramins

1998 House of Lords enquiry into antibiotic resistance

1999 Failed attempt to reduce sulfonamide resistance in the UK

2000s Oxazolidinones, lipopeptides, pleuromutilins (topical)

2001 WHO Global Strategy for the Containment of Antimicrobial Resistance

2012 European Parliament resolution on the Microbial Challenge

2014 Launch of the World Alliance Against Antibiotic Resistance declaration

*Sf*AM Spring Meeting 2016

19 April 2016 | 10:00 – 16:00
The Bloomsbury Hotel, London, UK

WHAT CAN **WHOLE GENOME SEQUENCING** DO FOR **CLINICAL** AND **PUBLIC HEALTH MICROBIOLOGY**?

Whole genome sequencing (WGS) of pathogens is rapidly changing the face of clinical and medical microbiology with scientists accessing thousands of complete genomic sequences. The advances being made using this vast amount of data is providing fascinating new directions for life sciences in general. The Society for Applied Microbiology Spring Meeting 2016 on whole genome sequencing will cover presentations on the latest technologies in the area that have allowed for new opportunities in health and disease research. This meeting will give delegates a better understanding of the laboratory process that is revolutionizing microbiology.

Speakers include

Jon Green
Public Health England, UK

Ed Feil
University of Bath, UK

Noel McCarthy
University of Warwick, UK

Grace Smith
Heart of England NHS Foundation Trust, UK

Judith Breuer
University College London, UK

Alison Mather
University of Cambridge, UK

Early Bird		Regular Rate
£50	Full Member	£80
£30	Student Member	£60
£60	Student Non-Member	£90
£75	IBMS Member	£105
£100	Non-Member	£130

HOW TO BOOK

The bookings page and programmes for all *Sf*AM events can be accessed through **www.sfam.org.uk**

For further information, contact **Sally Hawkes** by email: **sally@sfam.org.uk** or phone: **+44 (0)1933 382191**

society for applied sfam microbiology

*Sf*AM Summer Conference 2016

4 – 7 July 2016
The Assembly Rooms, Edinburgh, UK

MICROBIAL INTERACTIONS IN THE ENVIRONMENT

This meeting aims to promote the latest scientific research on the role of microorganisms in soil and plant ecosystems. The Society for Applied Microbiology is pleased to announce the Summer Conference on ***Microbial Interactions in the Environment***, to be held on 4 – 7 July 2016 in Edinburgh, UK. This will be a vibrant international conference with lectures and workshops detailing the current state of knowledge and recent advancements in the science of plant and soil microbiology.

The conference will enable delegates a chance to meet with leaders in the field and converse about the soil microbial communities that confer critical benefits or pathogenic disadvantages to our ecosystem. The meeting will also provide a unique platform to share the latest news on the microbiota of plants that may be beneficial or detrimental to the organisms they colonize.

DAY 1

Workshop & JAM Lecture

Workshop: Science policy

Journal of Applied Microbiology Lecture
Max Dow, *University College Cork, Ireland*

Drinks reception and buffet

Students and Early Career Scientists' 'beach ball' icebreaker, with buffet and wine

Quiz night

DAY 2

Soil microbiology – gaseous nitrogen emissions

Ecology of nitrogen cycling communities
Sara Hallin, *Swedish University of Agricultural Sciences, Sweden*

Regulation of denitrification at the cellular level
Lars Bakken, *Norwegian University of Life Sciences, Norway*

Soil nitrogen emissions to the atmosphere – an agricultural perspective
Tom Misselbrook, *Rothamsted Research, Harpenden, UK*

Copper control of bacterial nitrous oxide emission
David Richardson, *University of East Anglia, UK*

New single cell tools for functional analyses of microbes in their ecosystems
David Berry, *University of Vienna, Austria*

Determination of N^2O processes in soil using stable isotope approaches
Reinhard Well, *Johann Heinrich von Thünen Institute, Germany*

Bridging microbial community ecology and N-cycling
Laurent Philippot, *INRA, Dijon, France*

The megaprotein denitrification complex and anaerobic respirasome of *Pseudomonas aeruginosa*
Dieter Jahn, *Technische Universität Braunschweig, Germany*

Students and Early Career Scientists' session: Writing skills

Exhibition with wine, buffet and a competition

Students and Early Career Scientists' social event: Edinburgh walking tour

DAY 3

Plant-microbe interactions

Evolution and virulence of bacterial plant pathogens
Robert Jackson, *University of Reading, UK*

Fungal morphogenesis and virulence of *Magnoportha oryzae*
Nick Talbot, *University of Exeter, UK*

Effectors and virulence of plant pathogenic oomycetes
Yasin Dagdas, *The Sainsbury Laboratory, Norwich, UK*

Endophytes and their biotechnological uses
Gabriele Berg, *Graz University of Technology, Austria*

Early Career Scientists Committee AGM

Student Member oral presentations

SfAM Award Lectures

SfAM New Lecturer Research Grant Lecture
Roy Sleator, *Cork Institute of Technology, Ireland*

SfAM New Lecturer Research Grant Lecture
Tony Gutierrez, *Heriot-Watt University, Edinburgh, UK*

SfAM PhD Studentship Lecture
Danielle Weaver, *The University of Manchester, UK*

W H Pierce Prize Lecture (TBC)

SfAM Annual General Meeting

Drinks reception and conference dinner

DAY 4

Plant-microbe interactions

Plants as alternate hosts for human and animal pathogens
Nicola Holden, *The James Hutton Institute, UK*

Rhizosphere microbiology and plant health
Philip Poole, *University of Oxford, UK*

Unravelling plant-microbe interactions using metatranscriptomics
Peer Schenk, *University of Queensland, Australia*

Rhizobium interactions with plants
Allan Downie, *John Innes Centre, UK*

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£200	Student Member	£250
£400	Student Non-Member	£450
£600	Non-Member	£650

Closing date for registration:
Monday 20 June 2016
Book now at:
www.sfam.org.uk/summer

Journal**WATCH**

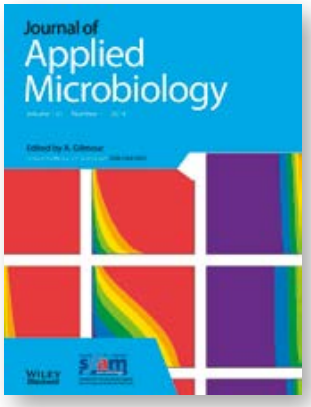
2015 highlights and featured articles from the *Sf*AM journals

Journal of Applied Microbiology

www.journalappliedmicro.com

Phospholipid fatty acid profiling of microbial communities – a review of interpretations and recent applications

C. Willers, P.J. Jansen van Rensburg and S. Claassens



Profiling of microbial communities in environmental samples often utilizes phospholipid fatty acid (PLFA) analysis. This method has been used for more than 35 years and is still popular as a means to characterize microbial communities in a diverse range of environmental matrices. This review examines the various recent applications of PLFA analysis in environmental studies with specific reference to the interpretation of the PLFA results. It is evident that interpretations of PLFA results do not always correlate between different investigations. These discrepancies in interpretation and their subsequent applications to environmental studies are discussed. However, in spite of limitations to the manner in which PLFA data are applied, the approach remains one with great potential for improving our understanding of the relationship between microbial populations and the environment. This review highlights the caveats and provides suggestions towards the practicable application of PLFA data interpretation.

http://onlinelibrary.wiley.com/doi/10.1111/jam.12902/full

Review of established and innovative detection methods for carbapenemase-producing Gram-negative bacteria

J. Osei Sekyere, U. Govinden and S. Y. Essack

The minimal antibiotic options for carbapenemase-producing Gram-negative bacteria necessitate their rapid detection. A literature review of a variety of phenotypic and genotypic methods is presented. Advances in culture methods and screening media are still subject to long incubation hours. Biochemical methods have shorter turnaround times and higher sensitivities and specificities, but cannot differentiate between various types and variants. Spectrophotometric methods are cheap and efficient, but are uncommon in many clinical settings, while the MALDI-TOF MS is promising for species identification, typing and resistance gene determination. Although next generation sequencing (NGS) technologies provide a better platform to detect, type and characterize carbapenem-resistant bacteria, the different NGS platforms, the large computer memories and space needed to process and store genomic data and the nonuniformity in data analysis platforms are still a challenge. The sensitivities, specificities and turnaround times recorded in the various studies reviewed favours the use of the biochemical tests (Carba NP or Rapid Carb screen tests) for the detection of putative carbapenemase-producing isolates. MALDI-TOF MS and/or molecular methods like microarray, loop-mediated isothermal amplification and real-time multiplex PCR assays could be used for further characterization in a reference laboratory. NGS may be used for advanced epidemiological and molecular studies.

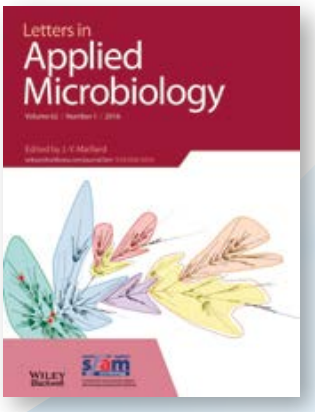
http://onlinelibrary.wiley.com/doi/10.1111/jam.12918/full

Letters in Applied Microbiology

www.lettersappliedmicro.com

Isolation of oxalotrophic bacteria associated with *Varroa destructor* mites

M. Maddaloni and D.W. Pascual



Oxalic acid, legally or *brevi manu*, is widely used to control phoretic *Varroa destructor* mites, a major drive of current honey bees' colony losses. Unsubstantiated by sanctioned research are rumours that in certain instances oxalic acid is losing efficacy, forcing beekeepers to increase the frequency of treatments. This investigation fathoms the hypothesis that *V. destructor* associates with bacteria capable of degrading oxalic acid. The data show that indeed oxalotrophy, a rare trait among bacteria, is common in bacteria that we isolated from *V. destructor* mites. This finding may have ramifications in the use of oxalic acid as a control agent.

http://onlinelibrary.wiley.com/doi/10.1111/lam.12486/full

Biofilm formation by pathogenic *Prototheca* algae

J. Kwiecinski

Prototheca algae are the only existing pathogenic plants. Almost nothing is known about mechanisms of *Prototheca* infections. This study identifies that, similar to pathogenic bacteria and fungi, *Prototheca* algae can form biofilms. These biofilms induce reduced immune cell activation relative to planktonic cells, and are also less susceptible to antimicrobials. Biofilm formation by *Prototheca* could be the first *in vitro* correlate of pathogenicity, opening a new research field for this pathogen.

http://onlinelibrary.wiley.com/doi/10.1111/lam.12497/full

Microbial Biotechnology

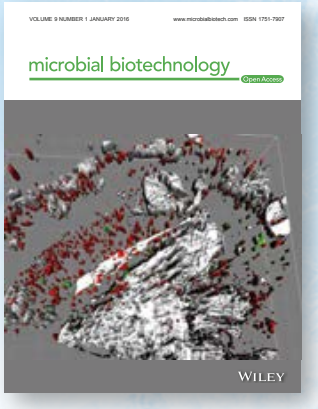
www.microbialbiotech.com

Plastic waste as a novel substrate for industrial biotechnology

Nick Wierckx *et al*.

Preparation of desiccation-resistant aquatic-living *Nostoc flagelliforme* (Cyanophyceae) for potential ecological application

Xiang Gao *et al*.



Nostoc flagelliforme is a terrestrial edible cyanobacterium that grows in arid and semi-arid steppes. The continued over-exploitation in the last century has led to a sharp decline of this resource and a severe deterioration of the steppe ecology. Liquid-cultured *N. flagelliforme* serves as promising algal 'seeds' for resource restoration. In this study, macroscopic (or visible) aquatic-living colonies (MaACs) of *N. flagelliforme* were developed under weak light and high nitrogen conditions. In a 24 day shake-flask culture, MaACs were propagated by about 4.5-fold in biomass without loss of their macro-morphology; at the same time, the addition of weak UV-B treatment resulted in slightly bigger MaACs. Polyvinylpyrrolidone (PVP) k30, a water-soluble polymer, was used to generate the coating around MaACs, and after full desiccation, the coated MaACs could recover their photosynthetic physiological activity when rehydrated, with 4% PVP k30 for coating being most effective. In contrast, PVP k30-coated microscopic aquatic-living colonies of *N. flagelliforme* and non-coated MaACs showed no resistance to full desiccation. The macroscopic morphology or structure of MaACs should be crucial for the formation of protection by PVP k30 coating. PVP k30-coated MaACs were more approaching to actual application for resource restoration.

http://onlinelibrary.wiley.com/doi/10.1111/1751-7915.12279/full

Characterization of microbial community structure during continuous anaerobic digestion of straw and cow manure

Li Sun *et al*.

Responses of bacterial and archaeal communities to the addition of straw during anaerobic digestion of manure at different temperatures (37°C, 44°C and 52°C) were investigated using five laboratory-scale semi-continuous stirred tank reactors. The results revealed that including straw as a co-substrate decreased the species richness for bacteria, whereas increasing the operating temperature decreased the species richness for both archaea and bacteria, and also the evenness of the bacteria. Taxonomic classifications of the archaeal community showed that *Methanobrevibacter* dominated in the manure samples, while *Methanosarcina* dominated in all digesters regardless of substrate. Increase of the operating temperature to 52°C led to increased relative abundance of *Methanoculleus* and *Methanobacterium*. Among the bacteria, the phyla Firmicutes and Bacteroidetes dominated within all samples. Compared with manure itself, digestion of manure resulted in a higher abundance of an uncultured class WWE1 and lower abundance of Bacilli. Adding straw to the digesters increased the level of Bacteroidia, while increasing the operating temperature decreased the level of this class and instead increased the relative abundance of an uncultured genus affiliated to order MBA08 (Clostridia). A considerable fraction of bacterial sequences could not be allocated to genus level, indicating that novel phylotypes are resident in these communities.

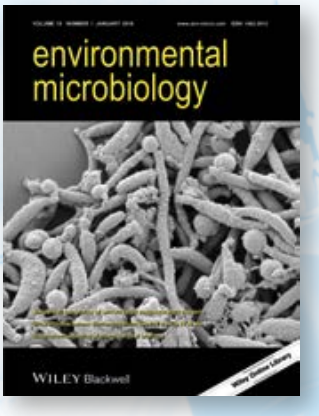
http://onlinelibrary.wiley.com/doi/10.1111/1751-7915.12298/full

Environmental Microbiology

www.env-micro.com

Metagenomic characterization of viral communities in corals: mining biological signal from methodological noise

Elisha M. Wood-Charlson *et al*.



Reef-building corals form close associations with organisms from all three domains of life and therefore have many potential viral hosts. Yet knowledge of viral communities associated with corals is barely explored. This complexity presents a number of challenges in terms of the metagenomic assessments of coral viral communities and requires specialized methods for purification and amplification of viral nucleic acids, as well as virome annotation. In this minireview, we conduct a meta-analysis of the limited number of existing coral virome studies, as well as available coral transcriptome and metagenome data, to identify trends and potential complications inherent in different methods. The analysis shows that the method used for viral nucleic acid isolation drastically affects the observed viral assemblage and interpretation of the results. Further, the small number of viral reference

genomes available, coupled with short sequence read lengths might cause errors in virus identification. Despite these limitations and potential biases, the data show that viral communities associated with corals are diverse, with double- and single-stranded DNA and RNA viruses. The identified viruses are dominated by double-stranded DNA-tailed bacteriophages, but there are also viruses that infect eukaryote hosts, likely the endosymbiotic dinoflagellates, *Symbiodinium* spp., host coral and other eukaryotes in close association.

http://onlinelibrary.wiley.com/doi/10.1111/1462-2920.12803/full

An analysis of *Pseudomonas* genomic diversity in take-all infected wheat fields reveals the lasting impact of wheat cultivars on the soil microbiota

T. H. Mauchline *et al.*

Manipulation of the soil microbiota associated with crop plants has huge promise for the control of crop pathogens. However, to fully realize this potential we need a better understanding of the relationship between the soil environment and the genes and phenotypes that enable microbes to colonize plants and contribute to biocontrol. A recent 2 years of investigation into the effect of wheat variety on second year crop yield in the context of take-all fungal infection presented the opportunity to examine soil microbiomes under closely defined field conditions. Amplicon sequencing of second year soil samples showed that *Pseudomonas* spp. were particularly affected by the wheat cultivar grown in year one. Consequently, 318 rhizosphere-associated *Pseudomonas fluorescens* strains were isolated and characterized across a variety of genetic and phenotypic traits. Again, the wheat variety grown in the first year of the study was shown to exert considerable selective pressure on both the extent and nature of *Pseudomonas* genomic diversity. Furthermore, multiple significant correlations were identified within the phenotypic/genetic structure of the *Pseudomonas* population, and between individual genotypes and the external wheat field environment. The approach outlined here has considerable future potential for our understanding of plant–microbe interactions, and for the broader analysis of complex microbial communities.

http://onlinelibrary.wiley.com/doi/10.1111/1462-2920.13038/full

Environmental Microbiology Reports

www.env-micro-reports.com

Amid the possible causes of a very famous foxing: molecular and microscopic insight into Leonardo da Vinci's self-portrait

Guadalupe Piñar *et al.*

Leonardo da Vinci's self-portrait is affected by foxing spots. The portrait has no fungal or bacterial infections in place, but is contaminated with airborne spores and fungal material that could play a role in its disfigurement. The knowledge of the nature of the stains is of great concern because future conservation treatments should be derived from scientific investigations. The lack of reliable scientific data, due to the non-culturability of the microorganisms inhabiting the portrait, prompted the investigation of the drawing using non-invasive and micro-invasive sampling, in combination with scanning electron microscope (SEM)

imaging and molecular techniques. The fungus *Eurotium halophilicum* was found in foxing spots using SEM analyses. Oxalates of fungal origin were also documented. Both findings are consistent with the hypothesis that tonophilic fungi germinate on paper metabolizing organic acids, oligosaccharides and proteic compounds, which react chemically with the material at a low water activity, forming brown products and oxidative reactions resulting in foxing spots. Additionally, molecular techniques enabled a screening of the fungi inhabiting the portrait and showed differences when different sampling techniques were employed. Swab samples showed a high abundance of lichenized Ascomycota, while the membrane filters showed a dominance of *Acremonium* sp. colonizing the drawing.

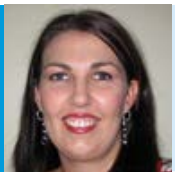
http://onlinelibrary.wiley.com/doi/10.1111/1758-2229.12313/full

Disturbance of the bacterial cell wall specifically interferes with biofilm formation

Tabitha Bucher *et al*.

In nature, bacteria communicate via chemical cues and establish complex communities referred to as biofilms, wherein cells are held together by an extracellular matrix. Much research is focusing on small molecules that manipulate and prevent biofilm assembly by modifying cellular signalling pathways. However, the bacterial cell envelope, presenting the interface between bacterial cells and their surroundings, is largely overlooked. In our study, we identified specific targets within the biosynthesis pathways of the different cell wall components (peptidoglycan, wall teichoic acids and teichuronic acids) hampering biofilm formation and the anchoring of the extracellular matrix with a minimal effect on planktonic growth. In addition, we provide convincing evidence that biofilm hampering by transglycosylation inhibitors and D-Leucine triggers a highly specific response without changing the overall protein levels within the biofilm cells or the overall levels of the extracellular matrix components. The presented results emphasize the central role of the Gram-positive cell wall in biofilm development, resistance and sustainment.

http://onlinelibrary.wiley.com/doi/10.1111/1758-2229.12346/full



Melissa McCulloch
Wiley-Blackwell

OPEN ACCESS

Unlocking the future of research

Melissa McCulloch
Wiley-Blackwell

Q What is open access?

A Open access (OA) benefits authors and institutions by, potentially, delivering increased readership and supporting overall citations. There are two types of open access: gold and green. Gold open access is a pay-to-publish model, with research being peer reviewed and made publicly available without charge to the reader. Green open access is self-archiving by the author of research in an online repository.

Q What does gold or green open access mean?

A Gold open access is a **pay-to-publish model**. It means that the final publisher version of the article is freely accessible online, immediately and permanently with full re-use rights, after going through the process of peer-review. An article publication charge (APC) is normally applied, and the article can appear either in a fully OA journal, or in a hybrid journal.

Gold open access articles are usually published under a Creative Commons (CC) license, and articles can be auto-archived in a repository such as Pub Med Central when appropriate.

Green open access is known as self-archiving, and is where the author, institution or publisher places a version of the article in a repository or website, after publishing in a subscription-based journal.

Individual self-archiving policies may vary by journal or publisher, and determine which article version can be used, where it is published, and when an article may be available (either immediately or after an embargo period).

Q What is an article publication charge (APC)?

A An article publication charge (APC) is required by gold OA journals to cover the cost of publishing. Whilst open access principles promote free availability of research and scholarly output, research papers are not cost free to produce. The cost of publication is moved from the reader (via subscriptions and pay-walls) to the creator (via the APC).

Q What is a fully or hybrid OA journal?

A A fully Open Access Journal is one in which all published papers are open access, and there are no subscribers. A hybrid journal is a subscription-based journal, that also offers authors the choice to publish their accepted article as open access. Subscription fees are typically adjusted so customers don't pay twice.

Q What are the benefits of publishing gold OA?

A When publishing an article as gold OA, the final published article is freely available online immediately. This supports article visibility and reach.

Q Is there any funding available for OA?

A Yes, there is. Many funders and institutions have made open access part of their general funding. Alternatively they may have created central funds dedicated to covering APCs for their researchers, faculty or members. As part of receiving these funds, researchers are often asked to follow the relevant funding requirements for their organization, known as a 'mandate'.

Q What are OA mandates?

A Many institutions, funders, societies and organizations globally have adopted OA mandates. These mandates request that affiliated authors make publicly funded research freely available to all. Some mandates preference the model required (e.g., green or gold), while others give the authors a choice for how and where they would like to publish their article open access.

Q What is a Creative Commons license?

A A Creative Commons (CC) license is considered the industry standard license for articles published under the gold OA / pay-to-publish model. With a CC license, the author typically retains the copyright, and it gives the public the right to share, use and build on an author's work. It also protects the people who use an author's work, so they don't have to worry about copyright infringement, so long as they abide by the conditions of the license.

There are six main types of CC license offered, and its use depends on the copyright policy of each different publisher. The most common license is the CC-BY, or Creative Commons Attribution License. The CC-BY allows anyone to do what they like with the article, allowing research to be continued and ideas to move on.

Q What are repositories?

A Repositories are a public archive for research and/or data to be stored for sharing and preservation. The most well-known subject-based repository for research is PubMed Central (PMC). Repositories may contain Submitted, Accepted or the Final Publisher versions – depending on funder and journal policies.

Q What is open data?

A Open availability of digital outputs of research are integral to understanding that research, e.g., software, code, materials, models, sound, interview transcripts, video and multiple images. Funders are increasingly requiring grantees to deposit raw research data in appropriate repositories – for researchers to share (and gain credit for sharing) their research data and provide greater accessibility and reproducibility.

Q How do I choose between green and gold?

A To choose between green and gold, you would look at a combination of your funder mandate and the journal policy. Firstly, find out the details of the OA policies for the funders supporting the research in your paper. At that point you should find out the details of the OA policy for your journal of choice.

Further information:

There is a lot of information on open access available through reputable organizations online, including most research institutions and publishers. For more information, you can visit:
http://www.wileyopenaccess.com/view/index.html

or watch our video on Understanding Open Access:
https://www.youtube.com/watch?v=gdR3X4Z5COU&feature=youtu.be

MEMBERSHIP Benefits & Options

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.
- Access to our five peer-reviewed journals: *Journal of Applied Microbiology* (JAM), *Letters in Applied Microbiology* (LAM), *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 S*f*AM meetings and conferences.
- Networking with worldwide professionals in over 80 countries
- Access to private Members' area of the S*f*AM website.
- Monthly email bulletins with the latest news from S*f*AM.
- Invitation to the annual *Environmental Microbiology* and *Journal of Applied Microbiology* lectures.
- Fostering cross disciplinary research.
- A 35% 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/membership**.

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, together with application forms, can be found on the website at **www.sfam.org.uk/grants**.

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*. See more at **www.sfam.org.uk/journals**.

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; and 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 lectures held to commemorate the success of two of our journals: *Environmental Microbiology* and the *Journal of Applied Microbiology*. We also hold *ad hoc* meetings on topical subjects and enter into joint ventures with other organizations on topics of mutual interest.

WEBSITE

www.sfam.org.uk is the best source of detailed information on the Society and its many activities. It has a fully interactive Members-only area (**www.sfam.org.uk/membersonly**) where you can find archive issues of *Microbiologist*, exclusive S*f*AM documentation and much more.

Membership OPTIONS

Full Ordinary gives access to our many grants and awards, online access to the *Journal of Applied Microbiology*, *Letters in Applied Microbiology*, *Environmental Microbiology*, *Environmental Microbiology Reports* and *Microbial Biotechnology*, copies of *Microbiologist*, preferential registration rates at Society meetings, and access to the Members-only area of the website.

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

Associate 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 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: 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: 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 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).

Join us!

You can apply for membership online (**www.sfam.org.uk/join**) or offline. To apply offline, please contact the Membership & Finance Co-ordinator, Julie Wright on **+44 (0)1234 326846**, or email **julie@sfam.org.uk**.

CAREERS

EVENTS management

When I was first asked to write a careers article for *Microbiologist* I wasn't sure many would be interested in reading about the processes of events organization. Then I realized just how much holding conferences on subjects such as antimicrobial resistance, vaccines and food contamination is central to S*f*AM's strategy as the voice of applied microbiology.

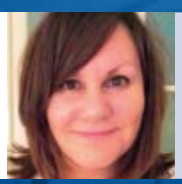
Networking is key in the scientific community, and that's why S*f*AM invests heavily in its scientific meeting programme. All scientists throughout their careers, from undergraduate to leaders in their fields, are strongly recommended to attend seminars, conferences and evening lectures so that they can meet and interact with other professionals with similar interests.

I've been a freelance Event Manager for 15 years now and worked with some really fascinating clients including the Society for Applied Microbiology. My degree is in Modern History, specializing in Nazi Germany and I find striking up a conversation about World War II far easier than one about super-resistant gonorrhoea or zoonotic disease transmission routes, but this has certainly not diminished the excitement I get from working with S*f*AM. In fact, being part of the team at the Society for about nine years has allowed me to really understand what is needed to be creative and responsive and to contribute effectively to the programme of events. Currently, as I write, S*f*AM feels very fresh, vibrant and new again, largely thanks to a great Executive Committee and Chief Executive, Lucy Harper. Wonderful things are ahead, I feel.

The route I took to becoming an event manager is not very typical. After I graduated from university I began training as an accountant, but realized very quickly that this type of work was not for me. So, in 1998, I did what every graduate with no idea of where she is going in life did. I started working at a call centre selling gas and electricity over the telephone.

In 2000 during maternity leave I began looking for ways to earn a living and juggle a career with a family life. Purely by chance, an old friend asked if I would help to organize a conference for a membership organization on a freelance basis. His magic words to me were, "*everything is a real mess, we are desperate, someone needs to put a process in place*". Well, he had me at "*everything is a real mess*". I can't help myself; I do love a challenge. And the rest is history! I was introduced to Phil Wheat in 2006 and started working with S*f*AM then. By the time he retired, even Phil was impressed with my services (high praise indeed).

When I started out the word 'mumpreneur' didn't really exist but there are now around 204,000 businesses in the UK run by mothers with children aged 18 or under, all targeting that work-life balance. This has obviously been made possible by the Internet and the virtual infrastructure now firmly in place. I often say to people that my business has grown with my son, who is



Sally Hawkes
SfAM Events Manager

FURTHER READING

http://www.telegraph.co.uk/finance/yourbusiness/11782294/Mumpreneurs-generate-7bn-for-the-UK-economy.html

nearly 15. Now, rather than it just being a means to an end, it is very much a huge part of my life.

Every conference is like giving birth to a new child, but a great deal less painful.

What is a day in my life like? I am often deep in the Internet, researching venues for upcoming events, and am so grateful to Google Maps and Trip Advisor for making my life that bit easier. I am regularly out and about visiting venues, checking out the mould on their shower curtains and realizing that photos and descriptions on websites can be very misleading. A hotel that waxes lyrical about the amazing high ceilings in its largest meeting room, for example, should be interpreted to read: "it has no windows and is in the basement". Of course, there are some excellent venues too, and *Sf*AM is keen to use as many good quality, good value places as possible.

Invariably my day includes some sort of encouraging (nagging) of speakers to send me their abstracts and other details. Sometimes I get all creative and work with *Sf*AM's Corporate Communications Manager, Paul Sainsbury, to produce the flyers and handbooks we have at our events. Then there's the nitty gritty of processing registrations and payments, receiving offered abstracts and sending those to be reviewed by volunteers on the Meetings Subcommittee. I'll be honest and say that name badges are often made in the evening in front of a few episodes of Friends, and a lot of caffeine is needed to get me through typing up minutes. Then as we all know, food and drink can make or break any conference so it's essential that a lot of thought be put into the menu! I try to ensure a good choice of courses, along with lots of wine and options for those with special dietary requirements.

My goal is always to arrange as much as possible in advance and to 'dot every i and cross every t'. Hopefully then, when the conference is underway, the only fires I have to put out are new, unexpected ones rather than those which should have been prevented before the event started. Being well organized in advance and not leaving anything to chance also ensures that *Sf*AM's Membership and Finance Co-ordinator, Julie Wright, and I have valuable time available for giggling late at night in the hotel bar.

I also try to keep up-to-date with the latest innovations in the event industry. New technologies are introduced all the time with wearable technology being one of the latest trends, such as heart rate monitors for the audience to wear indicating when it is time to do something interactive or spice things up a bit. Drones are the new way to take videos and photographs, hovering over the top of a dinner or conference perhaps. And, my personal favourite: holograms. Holograms can mean exhibitors won't need to send someone to the event, but can chat to people from their office, and holograms can mean that that elusive keynote speaker may be possible after all. I also follow other event-related discussions such as how to avoid the mid-afternoon slump by not offering the usual high flour and sugary treats at coffee breaks and opting for lower calorie and healthier lunches. This is something we can try to implement in the future. I'm also conscious of the need to work towards creating environmentally friendly events.

I hope you've enjoyed reading a bit about my work and getting to know more about me. I'm always available to help with your event bookings and other questions at sally@sfam.org.uk and it would be remiss of me if I didn't encourage you all to look at the list of brilliant conferences the Society has laid on for you in 2016: **http://www.sfam.org.uk/en/events/sfam-events/index.cfm**. Remember to book early!

Membership CHANGES

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

BELGIUM
S. Caulier

CAMEROON
V. J. Bella

INDIA
N. Choksi

IRELAND
D. Dowling
K. Egan
J.-C. Ellis
F. Paradisi
J. Ruth-Byrne
R. Sulea

ISRAEL
Y. Gerchman

ITALY
S. Salami

NIGERIA
B. S. Adeleke
B. Adeniyi
E. U. Agwu
A. L. Akunna
U. S. Angiegiaye
N. Chibuko
A. P. Chidinma
N. C. Chinedu
U. Chkwuebuka
D. O. Eduma
I. E. Ekpenyong
O. Fadipe
A. A. George
O. C. Gift
D. N. Harrison
B. O. Idam
E. N. Justine
E. I. Ngozi
G. H. Nkechinyere
P. Nwakpa
A. T. Nworie
C. E. Nzere
S. Obiazikwor
A. Obisesan
B. Odumosu
A. Oguji
E. B. Okonjo
O. Olonisakin
A. Olowookere
J. Oluchi
E. V. Omiko
G. O. Ude
C. U. Onyenucheya
I. L. Orji
A. E. Peace
B. A. Sampson
D. I. Ugwu
J. O. Uwa
U. N. Uzoma

PORTUGAL
C. F. Rodrigues

SINGAPORE
S. M. Khader

SOUTH AFRICA
O. A. Ijabadeniyi
A. Oladunjoye
O. F. Olagunju
G. P. Zwane

SWITZERLAND
S. Filippidou
F. Palmieri

UAE
N. Mustafa

UK
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D. R. Alves
J. Amartey
C. Arnold
D. Arnold
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C. Barrow
Y. Bashawri
R.-J. Bleichrodt
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H. Bundy
Y. Cai
L. Carpenter
A. Cawthrow
C. Christodoulou
L. Ciric
V. Clifton
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H. Copeland
M. Dawson
R. Devine
P. Donohoe
H. C. Dorfmueller
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A. Edmondson
M. El Awamie
S. Elbakoush
M. Fallon
P. Fernandez
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C. Martino
S. K. Velusamy

CORPORATE
Synbiosis Ltd

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

Wilfred Roling

Corporate NEWS

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

Browse by pathway – a new way to find reagents at antibodies-online

Aachen, 19th January 2016. No one molecule tells the whole story. Within the cell, individual components transact in beautiful, complex, dynamic interplay. Modern cellular biology is focused on decoding these intricate biological networks. The new pathway pages at antibodies-online.com are designed to help the intrepid researcher who wants to see the bigger picture. antibodies-online has made it easier than ever to find and buy antibodies against multiple targets in the same biochemical or cell-signaling pathway. At antibodies-online you can currently learn about, and browse for reagents in the following pathways: PI3K-Ak, Apoptosis, Cell Division Cycle, Complement System, Hedghog Signaling, JAK/ STAT Signaling, MAPK, Microtubule Dynamics, NF-kappaB Signaling, Notch Signaling, p53 Signaling, PI3K-Akt Signaling, RTK Signaling, and WNT Signaling.

For more information:
http://www.antibodies-online.com/pathway/

Further Information

Visit: www.antibodies-online.com
Tel: 0241-9367 2533
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Vetqas is the Animal & Plant Health Agency (APHA) independent, accredited, proficiency testing (PT) unit. It is the international market leader in proficiency testing (PT) for veterinary laboratories with over 30 years' experience.

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Your ability to anonymously compare your performance with other participating laboratories is an important feature of our service which helps to improve consistency between laboratories and countries.

Taking part in a PT scheme shows a commitment to improving performance. This is of great value in maintaining a good reputation for delivering high quality, reliable and accurate results.

The Vetqas PT schemes include:

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- Haematology
- Clinical Chemistry
- Histopathology
- TSE
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Rapid, clear identification of *Salmonella, Shigella, E. coli, Yersinia*

Clean, clear agglutination is what all microbiologists want from antisera used to confirm the identity of a pathogen.

SIFIN monoclonal antibodies have greater specificity than conventional polyclonal antibodies so deliver that clarity of result.

UK Customer Testimonial
Both salmonella & shigella reactions were noticeably stronger and easier to read with the Sifin antisera. We also observed that weak non-specific reactions with our existing antisera, caused by Hafnia alvei and E. coli

(which would normally require further identification tests) were virtually eliminated with the Sifin antisera.

50% discount on your first order.

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Email: welcome@bioconnections.co.uk

Environmental Monitoring Expertise with Exceptional Customer Service

Cherwell Laboratories based in Bicester, Oxfordshire has been manufacturing pre-prepared microbiological media for the pharmaceutical and related industries under the Redipor® name since the 1980s. As a family run company we pride ourselves in the highest level of customer service through all aspects of our business. The recent employment of Andrew Ramage as our Microbiology Product Specialist in November 2015 will enhance the knowledge and level of support we can offer to our customers.

Offering an extensive selection of both industry standard products and those with a unique formulation or presentation, the Redipor® range provides a flexible solution for environmental monitoring, sterility testing of products, operator validation and process validation. The range includes petri dishes (55mm, 90mm and 140mm) and contact plates, plus bottled media, broth bags and ampoules, with all products subjected to a full array of QC tests, including comprehensive growth tests.

For more information about our Redipor® range of media, our SAS air sampler product range and cleanroom decontamination solutions from Mar Cor Purification which includes the new Minncare®Dry Fog 2 system please visit our website at www.cherwell-labs.co.uk.

Further Information

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Service and Support for Laboratory Equipment

Don Whitley Scientific can offer UK customers comprehensive maintenance and repair contracts on a variety of laboratory equipment, including:

- Workstations
- Spiral platers
- Autoclaves
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- Gravimetric diluters
- Media preparators
- Colony counters
- Pourer stackers
- WASPLab

In almost all cases, we are able to carry out repairs on site or, when not possible, we can install loan units to minimise customer downtime whilst repairs are carried out at our premises.

Our engineers are trained by the manufacturers of the products we sell – training that is not available to everyone. This also means that we have continuous access to genuine replacement parts.

As for our own Whitley products, because we design and manufacture them ourselves, our engineers receive full factory training and the continuous support of our own R&D and Production teams. We consider ongoing training a crucial requirement to ensure our engineers are always aware of updates, production amendments, and changes due to emerging technologies. Because our engineers carry a comprehensive range of spare parts and consumables, many problems can be fixed on the spot, avoiding unnecessary downtime or repeat visits.

We can also offer UKAS calibration for equipment we sell. This facility is provided by our dedicated accreditation team.

Further Information

Visit: www.dwscientific.co.uk
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Email: sales@dwscientific.co.uk

Infection Control or Hygiene Control?

Environmental sampling is an area in which the needs and practices within health care and industry are similar. Infection control practitioners must monitor the effectiveness of cleaning practices, particularly within the near-patient environment, while the quality control specialist in the food and pharmaceutical industries needs to assess hygiene controls throughout the

manufacturing processes. With many decades of experience working with clinical and industrial microbiologists, Medical Wire has developed a range of devices particularly suited to environmental surveillance.

Polywipes™ are hand held sponge swabs for sampling larger surfaces, such as the conveyor systems often found in the food industry, and curtains surrounding patients beds. **NRS II Transwabs®** are premoistened with a range of diluents including some (NRS medium) with neutralisers to counter the effects of trace droplets of disinfectants which would be left on cleaned surfaces and interfere with recovery of any remaining bacteria – whether on food processing equipment, or near a patient's bed. **The new EnviroMax Plus®** has a large premoistened foam tip for sampling larger and less accessible surfaces , while **Isolation Transwabs®** allow the detection of particular pathogens including *Salmonella*, *Listeria* and Coliforms.

Further Information

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

NCIMB offers GMP fungal identification services

NCIMB offers genotypic identification of yeasts and moulds to Good Manufacturing Practice (GMP) standards with a choice of same day, next day, three day, and ten day turnaround.

Species level identification of fungi by phenotypic means is challenging, and so the development of genotypic methods has been extremely beneficial for this area of microbiology. Two distinct approaches have emerged: sequencing of the D2 region of the large subunit ribosomal DNA (D2 LSU), and sequencing of either one or both of the internal transcribed spacer regions between the small and large subunit ribosomal RNA genes (ITS). At NCIMB we combine these techniques to offer a comprehensive service that gives our customers the most reliable species level identification available.

For D2 LSU identification, sequences are analysed against the validated MicroSEQ® database, and this is always the first approach we use. In some cases, however, this only gives a genus level identification. When this occurs we often find a species level identification can be obtained by using the ITS method, if it is required.

NCIMB is regularly audited by blue chip clients from the UK and overseas, ensuring we meet their high standards, and we provide clear, easy to understand reporting tailored to customer requirements.

For more information contact Vikki Mitchell, v.mitchell@ncimb.com

Further Information

Visit: www.ncimb.com
Tel: +44(0)1224 711 100
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Southern Group Laboratory

SGL's new 2015/16 Microbiology product guide available now! Please contact info@sglab.co.uk to receive a copy.

Established over 90 years ago within the NHS and trading as a private limited company for the past 25 years, SOUTHERN GROUP LABORATORY (SGL) is an **independent media manufacturer** that offers an extensive range of **pre-prepared bottled media, plated media, stains, reagents and other products for microbiology**.

- All activities are certified to ISO 9001 with quality control accredited by UKAS ISO/IEC 17025, ensuring consistent high-quality products.
- All media production takes place in a clean room environments and our poured plate production facility has clean-rooms validated to: ISO 14644-1 (Class 7), EU GMP (Grade C).
- GMP and GLP techniques employed throughout all production and laboratory areas.
- Rigorous QC examination with certificates available online.

As an independent media producer we have the flexibility to manufacture in small batches and as such we can supply any commercial or **custom-specified formulations** to order. So, whether you require a completely new medium or simply a different pack or fill-size, please call our Customer Services Department on 01536 403815.

Further Information

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TCS Biosciences Ltd

Here at TCS Biosciences Ltd, we have 50 year's experience in supplying the needs of microbiologists worldwide. As Europe's leading supplier of donor animal blood and sera for inclusion in plated media, we have built a reputation for quality, versatility and outstanding customer service.

Our commitment to continuous improvement, quality monitoring and customer care has ensured the on-going growth of TCS and facilitated expansion beyond our core business in the Clinical sector. Today we are a prominent figure in the UK water industry and European pharmaceutical market, our current focus is the development of our product range within food microbiology.

TCS is focused on developing our presence and product portfolio in each market sector, without compromising our core business value.... Quality.

Further Information

Visit: www.tcsbiosciences.co.uk
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Thermofisher

Are you looking to move from BSAC to EUCAST antimicrobial susceptibility testing (AST) disc diffusion methodology?

To help ensure a seamless transition for laboratories that adopt the EUCAST methodology, Thermo Fisher Scientific offers a wide range of EUCAST-recommended AST Discs, as well as a variety of accessories for AST.

In fact, in a recent EUCAST study comparing the performance of disks from nine manufacturers around the world against EUCAST QC guidelines, Oxoid Discs showed the tightest performance to EUCAST target values across the range.

Sixteen discs with nominal potencies, as recommended by EUCAST, were selected for evaluation against published quality control (QC) ranges and targets for relevant strains. Nearly all of the Oxoid Discs evaluated in the study met the tightest criteria of the mean zone, being within 1mm of the target.

Antimicrobial Agent	Disk Content	Range	Oxoid Disk Performance Results
Benzylpenicillin	1 unit	EUCAST	
Amoxicillin-clavulanic acid	20-30	EUCAST/CLSI	
Piperacillin-tazobactam	30-Jun	EUCAST	
Oxacillin	1	EUCAST	
Mecillinam	10	EUCAST/CLSI	
Cefotaxime	5	EUCAST	
Cefoxitin	30	EUCAST	
Ceftazidime	10	EUCAST	
Meropenem	10	EUCAST/CLSI	H
Ciprofloxacin	5	EUCAST/CLSI	
Norfloxacin	10	EUCAST/CLSI	
Pefloxacin	5	EUCAST	
Gentamicin	10	EUCAST/CLSI	
Tobramycin	10	EUCAST/CLSI	
Erythromycin	15	EUCAST	
Tetracycline	30	EUCAST	

Mean value within ± 1 mm of the target value

Mean value › 1 mm but within ± 2 mm of the target value

Mean value › 2 mm from the target value but within the QC range

Mean value of the QC range

H = High, mean value › 1mm above target

This study was undertaken by the EUCAST Development Laboratory (EDL), Växjö, Sweden, in 2014 and 2015.

Thermo Scientific™ Oxoid™ Discs are manufactured in accordance with appropriate quality standards, including BS EN ISO 9001:2008, ISO 13485:2003 and FDA 21 CFR part 820, and undergo comprehensive quality control testing to ensure maximum accuracy and reproducibility, For clinical applications, Oxoid Discs are CE-marked under the IVD directive, 98/79/EC.

For more information on Oxoid Disks, as well as our complete portfolio of manual and automated AST solutions, visit www.thermoscientific.com/AST.

Further Information

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PRO-LAB DIAGNOSTICS

Celebrating 21 years of unparalleled success!

Microbank™ Bacterial & Fungal Preservation System

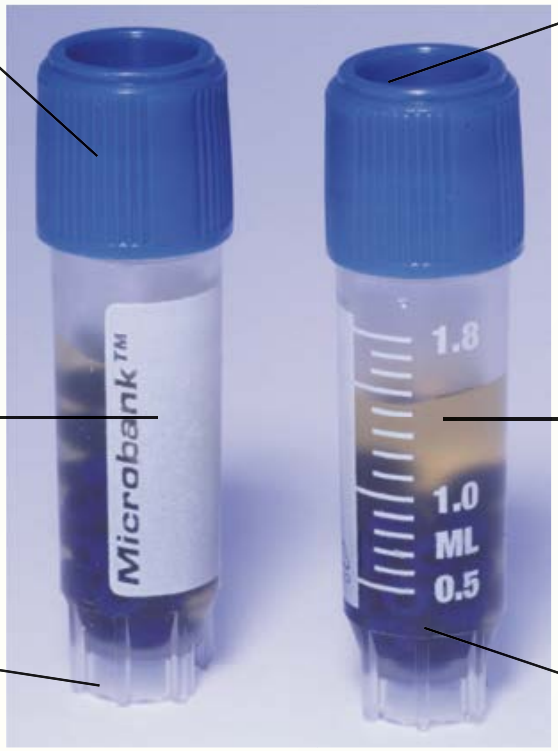
Microbank™ is a convenient, ready-to-use system designed to greatly simplify the storage and retrieval of bacterial cultures. It is composed of a unique cryovial system incorporating treated beads and a special cryopreservative solution.

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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Fax: 0151 353 1614
E-mail: uksupport@pro-lab.com

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E-mail: support@pro-lab.com

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- Superb catch and release of microorganisms
- Hi-white foam and shaft for easy visualisation of colorimetric changes
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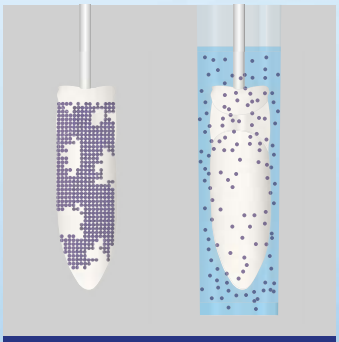
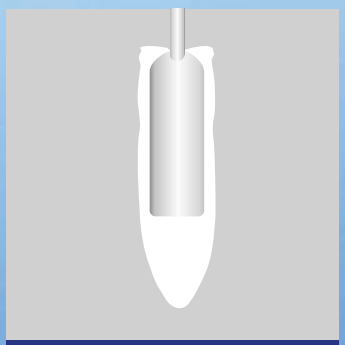
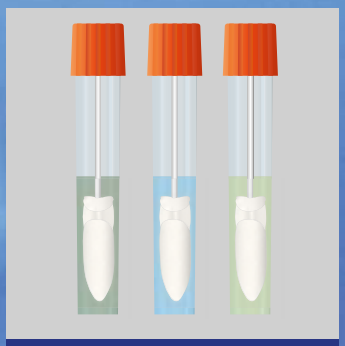


Catch and Release



Paddle Structure



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