The magazine of the
Society for Applied Microbiology

microbiologist

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Synthetic colloids with antimicrobial action

Academia and industry collaboration: challenges and opportunities

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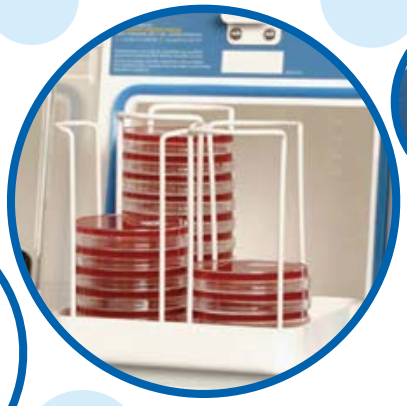

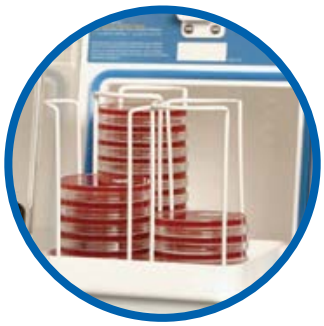

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Nancy Mendoza reviews the content of this issue

A new look for microbiologist

I am delighted to welcome you to the June 2014 edition of *Microbiologist*, which is sporting a brand new look. We hope that you will find the aesthetic changes pleasing and the layout accessible. Please let us know your views on the changes to *Microbiologist*. You can email me at **nancy@sfam.org.uk** or contact the whole team at **communications@sfam.org.uk**. Additional contact details can be found on page 9.

Industrial Microbiology

This edition focuses on Industrial Microbiology, with an emphasis on bridging the gap between academia and industry, and making the most of the economic potential inherent in the science of microorganisms.

In our first feature, Eileen Hao Yu from Newcastle University tells us about Microbial Fuel Cells (MFCs) and related applications, which are proving effective for sustainable energy production and recovery of useful products from wastewater. The coupling of MFCs to activated sludge sewage treatment plants has a theoretical energy output of up to 1200TWh/yr, if the organic matter excreted by all the humans on the planet into wastewater were used as a feedstock – that's nearly 1% of the entire energy usage of the world, just from wastewater! Following on from that, Anupam Das and Vesselin Paunov from the University of Hull discuss the industrial application of synthetic colloids as antibiotics and antiseptics – particularly topical, given current public attention on antibiotic resistance.

In our third feature, S*f*AM Executive Committee Member, Clare Taylor, looks at the various aspects of establishing successful public-private partnerships for research. She examines the pipeline from academia to industry, with the support of an institution's business development staff, and notes that high-quality communication is key. All involved have to negotiate differences in the languages of science and business to ensure that the commercial potential of research is not lost. Then we have a short feature from the Biotechnology and Biological Sciences Research Council, laying out the potential opportunities for microbiologists to transition into the field of Industrial Biotechnology; and a summary of a recent *Environmental Microbiology* editorial that proposes to establish pipelines for new chemicals from nature, partly in order to tackle the economic crisis in Southern Europe and provide jobs for talented young scientists in Italy, Greece, Portugal and Spain.

You'll find all the usual regular features in your new *Microbiologist*; a historical perspective on whooping cough, from Norman Fry; and Valerie Edwards-Jones tells us about her career in Medical Microbiology. The PECS Committee have events planned for students and early career scientists at our Summer Conference, as well.

It's welcome back to the S*f*AM office for Lucy Harper. Lucy, having entrusted me with the Communications reins at S*f*AM for nine months, has returned in a new role and so I'll be continuing to edit *Microbiologist*, as well as looking after Communications at S*f*AM.

NEWS IN BRIEF

MERS-CoV not yet emergency

WHO declares MERS-CoV not yet Public Health Emergency of International Concern. **http://bit.ly/SFAM_MERS**

Pizza herb destroys vomit bug

Effective disinfectant for the control of norovirus, the winter vomiting bug, from oregano oil. **http://bit.ly/SFAM_OREGANO**

Light-up Listeria

Bacteriophage swab developed to induce light emission from Listeria cells in food production. **http://bit.ly/SFAM_LISTERIA**

Nancy Mendoza, *Editor*

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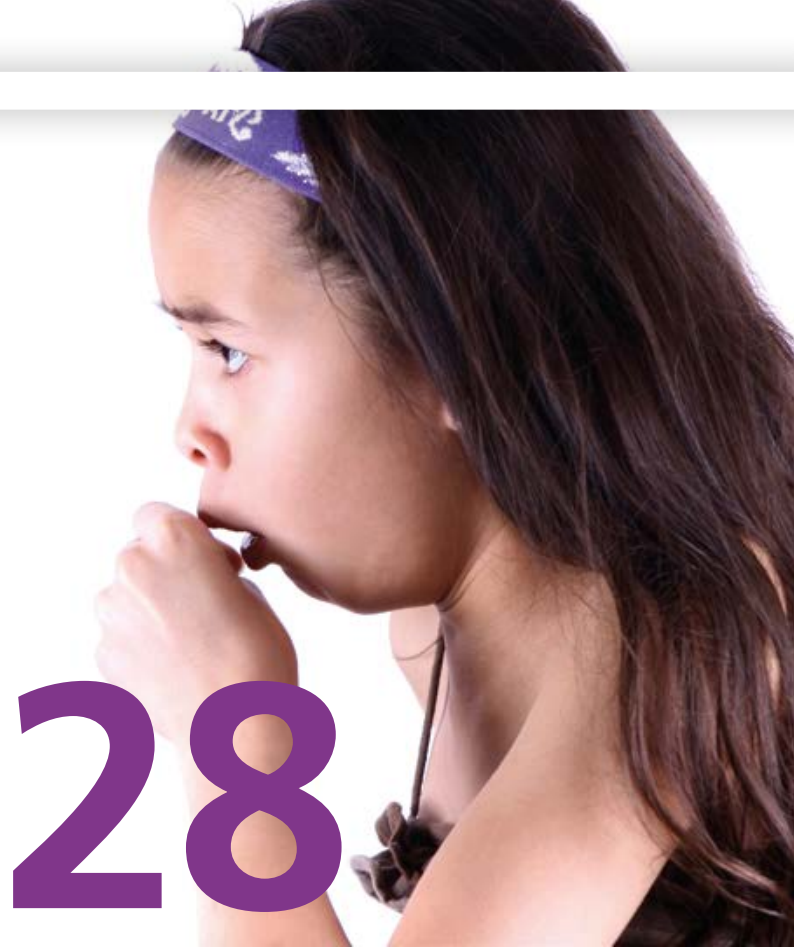

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President's column

This is my final President's column as my term of office ends at the AGM in July when Professor Christine Dodd assumes the Presidency. It has been a great honour to serve the Society over the last three years as indeed it was during my preceding terms on Committee and as Meetings Secretary.

I have been very fortunate to be President at what has been an incredibly buoyant time for the Society with record membership levels, an expanding programme of grants and awards, meetings and outreach events, underpinned by a sound financial position. This has been achieved against a background of international economic recession and what, for many, appeared as a harbinger of doom for learned societies – the advance of open access publishing. The Executive Committee and full-time staff have certainly not closed their eyes to these developments and have planned accordingly. While it may be true that at some stage expenditure will have to be reined in to reflect a declining income from publications, it appears that this is unlikely to be dramatic and that our current situation will not later be compared with the glorious Edwardian summer that preceded the cataclysm of the 1st World War, as some more pessimistic observers have maintained. We are very positive about the future, the growth and development of the Society, and our continuing ability to support our Members.

In April I visited Danielle Weaver, recipient of the first S*f*AM sponsored PhD studentship, and her supervisor Dr Dennis Linton at the University of Manchester. This award was a first venture for us and there is always a little anxiety about how well new initiatives will turn out; in the event, it has gone remarkably well. In these cash-strapped times it was not surprising that we received a large number of really excellent applications for the studentship, which made the judging process extremely difficult. So it was good to hear our decision vindicated and how, eight months into the project, the work is progressing extremely well. This will certainly encourage us to think about offering another studentship in the near future.

The objective of our grants and awards is to help Members in their professional lives and this can be done in a number of ways. I have always been a keen supporter of the Students into Work Grant which directly benefits both a supervisor and a student, and I was very pleased to see its extension last year to cover a stipend for undergraduate students gaining unpaid practical experience in an outside laboratory. For other Members, we have now started to address the important problem that the cost of care arrangements for children and other dependents can sometimes pose, preventing Members from attending scientific meetings.

We recognize the importance of interacting with the outside world, getting messages across about the importance of microbiology and encouraging its study; we have increased our activities dramatically in this area over the last few years. In part, this has been supported by Public Engagement Grants and the Communications Awards, but what has impressed me is the number of S*f*AM Members who give up their time so willingly to participate in these outreach events.

Record membership levels, an expanding programme of grants and awards, meetings and outreach events, underpinned by a sound financial position

The 2014 *Sf*AM Summer Conference is on Zoonoses and promises to be the biggest we have held for many years

This issue of the *Microbiologist* coincides with our Summer Conference, which promises to be the biggest we have held for many years. There is no doubting the huge importance of zoonotic disease to humankind and this has been amply demonstrated by the excellent scientific programme. This is serious stuff and that is why it has attracted such a large audience. The size of the meeting also reflects the growth of the Society's membership. I like to think that increasing membership is not just a reflection of shrewd judgement about value for money, the benefits and awards versus the incredibly good value membership fees, but also reflects Members buying into the ethos of the Society. We have always regarded ourselves as the friendly Society – Members have an obvious interest in the subject, a desire to learn more and to continue to stay abreast of developments in the field, but this is always pursued in a friendly and convivial way. We derive considerable satisfaction from learning about microbiology and its applications but it's important that we should not be too solemn about it. The mathematician and philosopher Bertrand Russell once deflated an earnest enquiry about how much happiness he had derived from his professional activities saying, "*I do not think that science per se is an adequate source of happiness, nor do I think that my own scientific outlook has contributed very greatly to my own happiness, which I attribute to defecating twice a day with unfailing regularity.*" This is probably not the answer for everyone – I am tempted to speculate whether, on that basis, a *Campylobacter* infection would have sent Russell into ecstasies of joy – but there is a clear message there about maintaining balance in one's life.

Finally, it wasn't simply a sense of pride that made my term as President so enjoyable but the pleasure of working with such an outstanding group of agreeable and capable people: the full-time staff, Officers and Committee Members. It would be nice to claim our recent successes for my own, but I have to acknowledge that my role in this has been very slight and the credit should go to them. We have made an excellent choice in Christine Dodd as the next President and I am sure she will continue, with the help and support of staff and Committee, to build an even better Society. *Floreat* SfAM.

Martin Adams
SfAM *President*

CEO's column

In recent times, the Executive Committee (EC) has made a strategic priority of grants, aiming to offer a variety of different benefits to Members. Recently, we have had considerable success in granting funds to Members, with increasing numbers benefiting. As an example, if you look at the number of individual Members who received grants in 2007, 65 Members received a total of approximately £79000; comparing this to the figures for 2013 which were 169 and £268000 respectively, the progress is clear.

The **Public Engagement Grant** is increasingly popular. This grant has enabled Members (and in some cases non-Members) to develop innovative pieces of work, which have been associated with applied microbiology and have public engagement as its main focus. The EC is continually reviewing which grants are offered to you as Members and has decided to split the Public Engagement Grant into two award categories:

(A) Public Engagement Award

This award is designed to support events where aspects of microbiology are promoted to the general public and other relevant stakeholders. Events eligible for support can be very diverse, from pieces of art to popular music, or funds may be used to aid individuals to attend and exhibit at public science festivals. The main criterion is that the event/activity must in some way promote the science of microbiology.

Eligible persons are Members and non-Members of the Society. Members should have no funding from any additional source. In addition, expert public engagement specialists/science communicators are also eligible to apply. This is provided that satisfactory evidence is produced concerning their expertise and provided that any suggested project has an element of applied microbiology within its theme.

The maximum award for this category is £3000 and is normally a one-off payment.

Phil Wheat
SfAM *Chief Executive Officer*

IMPACT

SfAM continues to increase grant funding to Members. In 2007, 65 Members received a total of approximately £79000; comparing this to the figures for 2013 which were 169 and £268000 respectively, the progress is clear.

(B) Educational Resources Award

This award is only available to Members of the Society who have at least two full years of membership.

The purpose of this award is to provide funding for Society Members to produce resources that can be used in education and training in applied microbiology. In addition, the resources may also be used to promote microbiology with the general public.

Resources promoting microbiology that may be considered for support could consist of the following: personnel time and materials in the design, production and delivery of items such as software, books, videos, pamphlets and other items used in education.

Once any items are produced, Members will be expected to share these resources with other Society Members. The Society will facilitate this exchange, and potential projects that result in the availability of material which can be offered to Members via the Members-only section of the Society's website will be particularly welcome.

Although the award will usually be just for a 12-month period, in exceptional cases, if the proposed project is suitable and further support is required after the first year, this may be considered and the applicant must submit justification for further funding support. The maximum award available is £10000 per annum.

It is critical that applicants show in their application how the success of their project is to be evaluated. This must include measurable key success factors.

Finally, on a personal note, in the article which appeared in the *Microbiologist*, September 2013 pages 44–47, I described my career to date. In the article I highlighted that I had made, over my career of 42 years, several key choices. I also mentioned that perhaps other key choices may lie ahead. **Indeed, I can announce to you all that at the end of 2014 I am proposing to retire as the Chief Executive Officer of the Society**. It has been an honour and a privilege to serve as an official of the Society for the last nine years. The EC have plans in place to recruit and select my successor, so that they are in place by the end of 2014.

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Wastewater could provide up to **1% of the world's energy needs**

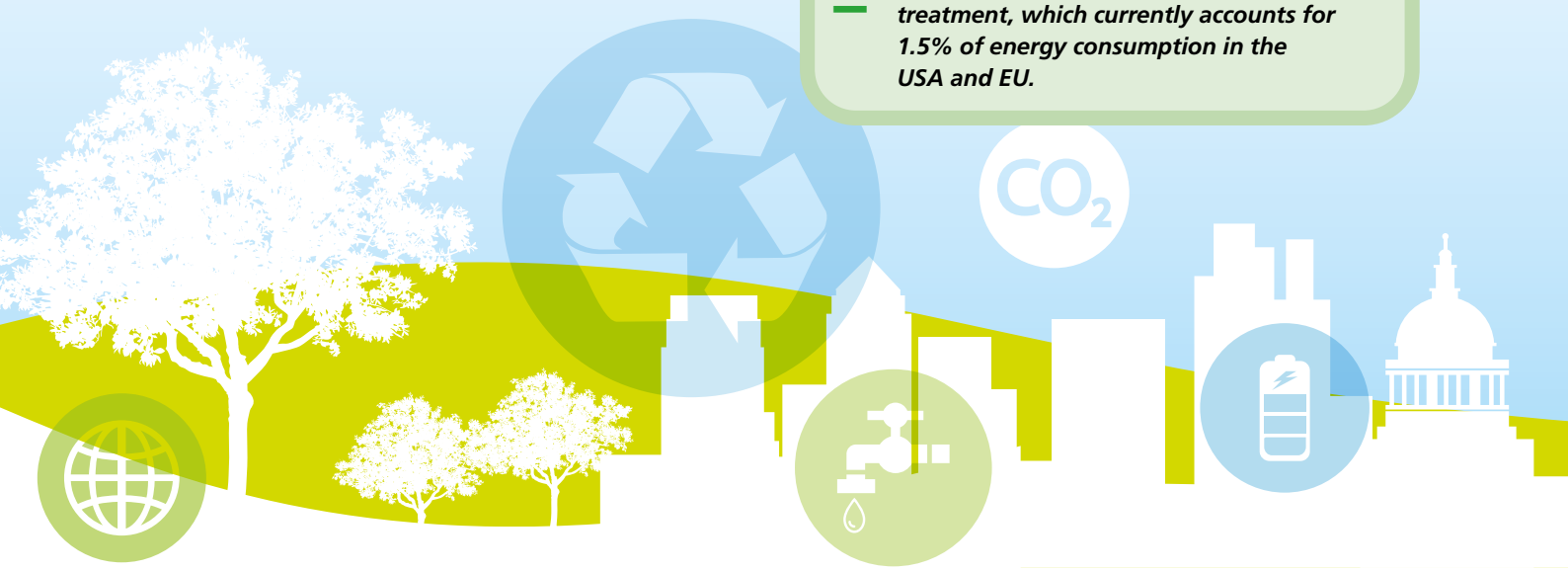
Introduction

Increased economic growth and social development are leading to a large gap between energy demands and the availability of fossil fuels. The development of electrogenic reactors based on microbial fuel cells (MFCs) represents a new approach for harvesting electricity from waste and other biomass, which will go some way to bridge this gap.

The concept of electricity production from bacteria decomposing organic compounds was conceived more than a century ago with the first paper published in 1911 by M. C. Potter, on electricity generation by *E. coli*.

IMPACT

At least some of the energy from organic compounds in wastewater could be recovered using microbial fuel cells. This has the potential to reduce the net energy requirement for water treatment, which currently accounts for 1.5% of energy consumption in the USA and EU.



BUG POWER
Microbial fuel cells

Combining wastewater treatment and energy harvesting

Wastewater treatment is an energy-intensive process. 1.5% of energy consumption in the USA and EU is for wastewater treatment; most energy is required for the aeration process. However, there is substantial untapped energy contained within the wastewater.

Organic waste generated by humans alone, in terms of chemical oxygen demand (COD), an indirect measurement of the amount of organic compounds in water, amounts to 60 to 120g COD/person/day. At an energy content of 14.7kJ/g COD and with the world population of 6.8 billion people, this is equivalent to 2.2 to 4.4 x 10^{15}kJ/yr = ca. 600 to 1,200TWh/yr. At least some of this energy can be recovered using MFCs.

MFCs, as a technology combining waste treatment and energy harvesting, have been developed rapidly during the past decade.

In an MFC, electrons are produced on the anode from the oxidation of organic matter using bacteria as the biocatalyst, while the most common cathode reaction is the oxygen reduction reaction (ORR), with oxygen from air reduced by the electrons transferred from the anode. Figure 1 shows the schematic diagram of the process of an MFC with a typical organic oxidation reaction on the anode, and oxygen reduction on the cathode.

Further developments using MFCs as a renewable energy source to use the energy from wastewater have been explored for various applications. These processes are mainly alternative cathode reduction reactions, which consume electrons from the anode, including metal recovery, pollution reduction, mineral recycling and chemical synthesis.

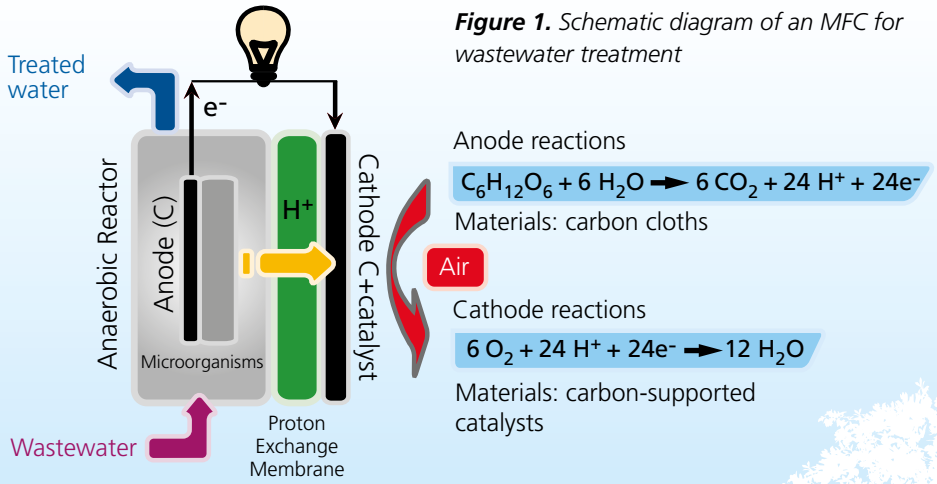


Figure 1. *Schematic diagram of an MFC for wastewater treatment*

A typical water treatment plant. *Organic waste generated by humans alone, in terms of chemical oxygen demand (COD), an indirect measurement of the amount of organic compounds in water, amounts to 60 to 120g COD/person/day.*

Mechanism of electron transfer from bacteria

MFCs make use of bacteria to convert chemical energy into electricity. When bacteria oxidize a chemical, they capture the electrons and transfer them to a series of respiratory enzymes used to store energy (in the form of ATP) within the cell. Electrons are then released to electron acceptors.

In MFCs, electrical energy generation largely depends on an electrochemically active microorganism community, which is able to transfer electrons from bacteria to the electrode through either membrane-associated direct electron transfer (DET) or mediator-associated electron transfer (MET).

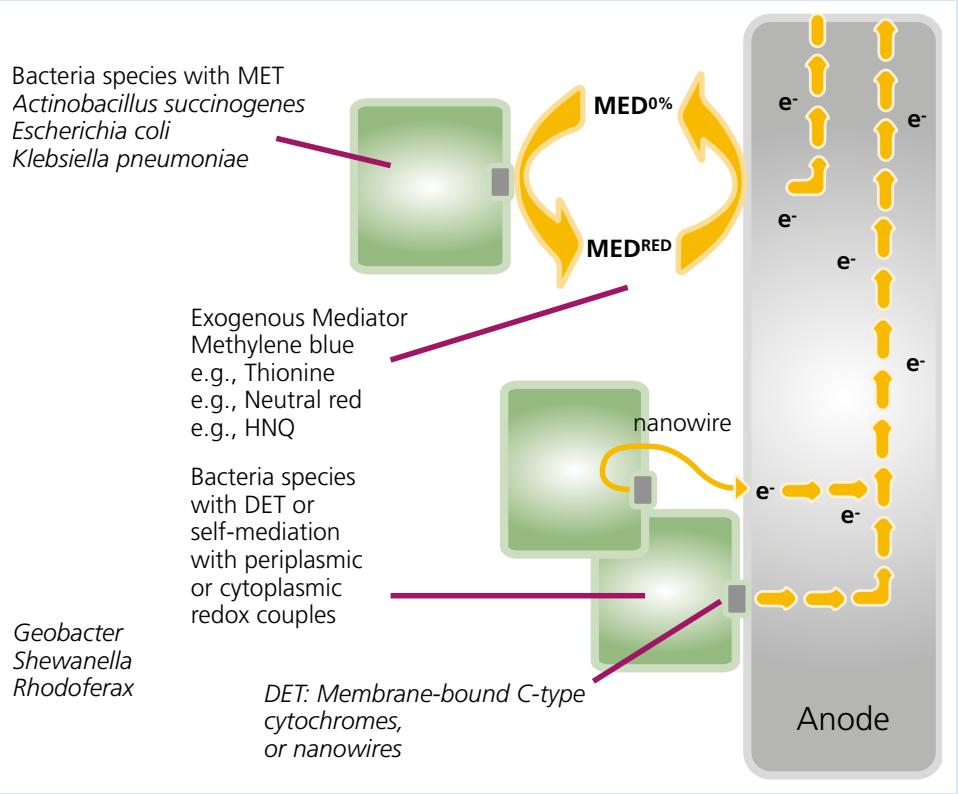


Figure 2. *Schematic illustration of mechanisms for extracellular electron transfer to the anode in MFCs*

DET is fulfilled by means of physical contact between the bacteria cell membrane and the electrode surface, or through conducting pili, also called nanowires, if a thicker active biofilm is formed.

Membrane-bound electron transport proteins, including multiheme c-type cytochromes, relay electrons from the inside of the cell to the outside, and allow the electron transfer to an external solid electron acceptor (anode or metal oxide). *Geobacter*, *Rhodoferax* and *Shewanella* often rely on solid terminal electron acceptors.

Some *Geobacter* and *Shewanella* have evolved molecular nanowires to reach and use more distant solid electron acceptors. Nanowires allow the organisms to transfer electrons to an electrode not in direct contact with the cell membrane. The pili connect to the membrane-bound cytochromes which transfer the electrons to the outside of the cell.

In MET, electron transfer occurs via mediators – soluble redox compounds transfer electrons from bacteria to the electrode. These mediators can be produced by the bacteria, or introduced by adding artificial mediators, such as thionine, methyl viologen, methylene blue, humic acid or neutral red.

For artificial mediators, regular addition of mediator to the MFC is needed, and mediators are costly and toxic. Therefore, studies are more focused on DET and MET with mediators produced by bacteria.

For MET with mediators produced by bacteria, electron transfer happens in two ways: through the generation of oxidizable metabolites (primary metabolites), such as hydrogen (H_2) or hydrogen sulfide (H_2S), and through the production of organic reversibly reducible compounds (secondary metabolites), such as phenazines, phenoxazines, phenothiazines and quinone. Figure 2 is the schematic illustration of the mechanisms for DET and MET in MFCs.

Studies using a single species of a microorganism or a mixed culture as biocatalysts in MFCs have been carried out. *Shewanella putrefaciens*, *Pseudomonas aeruginosa*, *Geobacter sp*. and *Rhodoferax ferrireducens* have been used as the anode catalysts in MFCs.

Higher electronic energy output is possible with single cultures, but these are not robust and practical unless used for fundamental studies and particular applications. Mixed cultures are usually obtained from inoculates in primary influent or activated sludge from wastewater treatment plants, or from marine or lake sediments. Since the microorganism communities are from the environment, they are more robust than single species.

Enriched electrochemically active microorganisms or biofilms are usually obtained by controlling the anode potentials during the inoculation period.

Artificial mixed culture consortia with microorganisms identified as having electrochemical activity were investigated by Zhang *et al*. to obtain enhanced electricity production. This could provide a new means of improving MFC electricity and power outputs.

Material aspects of MFCs

Compared with conventional fuel cells, the power outputs from MFCs are low (1 to 5Wm^{-2}, at best). Therefore, the material used for MFCs is the main factor limiting their commercialization potential. Low-cost materials are desirable.

For the MFC anode, materials with good electronic conductivity, biocompatibility and chemical stability are essential as the substrate used by the microorganism or biofilm to grow, and for electron transfer. Carbon materials with high surface area, such as carbon felt and carbon brush, are commonly used. Carbon materials treated with ammonia showed improved power generation due to the introduction of an N group and increased surface charge of the electrode.

Cation exchange membranes, e.g., Nafion, are usually used in MFCs to separate anode and cathode compartments. The cost of Nafion is high. It is found that MFCs with anion exchange membranes gave a better performance than using cation exchange membranes. Low-cost anion exchange polymers have been tested, as well as cheap micro-porous battery separators, or alternative cell configurations that have no membrane separator.

For cathode ORR, Pt is not an option for MFCs because of its high cost. Low-cost non-Pt catalysts, such as iron phthalocyanine, have shown comparable or even higher power output from MFCs. Research on using bacteria as the biocatalysts for ORR in order to develop an aerobic biocathode is ongoing, and will provide a more sustainable solution for MFCs.

Bioremediation and biosynthesis with microbial electrolysis cells (MECs)

The concept of MFCs using energy from wastewater can be applied to both bioremediation and biosynthesis. An important spin-off from MFC research has been H_2 production by microbial electrolysis cells (MECs).

In MECs, the anode is the same as in an MFC, i.e., an organic substrate is oxidized by bacteria to generate electrons and protons; whereas the cathode is connected to an external electrical energy source.

This system can be used for treating pollutants, recovering resources from waste and synthesizing valuable chemicals.

Research is ongoing into H_2 production, metal recovery and CO_2 utilization with an anode microorganism oxidizing organic matter from waste.

Figure 3 demonstrates the MEC bioelectrochemical system in an integrated industrial process for bioremediation and biosynthesis. These processes are based on alternatives to the oxygen reduction cathode reaction.

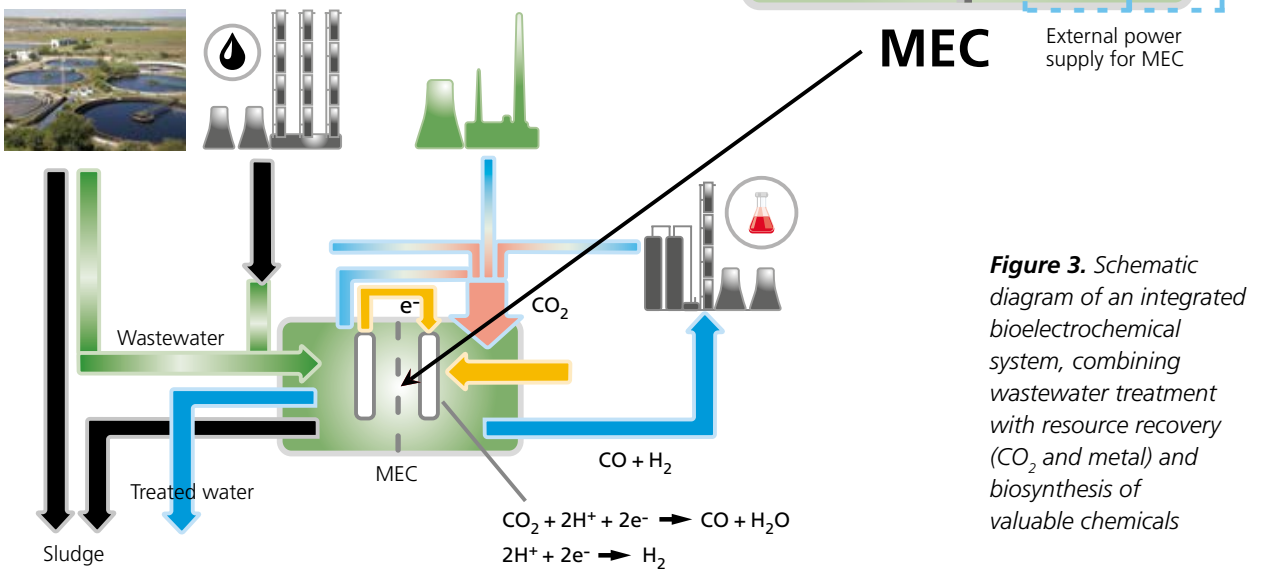


Figure 3. *Schematic diagram of an integrated bioelectrochemical system, combining wastewater treatment with resource recovery (CO_2 and metal) and biosynthesis of valuable chemicals*

The bioelectrochemical system is able to simultaneously treat wastewater and recover resources from waste or synthesize valuable chemicals. With electrons produced from the anode, the energy required by the cathode reaction can be reduced.

For H_2 production, applied cell voltages from 0.2V to 0.8V were used, compared with the thermodynamic requirement of 1.23V for water electrolysis. H_2 production rates as high as 3.12m^3 of H_2/m^3/day have been reported. MECs therefore provide an efficient route for producing H_2 from renewable and carbon-neutral biomass resources.

MECs have also been used to remove and recover Cu, Pb, Zn and Cd from dilute solution; and to produce methanol and formate from CO_2 reduction.

Biocathodes with microorganisms as the biocatalysts for cathode reduction reactions have been used for the removal of nitrate- and sulfur-based pollutants, with the reaction equations as shown below. They have also been applied for microbial electrosynthesis of organic compounds.

$$NO_3^- + 2H^+ + 2e^- \rightarrow NO_2^- + H_2O \quad (1)$$

$$NO_2^- + 3H^+ + 3e^- \rightarrow \tfrac{1}{2} N_2 + OH^- + H_2O \quad (2)$$

$$SO_4^{2-} + 8H^+ + 8e^- \rightarrow S^{2-} + 4H_2O \quad (3)$$

This indicates that further development of MFC technology could be in bioelectrochemical systems combining a bioanode for oxidation of organic molecules, and non-ORR cathode reactions, with the potential for extensive applications.

In 2009, two pilot scale plants were set up. An MFC pilot plant was set up in a Foster's brewery in Australia, and an MEC for H_2 production was set up by the Napa Wine company in the USA. Although there have been challenges in the operation of the two systems, they demonstrate that MFC and MEC are promising and sustainable technologies for simultaneous waste treatment and resource recovery.

MECs have been used to remove and recover Cu, Pb, Zn and Cd from dilute solution

FURTHER READING

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IMPACT

MFCs and MECs are being piloted on an industrial scale. An MFC pilot plant was set up in a Foster's brewery in Australia, and an MEC for H_2 production was set up by the Napa Wine company in the USA.

Eileen Hao Yu

School of Chemical Engineering and Advanced Materials
Newcastle University

Are you sitting comfortably? **BACTERIA** that tell you when they're not

Microbiologists are developing a way for bacteria and humans to talk to each other. They've engineered *E. coli* to emit light in response to changes in their growth conditions, such as heat and acidity, which could then be converted into speech.

When different factors change, the bacteria emit light of different colours. So, if the bugs are too hot, they emit light of one wavelength, and if their growth conditions are too acidic, they emit light of a different wavelength. The next step will be to turn these light signals into words.

Manuel Porcar of the University of Valencia published his findings in *Letters in Applied Microbiology*, he said "*the strategy of encoding questions and answers in 'light language' is feasible, and a first step towards true dialogue with bacteria*". The next steps in the research will be the conversion of audible signals to specific light wavelengths which could then trigger genetic responses in bacteria.

Potential applications include the emission of audible signals in packaged food when it starts to go off, or to better control the environmental conditions within industrial fermenters in medicine production.

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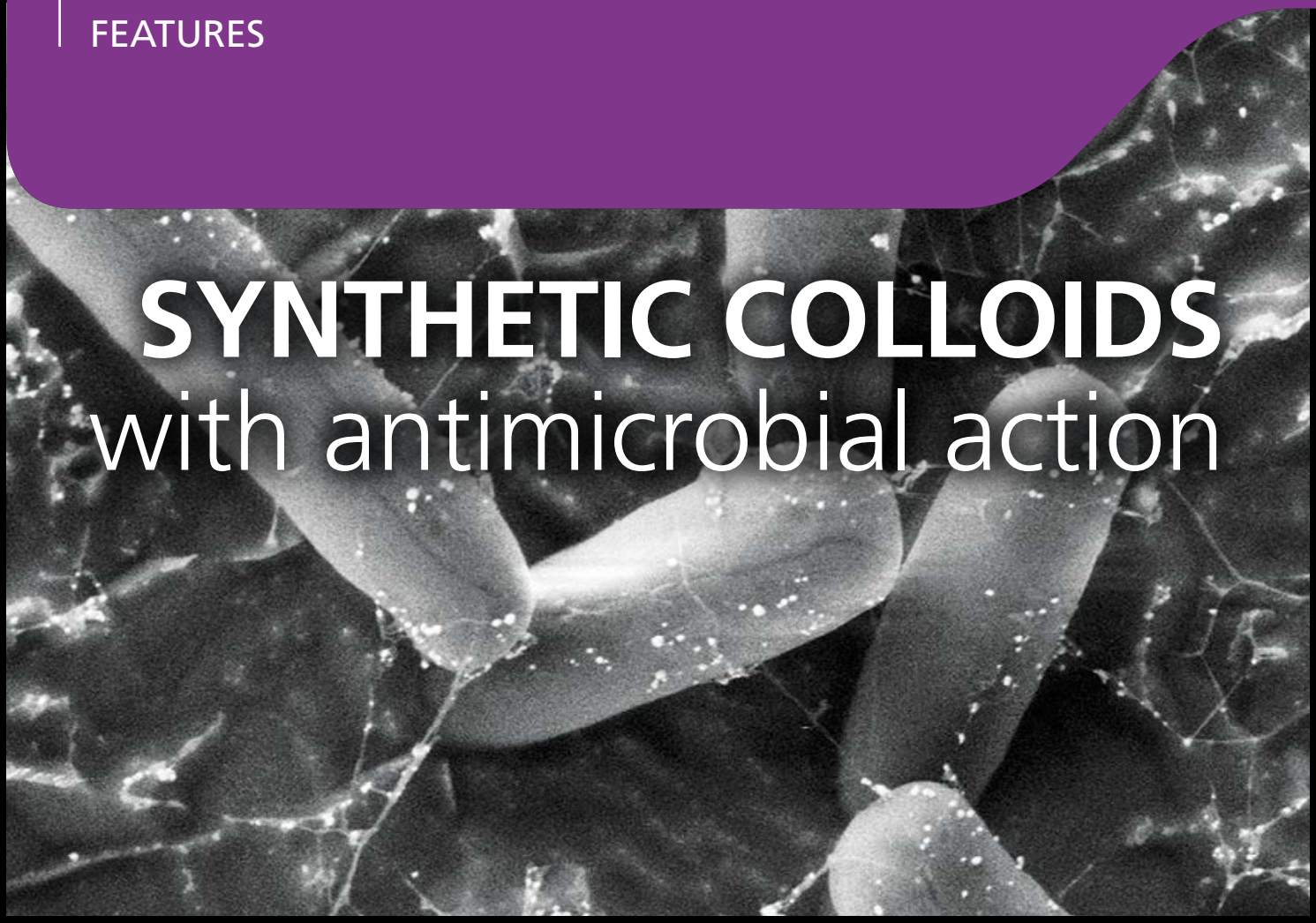
Lucy Harper,
Society for Applied Microbiology



SYNTHETIC COLLOIDS with antimicrobial action

Introduction

Conventional antimicrobials include antibiotics as well as natural and synthetic antiseptic agents whose molecules attack and kill microbial cells or suppress their growth. As many microbes develop resistance, treatment of infection can require doses higher than what is safely acceptable to work effectively, and calls for novel antimicrobials or alternative protection strategies.

Nanotechnology provides us with unconventional approaches for fighting microbes

Nanotechnology provides us with unconventional approaches for fighting microbes, which do not rely on the existing pathways of antibiotic action.

One possible route to address this challenge involves synthetic colloids with engineered antimicrobial action designed to target specific pathogens.

Colloids are a large class of materials which contain very small particles, with sizes ranging from a few nanometres to several micrometres. Synthetic colloids with antimicrobial action can potentially have high activity at ultralow particle concentrations.

There is a lot of ongoing work on colloid particles of added functionality which exhibit strong and universal antibacterial, antifungal and antiviral action towards which microbes have not been able to develop resistance.

Various novel strategies have been pursued in search of antimicrobial agents based on natural as well as synthetic colloid particles. The latter include nanoparticles produced from various metals and their oxides, e.g., copper, aluminium, gold, silver, magnesium, zinc and titanium. These inorganic nanoparticles have very different mechanisms of antimicrobial activity and can retain their antimicrobial action in adverse conditions. Smaller nanoparticles generally show greater antimicrobial activity, enhanced by their high surface area of contact with the target microbial cells.

Nanoparticles as antimicrobials

Recent research has been focused on antimicrobial nanoparticles composed of metals, e.g., platinum or silver; metal oxides such as TiO_2 and CuO; hydroxides such as $Mg(OH)_2$, as well as some from biodegradable materials, including dextran and chitosan (Figure 1).

Different methods for assessment of their antimicrobial action have been used, e.g., estimation of the MIC, growth inhibition method and minimum bactericidal concentration. The antimicrobial activity is tested on specific groups of pathogens such as *E. coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, etc.

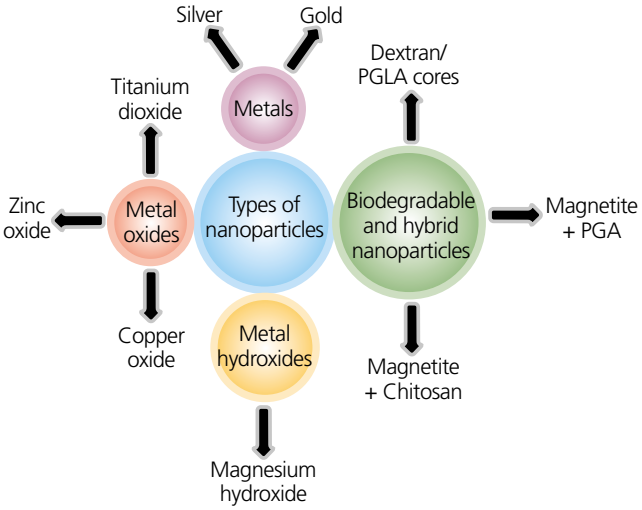


Figure 1. *(above) Classification of synthetic nanoparticles with antimicrobial action*

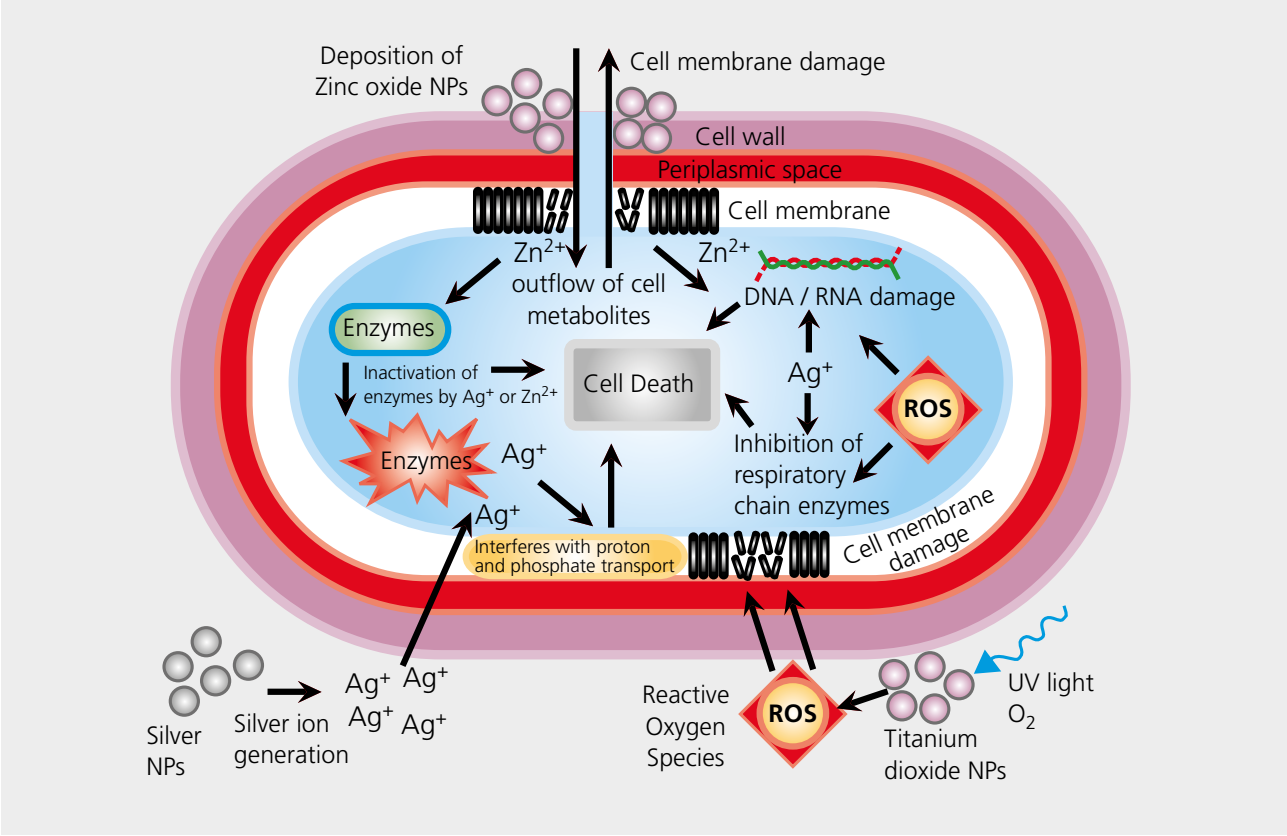
Mechanisms of nanoparticle antimicrobial action

The present understanding of the possible mechanisms by which nanoparticles of different materials kill microbial cells is still patchy and incomplete. Although various mechanisms of their antimicrobial activity have been explored, most of the research in this area is still ongoing. Some of the mechanisms of particle attachment to the microbial cells and pathways of cell damage are illustrated in Figure 2.

Silver nanoparticles release silver ions (Ag^+) which can damage the target cells through several different pathways, e.g., binding to DNA and RNA which result in their inactivation. In addition, they can also react with sulfur-containing peptides inside the cells and on the cell membrane which in turn affects their viability. It has been suggested that they can potentially destabilize cell membrane proteins and inhibit various intracellular enzymes.

At high nanoparticle concentration the released silver ions affect the cytoplasm components and nucleic acids, whereas at lower concentrations they tend to inhibit respiratory chain enzymes and impair membrane permeability to protons and phosphates. Recently, gold nanoparticles have been combined with various photosensitizers which make them antimicrobial for use in photodynamic therapy.

Figure 2. *(below) Mechanisms of action of some antimicrobial nanoparticles*



Colloidal silver particles of various shapes and sizes have different antimicrobial activity. For example, pyramid-shaped silver nanoparticles are more efficient in killing bacteria than rod- or spherically-shaped ones.

Other nanoparticles made of metal oxides, such as TiO_2, upon absorbing UV light generate reactive oxygen species (ROS) that cause cell damage. Due to their photocatalytic activity, UV light activated titania nanoparticles generate free radicals, which can oxidize membrane lipids and disintegrate the cell membrane.

The antimicrobial action of $Mg(OH)_2$ nanoparticles is believed to be due to the high concentration of dissociated hydroxyl ions, which form a surface layer of very high pH around them.

Some hybrid nanoparticles (like magnetite+chitosan/PGA), whose surfaces are modified by polymers of high affinity for the microbial cells, have shown a boost in their antimicrobial efficiency (Figure 3).

Nanoparticles have also been used to encapsulate and deliver bactericidal agents (Figure 3). For example, the antibiotic violacein has been encapsulated in poly-(D,L-lactide-co-glycolide) (PLGA) nanoparticles. The MIC of nanoparticle-loaded violacein was found to be five times less than free violacein. Similarly, biodegradable nanoparticles, including dextran, loaded with a silver carbene complex have been shown to have higher anti-bacterial activity compared with the free silver complex.

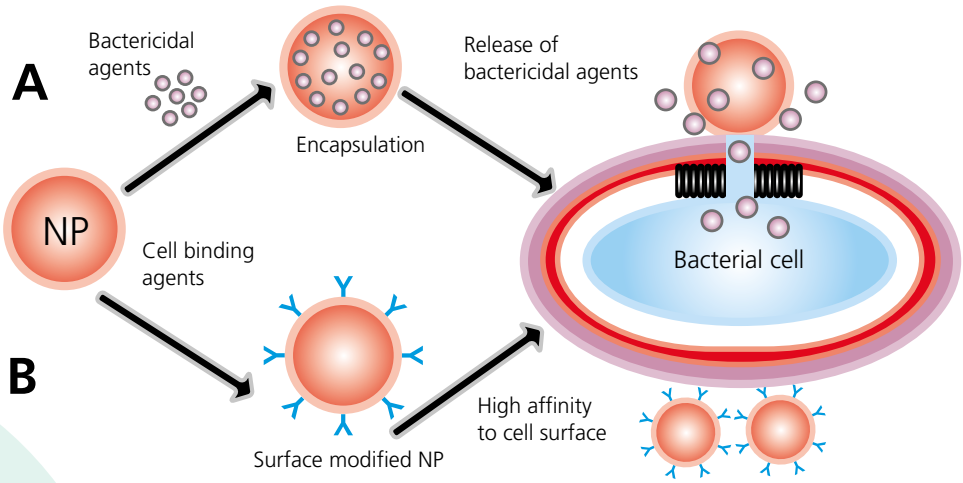


Figure 3. *Nanoparticle (NP) modifications can enhance their antimicrobial action: (A) delivery of concentrated biocides directly to the cell surface; (B) coatings can increase particle-to-cell adhesion*

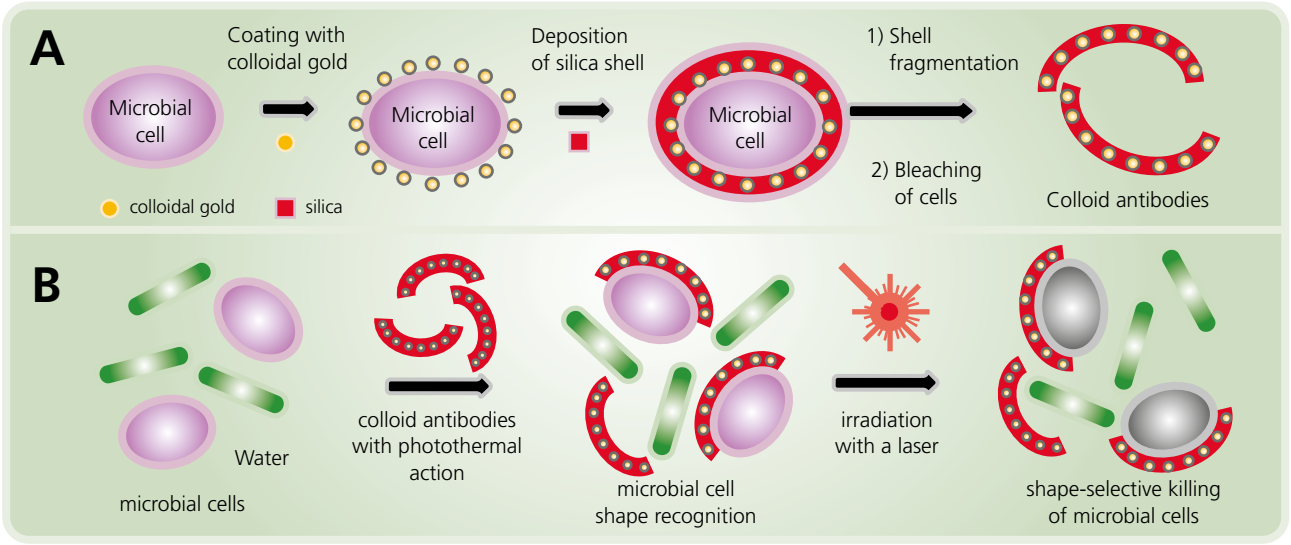
Nanoparticles in antiviral and antifungal applications

The antiviral and antifungal activity of nanoparticles has not yet been studied extensively but it is an area with huge potential. Silver nanoparticles were recently used as antiviral agents against the HIV-1 strain at non-cytotoxic levels. It showed good efficiency at the early stage of viral replication. The antifungal effect of silver nanoparticles against pathogenic yeast has also been demonstrated. Such nanoparticles would be promising substitutes for various broad-spectrum antibiotics.

Colloidal cell imprints

Antimicrobial nanoparticles have one major drawback as they cannot distinguish between microbial and other cells, hence they could potentially have a toxic effect on human health. An interesting alternative was recently proposed where a combination of antimicrobial nanoparticles with synthetic colloid particles imprinting

Figure 4. *(A) Fabrication and (B) mechanism of action of colloid antibodies for selective recognition and killing of microbes*



the shape of target microbes was used in cell shape-selective recognition and killing of the target cells.

The cell imprints were prepared by depositing silica on microbial cells pre-coated with gold nanoparticles. These composite shells were then fragmented and the fragments were recovered after bleaching of the templated cells.

Incubation of the colloidal cell imprints in a mixture of microbial cells of various shapes (Figure 4) showed that they only attach to cells matching the imprinted cell shape and deliver the antimicrobial agent, gold nanoparticles, directly to their cell membranes. Since the gold nanoparticles have photothermal properties, i.e., they heat up when illuminated with light, irradiation with a laser led to shape-selective killing of microbial cells due to cell surface overheating. The same approach can be applied with many other antimicrobial nanoparticles.

This cell shape recognition of the microbial cell imprints minimizes the direct exposure of other cells to antimicrobial nanoparticles.

Applications of antimicrobial nanoparticles

Nanoparticles may have a broad range of applications as antimicrobial agents (Figure 5). Metal and metal oxide-based nanoparticles with antimicrobial activity could find numerous uses in health-related and industrial products, such as food preservation, cosmetics, home and personal care, crop protection and water treatment.

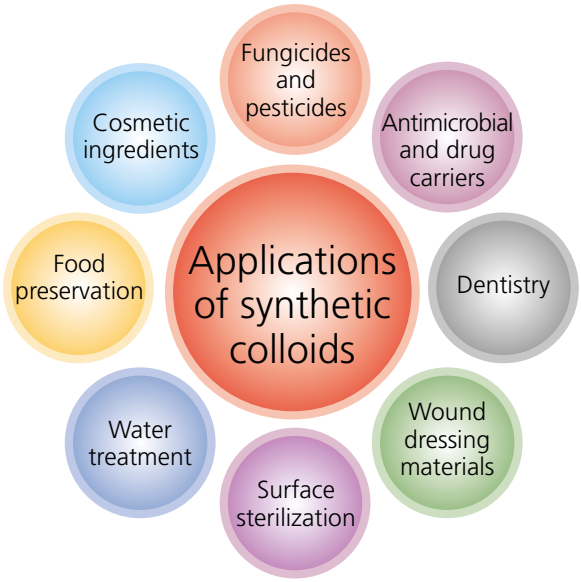


Figure 5. *Different practical applications of antimicrobial nanoparticles*

Colloidal titania particles have already been used in cosmetics, foods and wastewater treatment.

Zinc oxide nanoparticles are used as antimicrobial agents for surface coatings on walls and wallpapers.

Silver nanoparticles have also been incorporated in textiles and other consumer goods for surface sterilization. In many antimicrobial applications, silver nanoparticles outperform conventional antimicrobial agents at much lower concentrations.

Potential applications for antimicrobial effects of nanoparticles are in water disinfection and remediation, agriculture formulations for crop protection, antibiofouling and more. However, significant research effort is needed to carefully test the side effects, environmental impact and potential nanotoxicity before nanoparticles can be safely and broadly used as substitutes of conventional antimicrobials.

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Anupam A. K. Das left **Vesselin N. Paunov** right

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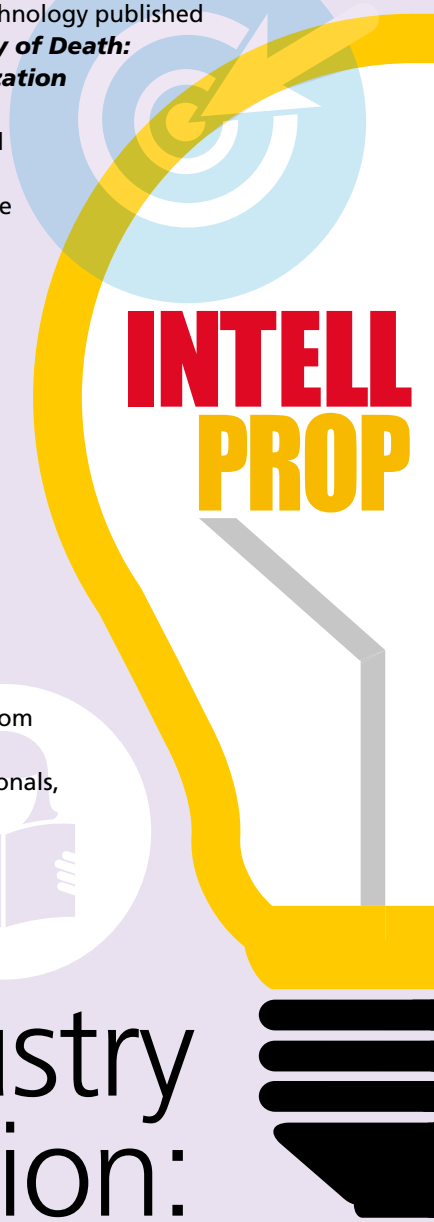
Understanding the language and nature of business has been critical to our successful engagement

IMPACT

In 2011/12, universities in the UK contributed £3.4 billion to the economy through engagement with business via consultancy and knowledge commercialization.

When you think of university, what is it that you think of? Is it of keen young minds sitting in lecture theatres, enthralled by the words of the knowledgeable lecturer? Or do you have an image of academics writing grants and papers, and working on their latest blue-skies research? Would you be surprised to learn that universities are hotbeds of commerce and industry? Did you know, for example, that in 2011/12, universities in the UK contributed £3.4 billion to the economy through engagement with business via consultancy and knowledge commercialization? This sounds like good progress but in 2013, the House of Commons Select Committee for Science and Technology published its report '***Bridging the Valley of Death: Improving the Commercialization of Research***' (to which SfAM contributed) which highlighted a number of issues that could enhance the flow of knowledge from universities into commercial opportunities. The Government's response to this report was to continue to set out its case for support of the Technology Strategy Board (TSB) and a variety of measures that would help to support business and transfer of Intellectual Property (IP), but what happens at the coalface? How do universities and industry work together? What follows are examples gained from conversations and experience working with industry professionals, as well as university business development executives.



Academia and industry collaboration:

CHALLENGES and OPPORTUNITIES

The academic perspective

In Scotland, academia-industry collaboration is often facilitated through an organization called Interface (**http://www.interface-online.org.uk/**). Interface is a Scottish hub, funded through various branches of the Scottish Government, which connects industry to higher education institutions (HEIs) and research institutes in Scotland. Where Interface seems to be having the most impact is in connecting micro (fewer than 10 employees), small (fewer than 50 employees) and medium (fewer than 250 employees) enterprises (SMEs) with academia, and current estimates suggest that £17 million GVA (gross value added) is generated for the Scottish economy each year. Much of my collaboration with micro and small enterprises started with an Interface enquiry. This has resulted in us applying for, and winning, funding for collaborative projects and as a result of our collaboration, companies have extended their capabilities. For example, a colleague and I responded to an Interface enquiry which allowed us to establish a relationship with a microbiology company. We bid for collaborative funding though a Government scheme to allow the company to develop and validate a new method for pathogen testing. Our successful bid required 50% match-funding from the company but ultimately they were able to extend the service they offered to their clients so from their point of view, the investment was worthwhile and from our point of view, we were satisfied that the transfer of knowledge had a positive impact. We have also been involved in a knowledge transfer partnership and consultancy. Collaborations such as these are also useful to provide 'real-life' examples and case studies that can be used in teaching, also we have gained a better understanding of what industry needs in terms of well-qualified graduates, which we can incorporate into programme design, and into research training where appropriate. So, the two-way knowledge exchange is indeed mutually beneficial. Additionally, the nature of much of our research in applied microbiology means that there may be potential commercial impact and it is useful to have a network of industry contacts whom we could turn to for advice in the future, or even potential collaboration. Understanding the language and nature of business has been critical to our successful engagement.

The industry perspective

Unsurprisingly, it is not uncommon for academics to approach industry to try and find funding for studies where they think the company may have an interest. Of course, unless the proposed study is likely to have a direct positive impact on the company's products, then an approach of this nature is not likely to be successful! And as you would expect, before any company commits to talking about collaboration with academics, they want to be sure that the academics in question have a track record and can demonstrate their excellence in the area of interest, so reputation is key. One of the great challenges to getting a project off the ground with an academic is that often it can be a long and complicated internal process to draw up a contract between the two parties. Here, patience and understanding are required, as academics may not be aware of how the wheels turn in business and how many different departments a contract may need to go through. Then, add in the

complexity of research/commercialization offices within HEIs which may themselves be disconnected from the academics and you have a potential three-way impasse that can cause hold-ups in paperwork being drawn up. A situation like this may be even more challenging if the collaboration is between industry and researchers in NHS teaching hospitals, where disconnect between R&D departments and the researchers can be even more acute.

Communication is key to maintaining a productive partnership and academics that can translate complex scientific reports into lay language, without 'dumbing down' any of the science are more likely to be successful. It is important that academics take time to fully understand a company's priorities and demonstrate their respect for agreements and reporting structures within the industry partner's organization. Fruitful collaborations are borne from mutual respect and clear lines of communication.

The business development executive perspective

Business development managers/executives (BDMs/BDEs) are increasingly common in universities, often attached to a commercialization or innovation office. Individuals who occupy this role are the 'real-life' interface between academia and industry, and they help to facilitate communication, particularly in the early stages of a new relationship. A typical BDE spends time networking with both academics and industry professionals trying to make connections, and in my institution at least, tries to match relevant academics and expertise to industry enquiries. Often, in that all-important first meeting, the BDE will be the person that can interpret the language of both sides to help the parties reach a common understanding; many BDEs have come from an academic background and can bridge the gap initially while the collaboration finds its feet. Again, communication is key and the BDE can help to set expectations within an agreement. BDEs are also often the person to turn to help identify sources of funding for projects. Although large companies such as global food and drink or big pharma may prefer to fund collaborative research or consultancy directly, SMEs, where a single employee may occupy several roles, often need to find external

funding and here a BDE may work with the industrial partner or the academic (or both) in helping to put together applications for funding. In my experience, they're useful to help with the often laborious task of getting all of the financial information together, and finding out who needs to sign off different types of application, which is actually critical to ensure that any liability is properly covered. Hence, maintaining a good working relationship with BDEs is also crucial to enable the exploration of collaborations, or to go forward and apply for funding to enable a collaboration.

Funding the way forward

Funding is of course necessary for many collaborations and in recent years, Governments have supported collaboration and innovation by providing the hard

QUICK LINKS

BiGGAR Economics (2013), Evaluation of Interface – The Knowledge Connection for Business
http://www.interface-online.org.uk/sites/default/files/Economic%20impact%20of%20Interface%20-%20executive%20summary%2021May13.pdf

Bridging the "valley of death": improving the commercialisation of research
http://www.parliament.uk/business/committees/committees-a-z/commons-select/science-and-technology-committee/inquiries/parliament-2010/role-of-the-private-sector/

UK Universities contribute to economic growth
http://www.hefce.ac.uk/news/newsarchive/2013/news81928.html_connect https://connect.innovateuk.org/

A Review of Business–University Collaboration
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/32383/12-610-wilson-review-business-university-collaboration.pdf

Funding Scheme	Provider	Notes	Website(s)
Knowledge Transfer Partnership	TSB	Duration 6–36 months. Funded in part by Government grant with industrial partner meeting additional costs. Average annual project cost is ~£60K.	http://www.ktponline.org.uk/
Innovation Voucher	TSB	Max £5K award from £6 million fund. Aimed at SMEs.	https://vouchers.innovateuk.org/
Biomedical Catalyst	TSB & MRC	Can be 'academic- or business-led'. Three types of award available from £180 million fund.	https://www.innovateuk.org/-/biomedical-catalyst http://www.mrc.ac.uk/Ourresearch/ResearchInitiatives/Translationalresearch/index.htm
Industrial Biotechnology Catalyst	TSB & BBSRC & EPSRC	£45 million fund, range from up to £250K for feasibility studies to up to £10 million for experimental development.	https://www.innovateuk.org/-/industrial-biotechnology-catalyst-industrial-research
Industrial Partnership Award	BBSRC	Science-led, responsive mode. Industrial partner contributes in cash at least 10% of the full economic cost (fEC).	http://www.bbsrc.ac.uk/business/collaborative-research/industrial-partnership-awards.aspx
'Stand-Alone' LINK	BBSRC	Pre-competitive research where industrial partner contributes 50% of fEC.	http://www.bbsrc.ac.uk/business/collaborative-research/stand-alone-link.aspx
Industry Fellowship	Royal Society	Can be for either academic or industry scientist.	https://royalsociety.org/grants/schemes/industry-fellowship/
Knowledge Exchange Fellows	NERC	Funding for 20-80% of time (1–3 years) working with partner to translate and develop research outputs.	http://www.nerc.ac.uk/funding/available/schemes/kefellows/kefellowscall/
Industrial CASE Award	RCUK	PhD studentships in collaboration with partner outside academia.	Individual websites (BBSRC, STFC, MRC, EPSRC, NERC, TSB)
Horizon 2020	EU Commission	€80 billion funding for research and innovation. Support for SMEs within funding calls.	http://horizon2020projects.com/ http://ec.europa.eu/research/participants/portal/desktop/en/opportunities/index.html

Table 1. *Examples of sources of funding for academia-industry collaboration*

cash needed. There are a number of different schemes available to facilitate collaboration (Table 1) but there has also been particular emphasis on engagement with SMEs to try and ensure their success and sustainability. A common route for SMEs to engage with academia is via Innovation Vouchers which provide £5000 to enable a company to find a new external partner, such as an academic, to develop a project that would normally be a 'challenge' for the company. Work must be carried out within a 6-month period and is intended to be a platform to facilitate further collaboration that would lead to further applications for larger amounts of support, such as knowledge transfer partnerships or industrial partnership awards. The relative success of this initial collaboration leading to larger funding applications is not currently known although the Wilson Review concluded that Innovation Vouchers themselves have been a success. In Scotland, the Government introduced a Follow-On Innovation Voucher scheme in 2012 to enable successful Innovation Voucher partnerships to apply for up to £20K to enable a more sustained collaboration but the overall impact of this new scheme may not yet be evident.

It is an exciting time for academia-industry collaborations with a number of different schemes available to promote knowledge exchange and innovation. However, what is absolutely clear is that communication is pivotal to successful partnerships and that both academia and industry need to respect each other's working practices to facilitate smooth and productive collaboration.

Clare Taylor
Edinburgh Napier University

INDUSTRIAL BIOTECHNOLOGY what's in it for you?

The challenges of meeting the rising demands of a growing population for food, energy, water and technology are well publicized, and not unique to current times. However, we are in a privileged position of having the biotechnological tools available to address these issues. Advances in bioinformatics, synthetic biology and metabolic engineering have led to speculation that biotechnology will be the distinguishing feature of the 21st century. This is not to say that the answer lies with bioscience alone; rather the solution will come from biologists collaborating with other disciplines, including chemists, engineers, geologists, sociologists and economists. This is a multifaceted problem, and so requires a multifaceted solution. Industrial Biotechnology (IB) can integrate these scientific advances into the technologies that underpin our everyday lives.

Understanding, manipulating and exploiting the metabolism of microorganisms is at the core of IB

IB is the use of cross-disciplinary technologies to exploit biological resources for producing and processing desirable products, such as chemicals, materials and energy. The primary advantage of using biological resources, such as plants or algae, as feedstocks or factories, is that the energy they provide is fixed from recent photosynthesis, unlike that in fossil gas, oil and coal, thus reducing the energy input and CO_2 emissions associated with their use. Cells have the potential to act as reactors for complex, multi-step reactions that would be prohibitively resource- or time-consuming when performed using conventional chemistry.

Understanding, manipulating and exploiting the metabolism of microorganisms is at the core of IB. Novel sources of enzymes to catalyse reactions more efficiently are attractive targets and are commercially interesting to a variety of industries. Biologically deriving end products and intermediates, including biosurfactants, terpenoids and polyketides, is increasingly important as an alternative to conventional chemistry.

QUICK LINKS

http://www.bbsrc.ac.uk/business/collaborative-research/tsb-competitions/ib-catalyst.aspx.

http://www.bbsrc.ac.uk/BBSRCNIBB.

There is a clear precedent for the acceptance of biology into our industrial processes. Fermentation has been developed by brewers into a highly profitable global industry, the production of proteins from animal cells has boosted innovation in the biopharmaceutical sector and algae are used as bioreactors for cosmetic ingredients. The market is growing – it is thought that the UK market for IB could be as much as £12 billion by 2025.

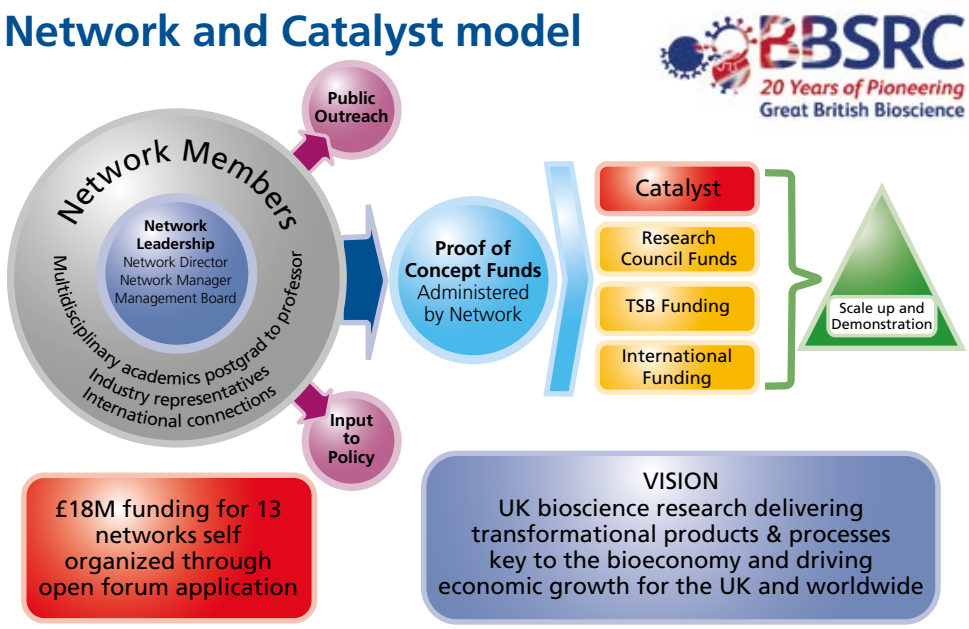


Figure 1. *The BBSRC Networks in Industrial Biotechnology and Bioenergy*

The definition of IB is broad, and covers a variety of disciplines, from structural biology to process engineering. Most recently, a typical IB project involved genome analysis of a microorganism informing the top-down and bottom-up approaches of systems biology and synthetic biology to create the desired end product, or optimization of bio-derived enzymes for integration into an existing chemical process. These present clear opportunities for biologists, chemists and engineers to benefit from cross-disciplinary working environments. Further progress will come from consideration, and integration, of the whole process – knowledge of downstream processing needs and challenges will influence the optimal feedstock composition, which may inform plant breeding techniques.

As awareness of the importance of IB grows, there is a need to engage those researchers outside the traditional biology-chemistry-engineering interface. Assessing the environmental impacts of growing a crop will help policymakers decide what feedstocks to support; business analysts can inform on the economic viability of any technology. To really fulfil their potential, these technologies must meet the triple bottom line, competing against their 'traditional' counterparts on cost, resource usage and harmful waste, whilst also taking into account the social and political ramifications of this potentially disruptive technology.

The UK recognizes the need for collaborative thinking in this area, and has funded 13 Networks in Industrial Biotechnology and Bioenergy (BBSRC NIBB) covering the IB landscape (Figure 1). The BBSRC NIBB are encouraged to reflect this multidisciplinarity, with a membership to include academics, industry, end users and knowledge brokers. The BBSRC NIBB will organize networking events, enabling those interested in a specific topic to exchange ideas with other interested parties from different disciplines or backgrounds. This mechanism aims to break through the traditional partnerships of expertise, and encourage skills and knowledge sharing to produce exciting ideas and innovative solutions.

It is vital to continue to explore the underpinning science, to discover new enzymes and pathways, to understand feedstocks and processes and optimize these accordingly. BBSRC will always fund excellent basic research, but key to transforming our day-to-day living from dependency on fossil carbon to using renewable, bio-based chemicals is the translation of lab-based discoveries to the industries that bring products to the market.

To support the integration of whole process thinking into academic research, BBSRC, the Technology Strategy Board and EPSRC (the Engineering and Physical Sciences Research Council) have launched the IB Catalyst. This funding scheme has £45 million available in 2014 for research and translation projects that use biological processes, or combine these with chemical processes, in the production of materials, chemicals (including biopharmaceuticals) and energy. The IB Catalyst will fund projects ranging from early stage academic-led projects that translate research discoveries into an industrial context, to near-commercialization projects demonstrating the performance and reliability of a new process.

Feodora Rayner
Biotechnology and Biological Sciences Research Council

BIO-PROSPECTING

new chemicals for economic growth

Bio-prospecting for new chemicals can uncover commercially interesting compounds in the natural world. At a time when money, energy, water and other inputs to manufacturing are being squeezed, there is the potential in this endeavour to provide a sustainable route to discovering new bioactive compounds that, through traditional means, would remain elusive.

At the same time, economic austerity, particularly in the debt-laden countries of Southern Europe, is driving away highly trained and supremely talented young scientists. In an editorial published recently in *Environmental Microbiology*, Chief Editor, Kenneth Timmis, and others propose the creation of new national academia-industry alliances for the discovery and development of chemicals from nature. Centres of excellence would

Perhaps the most famous microorganism to be bio-prospected is *Penicillium chrysogenum* which, of course, gave rise to the ß-lactam class of antibiotics

The potential for economic growth and employment of the young, invites investment in these national alliances from **budgets earmarked for economic development in Southern Europe**

provide employment to the early career scientists of Italy, Greece, Spain and Portugal, and serve to boost the economic development of these countries.

The young, says Timmis, are the most important innovators; young people brought us some of the most successful technology companies – the Googles and Facebooks of the world. This entrepreneurial spirit could be the answer to giving Southern Europe an edge in the highly competitive world market. The key will be to develop a pipeline to discover and exploit new chemicals from nature that will keep early career scientists from emigrating to countries in better economic health than their own.

The idea is to spend €120 million per national centre over 10 years. This would cover typical costs of €20 million initial set up and €10 million per year running costs for a series of research and development hubs around Southern Europe. The young scientists working at each hub would exploit the potential of microbial diversity in the environment to provide natural products that are then taken forward as viable commercial endeavours.

"*Some 40% of drugs used in clinical medicine have their origins in natural products,*" says Timmis, "*but the diverse populations of microbes in the environment have hardly been prospected, so far*".

Early career scientists in Southern Europe are highly trained in the relevant disciplines of biodiversity, microbiology, chemistry, cell biology and chemical engineering. They also have access to unique cultural and scientific links to regions of high biodiversity that remain untapped.

Co-locating academic research with networks for knowledge transfer will be essential. There will be a need to handle intellectual property transfer to spin-out companies and other SMEs, and the intention is that these smaller companies eventually translate into major enterprises. This, says Timmis, ought to be a major political goal of Europe.

The proposal is that the networks develop around existing centres of excellence in cell biology. This discipline is particularly important for the development of new screens for bioactive compounds, which will be vital. The new pipelines for chemical discovery will provide an avenue for utilizing the incredible range of biochemical, cellular and other activities that could serve as targets for new drugs but are, as yet, an underused output of cell biology research. Moreover, the freedom to venture down such avenues, unconstrained by current commercial strategies, provides cell biologists with an opportunity to focus on their primary research activities, while others take forward the application of research in the business sector.

The potential for economic growth and employment of the young, invites investment in these national alliances from budgets earmarked for economic development in Southern Europe. Each country has different strengths, interests and natural resources, minimizing the likelihood of overlap or competition and maximizing the range of products, value chains and business opportunities.

It is now up to the holders of purse strings, local, national and regional, to decide to pursue this enticing proposal. Watch this space!

FURTHER READING

K. Timmis, *et al*. Pipelines for new chemicals: a strategy to create new value chains and stimulate innovation-based economic revival in Southern European countries. 2014. *Environm. Microbiol*., **Vol. 16** pp9-18.

Nancy Mendoza
Society for Applied Microbiology

HISTORICAL PERSPECTIVES
The fall and rise of pertussis (whooping cough)

Pertussis (whooping cough) remains an important cause of disease and death in infants worldwide, and continues to be of major public health concern even in countries with high vaccination coverage. It has been described as the least well-controlled of the vaccine-preventable diseases. The causative agent of pertussis is *Bordetella pertussis* (originally described as *Haemophilus pertussis*). The genus *Bordetella* is a member of the family *Alcaligenaceae* within the subclass ß-*Proteobacteria*, and comprises nine species, of which one, *Bordetella ansorpii* sp. nov., still awaits formal description (see Table 1). *Bordetella pertussis* is unique in that it is the only species which produces pertussis toxin.

The first recognized description of the disease pertussis was in 1578, by Guillaume de Baillou, following an epidemic in Paris, France. However, it was not until 1906 that Jules Bordet and Octave Gengou (two Belgian bacteriologists) successfully isolated the aetiological agent, on media containing blood and potato extract. Subsequently an alternative media base was developed by Oxoid; 'charcoal agar', to which 10% v/v defibrinated horse blood is added together with cephalexin to a final concentration of 40µg/ml. The cephalexin helps to suppress unwanted nasopharyngeal flora. A pure growth of *Bord. pertussis* on charcoal agar is shown in Figure 1.

After an asymptomatic incubation period, classical whooping cough follows three stages; catarrhal, paroxysmal and convalescent. It is characterized by a paroxysmal, convulsive cough that can last for many weeks, and in Chinese medicine is known as 'The Hundred Day Cough' (bai re ke). The paroxysmal cough is often followed by a 'whoop' on inhalation which gives the disease its name. Mortality and morbidity are greatest in infants, particularly those in early infancy, unimmunized infants and infants who have not completed their primary immunization course. Pertussis infection also causes respiratory disease in older children, adolescents and adults, which is usually milder, but these cases represent an important source of infection for vulnerable groups.

Species	Year described	Host range	Disease
Bord. pertussis	1906	Man (only)	Whooping cough
Bord. bronchiseptica	1912	Man	Respiratory disease, pneumonia, bacteraemia and cystic fibrosis (CF) patients
		Horses, dogs, pigs, rabbits, cats, rodents	Respiratory disease
Bord. parapertussis	1937	Man	Whooping cough (milder)
		Sheep	Chronic pneumonia
Bord. avium	1984	Man, poultry (turkeys)	Respiratory infection
Bord. hinzii	1995	Man, poultry	Respiratory infection
Bord. holmesii	1995	Man	Septicaemia (underlying disorders, e.g., asplenic), respiratory tract
Bord. trematum	1996	Man	Ear and wound infections
Bord. petrii	2001	Man, environment	Respiratory, CF patients
'Bord. ansorpii'	2005	Man	Wound infections

Table 1. *Members of the genus Bordetella, showing year of description, host range and disease*

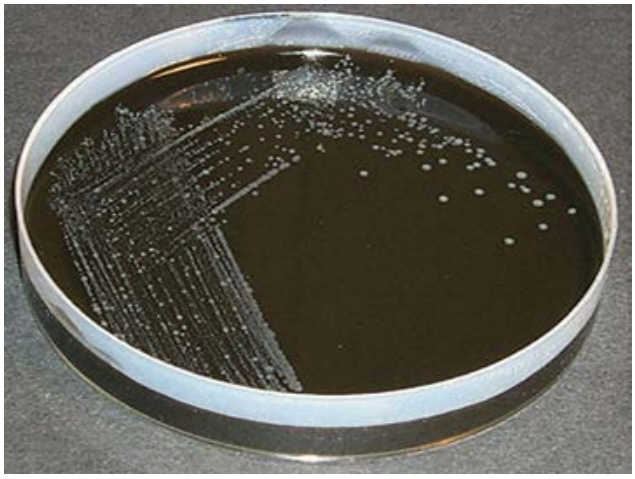


Figure 1. *Bordetella pertussis on charcoal agar with cephalexin*

Worldwide context

Data from the World Health Organization (WHO) reveal ca. 16 million cases of pertussis occurred worldwide in 2008 (95% of which were in developing countries) and approximately 195,000 patients died from this disease.

Vaccination

The primary goal of pertussis vaccination is to reduce the risk of severe pertussis in infants. The worldwide priority is to achieve ≥ 90% coverage with three doses of high-quality pertussis vaccine in infants, particularly where pertussis poses a serious health threat to infants and young children.

In 1979, the WHO recommended the inclusion of all three of the *Bord. pertussis* major agglutinogens (agglutinogen 1, fimbrial protein 2 and fimbrial protein 3) in the final whole cell pertussis vaccine (wP). However, due to the reactogenicity of the wP (and the adverse publicity this elicited), efforts were made to develop acellular vaccines (aP). The absence of recommendations regarding inclusion of other specific antigen types, together with different and changing vaccine regimens, has meant that the vaccination history in each country appears unique.

The UK picture

In the UK (as in many countries) pertussis is a notifiable disease. Since 2008, notifications had fallen to historically low levels and in 2010 there were only 400 notifications in England and Wales. However, from the third quarter of 2011, a marked and continuing increase in notifications was seen, resulting in the declaration of a national incident, in April 2012, by the Health Protection Agency, to coordinate the public health response.

In August 2012, at an *ad hoc* meeting of the Joint Committee on Vaccination and Immunisation (JCVI), the latest epidemiological data were presented which noted

a high incidence in infants under 3 months of age, and a relatively high number of confirmed deaths in infants under 1 year of age (all of whom were unvaccinated). In response, the Department of Health announced, on 28 September 2012, that pertussis immunization would be offered to pregnant women from 1 October 2012 in order to protect infants from birth, as an outbreak response measure, whilst disease levels remain high. This programme has been continued into 2014 and remains under review by the JCVI.

Diagnostic methods

Laboratory confirmation of pertussis infection can be achieved by isolation of the causative organism, or detection of its DNA by, for example, PCR from respiratory (nasopharyngeal) specimens, or detection of significant levels of specific antibody (for example, to pertussis toxin) from patients' sera or oral fluid.

Bord. pertussis resides in the posterior nares in man; hence the recommended specimens for culture and PCR are pernasal/nasopharyngeal swabs or nasopharyngeal aspirates. The outcome of these tests is influenced by a number of critical factors including: age of case, vaccination status, proximity of specimen collection to onset date, antibiotic treatment and any delay in transport to the laboratory. Typically, sensitivity is highest in unvaccinated infants, sampled close to onset and prior to antibiotic treatment, and lowest in older children, adolescents and adults with a longer duration of cough prior to sampling. For patients with prolonged cough (> 2 weeks), serological investigation is usually recommended. However, these results may be confounded by recent vaccination with a pertussis-containing vaccine or previous infection.

FURTHER READING

Health Protection Agency (now part of Public Health England): http://www.hpa.org.uk/topics/infectiousdiseases/infectionsaz/whoopingcough/.

Campbell, H., Amirthalingamm G., Andrews N., Frym N. K., Georgem R. C., Harrison, T. G., and Miller, E. (2012). Accelerating control of pertussis in England and Wales. *Emerg. Infect. Dis.*, **Vol. 18**, pp38–47.

Locht, C., and Mielcarek, N. (2012). New pertussis vaccination approaches: en route to protect newborns? *FEMS Immunol. Med. Microbiol.*, **Vol. 66**, pp121–133.

Plotkin, S. A. (2014). The pertussis problem. *Clin. Infect. Dis.*, **Vol. 58**, pp830–833.

Newer 'omics' technologies are helping to provide a greater appreciation of subtle shifts in the *Bord. pertussis* population & disease

Explanation for the apparent increase

Various explanations have been proposed for pertussis resurgence, including increased ascertainment due to improved diagnostic methods, genetic and thus antigenic variation occurring in the *Bord. pertussis* population, and waning immunity. Changes in laboratory testing and differences in case reporting also highlight the need for standardized criteria to facilitate comparison between countries. National, European, global networks and fora are beginning to more actively address these issues, but there remains much to be done.

Future

The resurgence of pertussis has stimulated a revitalization of interest and research into this complex organism and disease. Despite extensive work to date, there remain important gaps in our knowledge, particularly regarding transmission, a possible carriage state and the most effective immunization strategy. Building upon more traditional techniques, the newer 'omics' technologies are helping to provide a greater appreciation of subtle shifts in the *Bord. pertussis* population and disease; new animal models and novel approaches to vaccine development and administration are also forthcoming.

Only by combining all the available weapons at our disposal will we be able to more effectively combat this pathogen and disease. The hope for the future is that greater collaboration across existing and newer disciplines will ultimately lead to more effective control of this microorganism and its ability to cause disease.

Norman Fry
Vaccine Preventable Bacteria Section, Public Health England

'Standing up for Science' MEDIA WORKSHOP

SfAM was pleased to sponsor delegates to attend the Sense About Science 'Standing up for Science' Media Workshop in Manchester on 14 March 2014. Here, two of the attendees, Yinka Somorin and Tosin Onabanjo, talk about their experience of the day.

The opportunity to participate in the 'Standing up for Science' Media Workshop was an interesting one, in the wake of the growing need for early career researchers to engage with society in discussions about their research and the role science plays in everyday life.

The workshop started with a discussion on science and the media led by Matthew Cobb, Jeff Forshaw and Susanne Shultz. These scientists described their various experiences of interacting with the media, citing some good and also some unpleasant experiences. One of the challenges for scientists that they identified was the potential to be quoted out of context, in a bid to explain research in plain terms. However, in order to avoid these mistakes, it was advised that communication should be kept simple such that it can be readily understood by anyone. Matthew Cobb further suggested that scientists should explain their research in plain everyday English, such that a 10-year-old can understand it. Participants were further encouraged not to be afraid to say "*I don't know*" when asked questions they couldn't give an answer to.

The most informative for us was the journalist session where Victoria Gill and David Derbyshire gave lucid details on what qualifies a science story to make the news. David, in his introductory remarks, stated why scientists must engage with the media and posited the fact that if scientists do not speak to journalists, others, often promoting pseudoscience, will. He further stated that for a story to be of interest to a journalist, it must be of human interest, entertaining and have an element of surprise in it. The panellists explained how science news is sourced and the processes involved in checking the veracity before it finally becomes an article in the news.

At the breaks between the sessions, groups discussed what was good and bad about science reporting in the media, and later the challenges preventing early career researchers from 'Standing up for Science' with a view to advancing ways for early career scientists to get involved.

In the final session, Jamie Brown of the University of Liverpool Press Office gave useful tips on how early career scientists can 'Stand up for Science' and get involved. He gave the example of a young researcher at their university who completed a project with a small grant – media reports on the outcome have attracted funding from large industries. Additionally, he urged participants to always prepare the message they want to convey, and liaise with their university press office before such media-related activities. Further into the last session, Lydia Le Page of the University of Oxford shared her experience on how she got involved with Sense About Science and the 'Ask for Evidence' campaign, which has received wide interest.

After each session, questions were asked by the participants and the panellists provided useful responses. Participating in the Media Workshop has enabled us to understand the journalist's activity in reporting science so as to effectively engage with the media. More so, it has shown us that we can take action to correct misrepresentation of science in the media and get involved in science writing through various media platforms.

Special thanks go to the Society for Applied Microbiology for funding our participation at the workshop.

Yinka Somorin left **Tosin Onabanjo** right

BIOFocus

We all know that it is better to be safe than sorry. Something you simply can't disagree with, but perhaps made more difficult when you are not sure whether you will be sorry or not. Yet, as scientists we are familiar with approaching safety as relative risk, weighing the potential for adverse outcomes against the benefit that might accrue. It is our decisions about risk management which underpin significant parts of our personal and professional lives. The way in which the risk is presented, and the information available alongside it is also critical to the decision-making process. In short, it is a complex area that requires sophisticated understanding. Unfortunately, this is not always present, especially among political institutions and politicians. We all have an obligation to try to enable policymakers to better understand risk, and how perceptions of risk influence decision-making, and nowhere more so than at a European level.

SOCIETY OF Biology

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We all have an obligation to try to enable policymakers to better understand risk, and how perceptions of risk influence decision-making

Perhaps the most famous (infamous?) policy governing risk management is the 'precautionary principle' that is applicable to a range of European legislation. It is often quoted as the reason why actions shouldn't proceed but yet is frequently misrepresented and often not understood. It is a big area to cover but as part of a contribution to the current debate, which has somewhat of a focus on implications for GM crops, the Society of Biology hosted a 'Policy Lates' discussion event in April to debate the precautionary principle and the capacity to use it to balance risk and reward. We were lucky to have Professor Jim Dunwell, University of Reading, as our chair, alongside panellists Professor Ian Boyd FSB, the Chief Scientific Adviser from Defra; Professor Joe Perry FSB, Chair of the EFSA Panel on Genetically Modified Organisms and Tracey Brown, Managing Director of Sense about Science. The panel joined an audience of around 75 at Charles Darwin House.

The precautionary principle is defined as "*enabling a rapid response in the face of a possible danger to human, animal or plant health, or to protect the environment. In particular, where scientific data do not permit a complete evaluation of the risk*." Going on to say, "*recourse to this principle may, for example, be used to stop distribution or order withdrawal from the market of products likely to be hazardous*".

The focus of discussion is often around GM, with the science community arguing that the inappropriate influence of the precautionary principle is holding back the EU/UK's ability to reap the economic and other benefits that some applications of the technology have delivered elsewhere, or could deliver. Moreover, the concept of applying this principle to a cluster of different technologies (which is essentially what GM has now become) rather than individual products, seems, to many, to be at odds with the underlying intention. Some point to the way in which Canada legislates as more appropriate, where technology is irrelevant: it is the release of 'novel' plants and animals that needs review, irrespective of the underlying technology. The risks in any application for GM trials are assiduously assessed but the benefits that could accrue cannot be considered under the current formulation of the precautionary principle and so remain absent from the decision-making process. The disappointing reality is that this version of the precautionary principle cannot appropriately balance risk with benefit and it would be preferable to think about a more effective process or, more likely, a better interpretation of the current process, if we are to move forward with the many promising bio-based products and processes.

And it is not just about GM. This principle, and the knowledge of it, affects the construction of a whole range of legislation that is developed within the EU. It is proposed, or threatened, too frequently as a reason not to act or to consider only some of the evidence, whether it's packaging additives or neonicotinoids and bee health. It is much easier to be seen to champion consumer safety than eventual consumer benefit based on new products that involve unpopular or unknown technologies and/or other uncertainties. Perhaps that is why greater engagement between science and publics across all the Union's member states came out as a clear message from our 'Policy Late' debate. The EU policy system, just like any political environment, is highly susceptible to public opinion and the reality is that the voters in many parts of Europe remain highly sceptical about the benefits from some areas of bioscience.

As learned societies with an international membership and partners across the EU, we all have an obligation to help encourage transparent debate in all countries, locally driven wherever possible. For the Society of Biology this will involve developing more formal relationships across the EU, starting with VBIO, our sister Society in Germany, to see how we can share best practice when it comes to influencing public policy.

If you have an idea for a follow-up debate or another 'Policy Lates' theme, the team would love to hear from you: **policy@societyofbiology.org**.

Mark Downs FSB
Chief Executive, Society of Biology

Journal**WATCH**

Highlighted Articles from the *Sf*AM journals

Environmental Microbiology

Environmental conditions that influence toxin biosynthesis in cyanobacteria

Neilan *et al*.

Over the past 15 years, the genetic basis for production of many cyanobacterial bioactive compounds has been described. This knowledge has enabled investigations into the environmental factors that regulate the production of these toxins at the molecular level. Such molecular or systems level studies are also likely to reveal the physiological role of the toxin and contribute to effective water resource management. This review focuses on the environmental regulation of some of the most relevant cyanotoxins, namely the microcystins, nodularin, cylindrospermopsin, saxitoxins, anatoxins and jamaicamides.
http://bit.ly/EMI_Neilan

The role of bacterial outer membrane vesicles for intra- and interspecies delivery

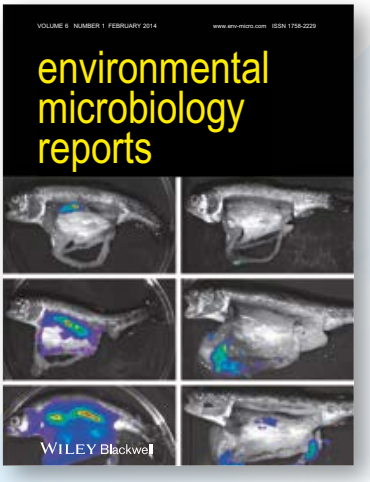
Berleman and Auer

An increasing number of Gram-negative bacteria have been observed to secrete outer membrane vesicles (OMVs). Many mysteries remain with respect to OMV formation, the regulation of OMV content, and mode of targeting and fusion. Bacterial OMVs appear to serve a variety of purposes in intra- and interspecies microbial extracellular activities. OMVs have been shown to mediate cell-to-cell exchange of DNA, protein and small signalling molecules, and this study discusses the impact of such material exchanges on microbial communities and pathogenic processes, including the delivery of toxins at high concentration through OMVs. This recent aspect of microbial ecology is likely to remain an important area of research as an in-depth understanding of OMVs may allow new approaches for combating bacterial infections and provide new routes for selective drug delivery.
http://bit.ly/EMI_Berleman-Auer

Environmental Microbiology Reports

Distribution of antibiotic resistance genes in glacier environments

Segawa *et el*.



Antibiotic resistance genes are biologically transmitted from microorganism to microorganism in particular micro-environments where dense microbial communities are often exposed to an intensive use of antibiotics, such as intestinal microflora and the soil microflora of agricultural fields. However, recent studies have detected antibiotic-resistant bacteria and/or antibiotic resistance genes in the natural environment geographically isolated from such areas. Here we sought to examine the prevalence of antibiotic resistance genes in 54 snow and ice samples collected from the Arctic, Antarctic, Central Asia, North and South America and Africa, to evaluate the level of these genes in environments supposedly not affected by anthropogenic factors.
http://bit.ly/EMR_Segawa

Comparison between MICRO–CARD–FISH and 16S rRNA gene clone libraries to assess the active versus total bacterial community in the coastal Arctic

De Corte *et al*.

This study collected and examined surface- and deep-water samples during the spring–summer transition in the coastal Arctic along a transect in the Kongsfjorden (Ny-Ålesund, Spitsbergen, Norway) to determine the structure of the active versus total marine bacterioplankton community using different approaches. Catalysed reporter deposition–fluorescence *in situ* hybridization combined with microautoradiography (MICRO–CARD–FISH) was used to determine the abundance and activity of different bacterial groups.
http://bit.ly/EMR_DeCorte

Journal of Applied Microbiology

Bioactives from probiotics for dermal health: functions and benefits

Lew and Liong

Probiotics have been extensively reviewed for decades, emphasizing improving general gut health. Recently, more studies showed that probiotics may exert other health-promoting effects beyond gut well-being, attributed to the rise of the gut-brain axis correlations. Some of these new benefits include skin health such as improving atopic eczema, atopic dermatitis, healing of burn and scars, skin-rejuvenating properties and improving skin innate immunity. Increasing evidence has also showed that bacterial compounds such as cell wall fragments, their metabolites and dead bacteria can elicit certain immune responses on the skin and improve skin barrier functions. This review aimed to underline the mechanisms or the exact compounds underlying the benefits of bacterial extract on the skin based on evidence from *in vivo* and *in vitro* studies, and could be of help in screening of probiotic strains with potential dermal-enhancing properties for topical applications.
http://bit.ly/JAM_Lew-Liong

Effects of silver nanoparticles on microbial growth dynamics

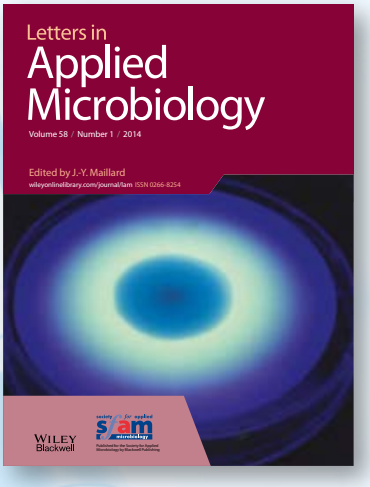
Schacht *et al*.

Engineered metal nanoparticles are increasingly used in consumer products, in part as additives that exhibit advantageous antimicrobial properties. Conventional nanoparticle susceptibility testing is based largely on determination of non-temporal growth profiles such as measurements of inhibition zones in common agar diffusion tests, counting of CFUs or endpoint or regular-interval growth determination via optical density measurements. For better evaluation of the dynamic effects from exposure to nanoparticles, a cultivation-based assay was established in a 96-well format and adapted for time-resolved testing of the effects of nanoparticles on microorganisms. Contrary to the expected results, our data indicate growth stimulation of C. *necator* at certain Ag(0) nanoparticle concentrations, as well as varying susceptibility to nanoparticles at different growth stages. These results underscore the need for time-resolved analyses of microbial growth inhibition by Ag(0) nanoparticles.
http://bit.ly/JAM_Schacht

Letters in Applied Microbiology

Occurrence and distribution of *Naegleria* species from thermal spring environments in Taiwan

Kao *et al*.



Naegleria spp. is a free-living amoeba that can be found in the natural environment. A number of *Naegleria* spp. can cause fatal infections in the central nervous system in humans and animals, and the most important source of infection is through direct water contact. In this study, water samples from various thermal springs were taken from four thermal spring areas. *Naegleria* spp. was detected via culture confirmation and molecular taxonomic identification. Among the 60 samples obtained, *Naegleria* spp. was identified in 26 (43.3%) samples. The identified species included *Naegleria australiensis*, *Naegleria gruberi*, *Naegleria lovaniensis* and *Naegleria mexicana*. The presence of living *Naegleria* spp. was significantly associated with elevated pH value in the water sample.
bit.ly/LAM_Kao

Use of Moroccan medicinal plant extracts as botanical fungicide against citrus blue mould

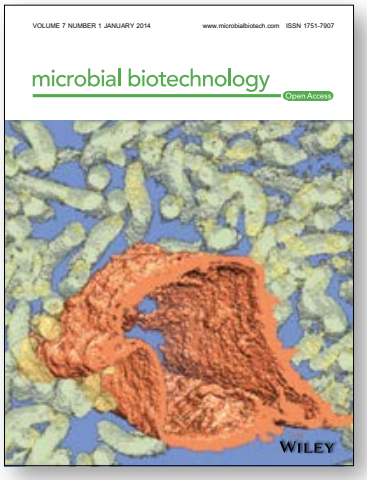
Askarne *et al*.

This work aimed to find an alternative to chemical fungicides currently used in the control of post-harvest citrus fruit diseases. In this study, we screened eight Moroccan medicinal and aromatic plants extracted with petroleum ether, chloroform, ethyl acetate and methanol for their antifungal activity against *Penicillium italicum*, the causal agent of citrus blue mould. The antifungal activity of these extracts was tested based on the disc diffusion method. This study demonstrated that plant extracts have a high potential to control blue mould of citrus and will provide a starting point for discovering new compounds with better activity than chemical fungicides currently available. Such natural products therefore represent a sustainable alternative to the use of chemical fungicides.
http://bit.ly/LAM_Askarne

Microbial Biotechnology

The antagonistic strain *Bacillus subtilis* UMAF6639 also confers protection to melon plants against cucurbit powdery mildew

García-Gutiérrez *et al*.



Biological control of plant diseases has gained acceptance in recent years. *Bacillus subtilis* UMAF6639 is an antagonistic strain specifically selected for the efficient control of the cucurbit powdery mildew fungus *Podosphaera fusca*, which is a major threat to cucurbits worldwide. The antagonistic activity relies on the production of the antifungal compounds iturin and fengycin. In a previous study, we found that UMAF6639 was able to induce systemic resistance (ISR) in melon and provide additional protection against powdery mildew. In the present work, we further investigated in detail this second mechanism of biocontrol by UMAF6639. We examined the signalling pathways elicited by UMAF6639 in melon plants, as well as the defence mechanisms activated in response to *P. fusca*, then analysed the role of the lipopeptides produced by UMAF6639 as potential determinants for ISR activation. Our results demonstrated that UMAF6639 confers protection against cucurbit powdery mildew by activation of jasmonate- and salicylic acid-dependent defence responses, which include the production of reactive oxygen species and cell wall reinforcement. We also showed that surfactin lipopeptide is a major determinant for stimulation of the immune response.
http://bit.ly/MBT_Gutierrez

Bio-based production of organic acids with *Corynebacterium glutamicum*

Wieschalka *et al*.

The shortage of oil resources, the steadily rising oil prices and the impact of its use on the environment evokes an increasing political, industrial and technical interest for development of safe and efficient processes for the production of chemicals from renewable biomass. Thus, microbial fermentation of renewable feedstocks found its way in white biotechnology, complementing more and more traditional crude oil-based chemical processes. Rational strain design of appropriate microorganisms has become possible due to steadily increasing knowledge on metabolism and pathway regulation of industrially relevant organisms and, aside from process engineering and optimization, has an outstanding impact on improving the performance of such hosts. *Corynebacterium glutamicum* is well known as a workhorse for the industrial production of numerous amino acids. However, recent studies also explored the usefulness of this organism for the production of several organic acids and great efforts have been made for improvement of the performance. This review summarizes the current knowledge and recent achievements on metabolic engineering approaches to tailor *C. glutamicum* for the bio-based production of organic acids.
http://bit.ly/MBT_Wieschalka

Melissa McCulloch
Wiley-Blackwell

stat+NOte 37

In the 37th of a series of articles about statistics for biologists, Anthony Hilton & Richard Armstrong discuss:

The negative binomial distribution

Introduction

In StatNote 36 (Hilton & Armstrong, 2014), we described how the Poisson distribution could be fitted to counts of yeast cells in samples obtained from a freshwater environment. An organism living in water, and present at low density, may be distributed at random and therefore, samples taken from the water are likely to be distributed according to the Poisson distribution (El Shaarawi *et al*., 1981). The distribution of many organisms, however, is not random, individuals being either aggregated into clusters or more uniformly distributed. By fitting a Poisson distribution to data, it is only possible to test the hypothesis that an observed set of frequencies does not deviate significantly from an expected random pattern. Significant deviations from random, either as a result of increasing uniformity or aggregation, may be recognized by either rejection of the random hypothesis or by examining the variance/mean (V/M) ratio of the data. Hence, a V/M ratio not significantly different from unity indicates a random distribution, greater than unity a clustered distribution, and less then unity a regular or uniform distribution (StatNote 36, Hilton & Armstrong, 2014). If individual cells are clustered, however, the negative binomial distribution should provide a better description of the data. In addition, a parameter of this distribution, *viz*., the binomial exponent (k), may be used as a measure of the 'intensity' of aggregation present (Cox, 1990). Hence, this StatNote describes how to fit the negative binomial distribution to counts of a microorganism in samples taken from a freshwater environment.

Scenario

Background

We return to the scenario first described in StatNote 36 (Hilton & Armstrong, 2014). Studies of the density of aquatic yeasts or bacteria in large bodies of water usually involve the collection of a number of water samples of small volume at various locations over time. To use these data to estimate overall density of yeast cells, however, assumptions are made concerning how the samples may represent the body of water as a whole and especially whether their density is likely to follow a particular statistical distribution. One of the first microbiological studies carried out in an aquatic environment assumed that coliform bacteria were distributed randomly in small volumes of water (Phelps, 1908) and later, it was suggested that numbers of bacteria in such samples could be described by the Poisson distribution (Greenwood & Yule, 1917). Subsequently, Fisher *et al*. (1922) concluded that whereas the Poisson distribution was often a good fit to bacterial counts under controlled environmental conditions, if the Poisson distribution did not fit the data, then the negative binomial distribution could be used as an alternative.

Methodology

The number of yeast cells per sample was estimated in 75 x 5ml samples of water collected from a freshwater lake. The original suspension was mixed thoroughly and 1ml subsamples taken from each of the larger samples. The number of yeast cells per sample is quite low in freshwater environments so dilution of the sample before counting was not required. The number of yeast cells was then counted using an improved Neubauer haemocytometer enabling the total number of cells per ml of sample to be obtained. Hence, the data comprise the number of yeast cells present in each of the 75 samples and the frequency distribution of these counts is shown in Table 1.

How is the analysis carried out?

The negative binomial is a two-parameter distribution defined by its mean (μ) and binomial exponent (k), and results from the expansion of the expression:

$Pk(1 - q)-k$ where $p = k/(k + \mu)$ and $q = 1 – p$

In populations with similar density of microorganisms, the value of 'k' decreases as the degree of aggregation of the population increases and hence, the reciprocal of 'k' (1/k) can be used as an index of the 'degree of aggregation'. Essentially, any sample information about the numbers of an organism in space or time can be analysed as long as the mean number of individuals per sample is relatively low and the sample size is adjusted to reflect this limitation. The procedure for fitting the negative binomial distribution to data is given by Cox (1990):

(1) Data are first grouped as a frequency distribution to show the number of samples (f) containing various numbers of individuals (X).

(2) The mean number of individuals per plot (μ) is calculated and 'k' estimated by an iterative procedure using freely available computer software (Wessa, 2008).

(3) The expected frequencies of samples containing various numbers of individuals are then calculated.

(4) Observed and expected distributions are compared using the chi-square (χ^2) goodness-of-fit test (StatNote 1, Hilton & Armstrong, 2005).

Interpretation

The observed distribution of counts of yeast cells and the predicted frequencies calculated from the negative binomial distribution are listed in Table 1 and shown in Figure 1. The histogram suggests that the negative binomial distribution is a good fit to these data (χ^2= 2.69, P > 0.05) and indicates that the samples are likely to come from an aggregated population. In addition, the value of k (0.3017) is quite low and therefore, the observed value of 1/k (3.31) suggests a considerable degree of clustering of yeast cells in the

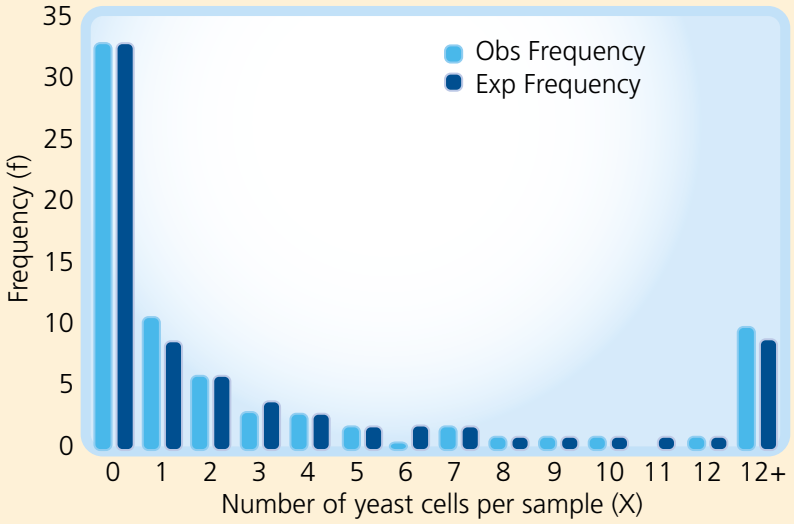


Figure 1. *Histogram illustrating the observed (O) and expected (E) frequencies (f) for the counts of yeast cells. The histogram suggests that the negative binomial distribution provides a good fit to these data*

lake studied. There could be various reasons for the clustering of yeast cells including stratification within the lake or clustering at certain times of the year.

Conclusion

If the data comprise measurements of the density of a relatively rare microorganism, such as a yeast or bacterium in an aquatic environment, the data are unlikely to follow a normal distribution. If the individuals are randomly distributed, the Poisson distribution should provide a better fit to the data. If aggregation is present, then the negative binomial distribution should fit the data better than a Poisson. Fitting the negative binomial distribution enables the degree of aggregation present in a population to be estimated and compared in different locations or times. Care must be taken in comparing different populations using 'k', however, since they may differ in both mean density and degree of aggregation, the relationship between 'k' and density can be complex (Taylor *et al*., 1978, 1979).

Table 1. *Observed (O) and expected (E) frequencies (f) for the counts of yeast cells. Parameters of the negative binomial distribution: mean (μ) = 4.187, k = 0.3017. Test of goodness-of-fit to the negative binomial distribution: χ^2 (all categories) = 2.69 (P > 0.05)*

Number of yeast cells per sample (X)	f(O)	f(E)	O – E
0	33	33	0
1	11	9	2
2	6	6	0
3	3	4	-1
4	3	3	0
5	2	2	0
6	1	2	-1
7	2	2	0
8	1	1	0
9	1	1	0
10	1	1	0
11	0	1	-1
12	1	1	0
>12	10	9	1

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*Sf*AM Winter Meeting 2014

MORNING Session

The morning session began with a welcome from the S*f*AM Vice President, Christine Dodd, and an introduction to the **8th Denver Russell Memorial Lecture**. Denver Russell (1936–2004) was a Professor of the Welsh School of Pharmacy at Cardiff University and a leading world authority on antibiotic and biocide mechanisms of action and the development of resistance.

This year's memorial lecture, ***"Food safety – current and future challenges"***, was given by **Colin Dennis**, Chairman of the English Food and Drink Alliance. Colin also serves on numerous national and international advisory boards and has previously been the Director-General at Campden BRI and President of the Institute of Food Science and Technology.

The multiple factors affecting food safety need to be addressed by a partnership involving industry, Governments and consumers; an integrated approach from crop and animal production right through to the consumer is necessary to manage the many potential sources of microbial contamination.

Some of the more recent examples of the breakdown of food safety have arisen following the reduction of salt or sugar levels in food products. The implications of these changes have not been fully appreciated and highlight the need for food microbiologists.

Colin described the use of prerequisite programmes (PRPs) as the basis of food safety management programmes and explained that failure of operational PRPs and HACCP leads to a high likelihood of food safety problems. However, it is now recognized that simply having the management tools is insufficient; employees need to be effectively trained and possess appropriate attitudes regarding their responsibilities. Behavioural studies into human factors are needed to complement traditional scientific studies.

Colin cited the example of a company which holds an annual remembrance day for those people whose lives were lost following a previous failure of their food safety systems in the hope that this will encourage employees to take their responsibilities seriously.

A future challenge is to harness the opportunities created by technological advances which will facilitate exploitation of the vast amount of relevant data which has not yet been analysed.

Following the memorial lecture Jean-Yves Maillard, Chief Editor of *Letters in Applied Microbiology*, presented Colin with a framed piece of artwork to mark the occasion. The morning session then continued with two taster lectures to introduce the themes for the parallel afternoon sessions.

The biodefence introductory lecture, ***"Nasty germs: in the bed or 'reds under the bed'?"*** was given by **Tim Brooks** of the PHE's Rare and Imported Pathogens Laboratory (RIPL). He questioned the proportionality of regulations which have been put in place in response to the threat of bioterrorism and drew parallels with the fears about Soviet spies in the US being fuelled by Senator McCarthy.

Special precautions for dealing with people suspected of having viral haemorrhagic fever can hinder diagnostic investigations which could otherwise assist in patient management. Case studies involving Lassa fever, Crimean-Congo haemorrhagic fever and Rift Valley

An integrated approach from crop and animal production right through to the consumer is necessary to manage the many potential sources of microbial contamination

fever were used to illustrate the dilemmas associated with these diseases.

Cases of anthrax have been widely reported in the press, including those recently associated with goatskins used in drums. Three strains of *Bacillus anthracis* were isolated from the drums used by an Edinburgh man who died of anthrax, one of which matched that isolated from his blood. One possible source of the organism is the water used to wash the goatskins in Afghanistan.

In conclusion, Tim said that although biological weapons are feasible, in reality they are rarely used.

The food contamination introductory lecture ***"A food safety 'culture': what does it look like and why is it important?"*** was given by **Chris Griffith**, Editor of the British Food Journal. He built on the messages from the earlier Denver Russell Memorial Lecture, emphasizing the high incidence of food handler errors.

Although food safety management systems have improved, the effectiveness of their application is influenced by the organizational culture of the businesses involved. The speaker defined organizational culture as "*the aggregation of the prevailing relatively constant, learned, shared attitudes, values, attitudes and beliefs contributing to the hygiene behaviours used in a particular food handling environment*".

Chris suggested the use of psychometric approaches to tackle the problem that 4% of food handlers questioned in a survey by a PhD student admitted to not adhering to safe practices, despite knowing what they were. The global nature of the food chain means that global solutions are needed to ensure all links in the chain have both the management systems and organizational culture to deliver safe food.

Louise Hill-King
Frimley Park Hospital NHS Foundation Trust

PARALLEL Session

Food contamination: the food handler's role

The afternoon session on ***"Food contamination: the food handler's role"*** provided four different perspectives on the key issues for safe food production. **Peter McClure** (Unilever R&D) described the problems faced by food manufacturers. There is a need for detailed information on key foodborne pathogens and their infectious doses, so that manufacturers can target control strategies appropriately. Surveillance ideally should report underlying causes of contamination. Food safety is of paramount importance in the manufacture of pre-packaged foods, since breakdowns in safety can potentially affect large numbers of consumers and cause massive economic loss. The contamination of a peanut butter manufacturing plant was given as an example where poor practices led to the presence of dust/fines from uncooked ingredients into areas for post-cook processes and ultimately resulted in a major outbreak of *Salmonell*a food poisoning.

Tayo Irawo, an independent food safety consultant, described food safety in the catering sector. This sector is extremely complex and ranges from the small caterer to industrial caterers in hospitals or schools. Approximately one million people in the UK suffer from foodborne illness each year and around 20,000 are hospitalized. Food handlers are defined as anyone who touches food and may include managers, cleaners or maintenance contractors. Ensuring that everyone is appropriately trained and that procedures are properly implemented is challenging. The outbreak of norovirus in a top-end restaurant provided an example to highlight the many areas where processes can break down. In this case, contaminated shellfish brought the virus into the restaurant, but staff attending work when ill was equally important in sustaining the outbreak.

The views of a retailer were described by **Peter Mather** of Sainsbury's Supermarkets Ltd. The sheer scale of the operation, with 150,000 staff involved in food handling, produces specific food safety issues. All employees receive training in basic food safety from the day they

PARALLEL Session

Approximately one million people in the UK suffer from foodborne illness each year and around 20,000 are hospitalized

start, and training is scaled up for those involved in high-risk areas. Clear messages are needed to ensure that they are understood by everyone. However, the requirements of the company sometimes do not sit well with the needs for clear guidance. For example, segregation of cooked and uncooked meat is not always practical. Although it may be safe to place well-sealed packages of uncooked meat adjacent to cooked products, this unavoidably leads to confusion for staff and customers. Overall, a large company benefits from having resources to provide well-maintained equipment and facilities, and to segregate foods effectively, which can be difficult for smaller operators.

The consumer's perspective was given by **Ellen Evans**, a PhD student from Cardiff Metropolitan University. Ellen gave an outstanding presentation on her research into awareness of *Listeria monocytogenes* control by consumers. *L. monocytogenes* infections are relatively rare, but are extremely serious when they occur. Her work targeted the over-60s, since there has been a rise in *L. monocytogenes* infections in this group recently. Most people in this group were unaware of the optimal temperature for food storage to minimize *L. monocytogenes* growth (≤ 5^{0}C), and the majority of consumers keep products beyond their 'use-by' dates. Laboratory studies confirmed the importance of maintaining a low refrigerator temperature to restrict *L. monocytogenes* growth.

The session finished with emotional acknowledgements to **Louise Fielding**, who put together the programme, but tragically passed away at the end of last year. She had been a dedicated member of the SfAM Executive Committee for many years, and she will be sorely missed at our meetings.

Nick Jakubovics
Newcastle University

PARALLEL Session

Biodefence

With the scene already having been set by the excellent and entertaining lecture by Tim Brooks, this afternoon session further evolved the biodefence theme, giving more detail on different aspects of biodefence. The first of these talks, delivered by **Petra Oyston** from DSTL, provided a valuable overview discussing biodefence over the ages and predictions for the future. Many of us consider that bioterrorism is a modern issue; however, misuse of terrifying infections has been used since ancient times. Petra described how the bodies of plague victims were used to break the siege of Kaffa during the 14th century. Later during the 18th century, smallpox-infected blankets were given to native people in the New World with the express intention of depopulating their numbers. We then learned about Unit 731 during World War II, who worked with anthrax, cholera and yellow fever to name but a few! We were brought up-to-date with descriptions of "Amerithrax" (anthrax letters in the USA) which, on a positive note, have resulted in funding being made available for research on high-risk agents. We were cautioned regarding some of the books discussing historic misuse of biological agents, as some appeared to blend fact and fiction. Petra then described DSTL and its role in producing medical countermeasures. The remit of this work is wide, embracing hazard assessment, detection, protection (vaccines) and decontamination. As the aerosol route is most often used during deliberate exposure, this necessitates investigation of intervention strategies using this route of infection which poses many logistical challenges. Facilities at DSTL have been designed to enable this. She then provided a brief review of some of the major biological agents that might be misused including *Bacillus anthracis*, *Yersinia pestis*, *Burkholderia mallei* and *B. pseudomallei*, smallpox virus and Ebola. With our leaps forward in biotechnology, we now additionally need to consider the threat of biologically enhanced microbes, or even synthetic recreation of organisms. This provided the audience with a comprehensive introduction regarding these "nasty germs", and laid the foundation for the following presentations.

This was followed by **Les Baillie** with the intriguing title of ***"If the anthrax does not get you the worms will! All you need to know about Bacillus anthracis, from nasty things in the mail to tea, sharks and green fluorescent nematodes"***. Although many were a little mystified by what the content of this talk might be, all of these aspects were covered, from the historic infection experiments with sheep on Gruinard Island off the coast of Scotland, through to worms as experimental models

for anthrax. After giving the audience an update on *B. anthracis*, Les went on to discuss relevant research in its detection, medical countermeasures and methods of decontamination. Detection is now possible using lateral flow assays that offer assay portability however, the performance of many novel detection methods during the "Amerithrax" anthrax letters demonstrated that traditional cultivation was probably as good as any of the diagnostics available. Additionally, with increasing antimicrobial resistance, this conventional approach will enable assessment of antimicrobial susceptibility. Moving on to medical countermeasures, we learned that drinking tea has been shown to contribute to resistance to infection; however, this activity is ameliorated by the addition of milk! The protective activity was likely to reside in the polyphenols present in tea. The presentation then moved towards decontamination methods, which can present a multitude of problems. Burying has historically been used but subsequent flooding can bring spores back to the surface whereby fresh infection can follow. There are still many gaps in our knowledge, such as what is a safe level (if any). Epidemiological studies have revealed soil can carry a significant level of spores, yet in the absence of human infection. Whether this indicates a tolerable level or a locally acquired degree of protection remains unresolved. Decontamination becomes more achievable if the highly resistant spores can be germinated prior to treatment. Indeed, a five log difference in kill rates could be seen when peracetic acid was used in combination with a germinant. Other methods for decontamination being explored include the use of specific bacteriophages and nematodes that eat vegetative cells (sadly, spores pass through nematodes unscathed).

We then switched our focus to two highly related microbes with treacherous historical records, *Burkholderia mallei* and *Burkholderia pseudomallei*, the causes of glanders and melioidosis respectively. Glanders is primarily an equine infection, but through the role of horses in our historical battles, such infection can devastate your opponent's ability to succeed, hence misuse of this infection. Reports of glanders extend back to the days of Hippocrates and Aristotle. Countries including the UK, USA and Canada have become free of disease, though much of the Middle East, Central and Southern America remain endemic. The clinical name for this infection was derived from 'frothy' as infected equines typically demonstrate excessive mucus excretions however, some cases may present with multiple skin nodules known as farcy. These organisms can result in both acute and chronic infections often associated with abscess formation. Our understanding of human infection with *B. mallei* was recently enhanced following a laboratory acquired infection that was subsequently published with the patient as a co-author. The human burden of melioidosis remains significant in endemic areas. Infection is common during the rainy season, particularly following extreme weather events. Occupations such as rice farming again correlate with greater risk of infection. Of particular concern is the incredible persistence demonstrated after primary infection that can manifest many years after initial exposure. On a cautionary note, this will complicate the development of effective vaccines to prevent this severe infection.

The final talk of this session discussed synthetic biology and its role in biosecurity. This topical and emerging area has captivated scientific and public thinking alike and fuelled many debates regarding risks and benefits. When we step back from these often controversial discussions, biotechnological advances have always instigated debate and consideration of boundaries before becoming accepted as biomedical tools. As dual use of technologies cannot be ignored, a level of international governance is prerequisite to avoid abuse of our biotechnological advances. The field of synthetic biology is now in its seventh year and is evolving in many directions from synthetic biochemical pathways, engineering microbial interactions, through to ability to create whole microbes using *de novo* synthesis. In consequence, researchers must ensure compliance to 'bioethics' and consideration of the potential misuse of information should be considered prior to placing this in the public domain. There is a need for global harmonized approaches that embrace societal, political and scientific concerns and priorities.

Reports of glanders extend back to the days of Hippocrates and Aristotle

Sally Cutler
University of East London

30 June – 3 July 2014, The Grand Hotel, Brighton, UK

Monday 30 June 2014

11:00 – 17:00	**Workshop** **International zoonoses collaboration**
18:00 – 19:00	***Journal of Applied Microbiology Lecture**:** **Bacterial metabolism in the large intestine and its consequences for the host** *George Macfarlane, University of Dundee, UK*
19:00 – 20:00	**Drinks reception and buffet**
20:30 onwards	**Quiz night**

Tuesday 1 July 2014

SESSION 1 **RISK RESEARCH**

Chair:	*Arjen van de Giessen, RIVM, The Netherlands*
09:00 – 09:35	**The influence of acquired immunity on the risk assessment of *Campylobacter*** *Arie Havelaar, National Institute for Public Health and the Environment, and University of Utrecht, The Netherlands*
09:35 – 10:10	**Uncovering the real burden of zoonoses** *Sara Monteiro Pires, Technical University of Denmark, Denmark*
10:10 – 11:05	**Tea, coffee and trade show**
11:05 – 11:40	**Modelling the species jump: assessing the risk of zoonotic influenza infection** *Andrew Hill, Animal Health and Veterinary Laboratories Agency, UK*
11:40 – 12:15	**Source attribution of ESBL-*E. coli* – what is the contribution of livestock to the public health risk?** *Annemarie Kaesbohrer, National Reference Laboratory for Antimicrobial Resistance, Germany*
12:15 – 13:15	**Lunch and trade show**

SESSION 2 **HOST PATHOGEN INTERACTIONS**

Chair:	*Roberto La Ragione, President Med-Vet-Net Association*
13:15 – 13:50	**Understanding the virome in 'one' health and disease** *Jonathan Heeney, University of Cambridge, UK*
13:50 – 14:25	**Alternative models for the assessment of virulence** *Rick Titball, University of Exeter, UK*
14:25 – 14:45	**Tea, coffee and trade show**
14:45 – 15:20	**Colonization of MRSA on porcine nasal mucosa** *Birgitta Duim, University of Utrecht, The Netherlands*
15:20 – 15:55	**Host Pathogen interactions in *Salmonella*** *Paulo Pasquali, Istituto Superiore di Sanità, Rome, Italy*
16:00 – 17:00	**Attended poster session**
17:00 – 18:00	**Student session**
17:00 – 19:30	**Trade show with wine, buffet and a competition**

Wednesday 2 July 2014

SESSION 3 **EPIDEMIOLOGY AND SURVEILLANCE**

Chair:	*Karin Arturrson, SVA, Sweden*
09:00 – 09:35	**Policy and economic constraints on developing efficient surveillance strategies** *Katharina Stärk, Royal Veterinary College, UK*
09:35 – 10:10	**Seroepidemiology in foodborne infections** *Kåre Mølbak, Statens Serum Institut, Copenhagen, Denmark*

Summer Conference 2014: ZOONOSES

10:10 – 10:45	**Surveillance based on whole genome sequence data** *Marion Koopmans, National Institute of Public Health and the Environment, The Netherlands*
10:45 – 11:05	**Tea, coffee and posters**
11.05 – 11.40	**Preventing ESBLs in the food chain** *Dik Mevius, CVI Lelystad, The Netherlands*
11:40 – 12:15	**Antibiotic resistance in *Salmonella*: from phenotype to genotype and back again** *Laura Piddock, University of Birmingham, United Kingdom*
12.15 – 12.50	**Metagenomics for investigating niche adaptation in the food chain** *Sam Sheppard, University of Swansea, UK*
12.50 – 13.50	**Lunch and networking**
13:50 – 15:30	**SfAM and MVNA Student Members' oral presentations**
15:30 – 16:30	**Attended poster session**
16:30 – 16:35	**Introduction to the New Lecturer Research Grant** *President of* SfAM
16:35 – 17:10	**SfAM New Lecturer Research Grant Lecture: Biofilms, biocides and buttercups** *Douglas Fraser-Pitt, NovaBiotics Ltd*
17:10 – 17:15	**Introduction to the W H Pierce Prize** *President of* SfAM
17:15 – 17:50	**W H Pierce Prize Lecture** *Vasilis Valdramidis, University of Malta*
17:50 – 18:20	**SfAM Annual General Meeting**
19:00 onwards	**Drinks reception and conference dinner**

Thursday 3 July 2014

SESSION 4 **DETECTION AND CONTROL OF NEGLECTED AND EMERGING ZOONOSES**

Chair: *Christine Dodd, University of Nottingham, UK*

09:00 – 09:35	**Detection of new and emerging zoonotic viruses (including foodborne)** *Wim van der Poel, Central Veterinary Institute of Wageningen University, The Netherlands*
09:35 – 10:10	**New coronaviruses, common genetics and pathobiological features** *Astrid Vabret, University Hospital of Caen, France*
10:10 – 10:45	**Tea, coffee and posters**
10:45 – 11:20	**Factors driving the epidemiology and control of Crimean-Congo haemorrhagic fever (CCHF) in Europe** *Agustin Estrada, University of Zaragoza, Spain*
11:20 – 11:55	**Can rabies be eradicated? The need for a 'One Health'approach** *Tony Fooks, Animal Health and Veterinary Laboratories Agency, United Kingdom*
12:15 – 13:15	**Lunch and depart**

*If you do not intend to register for the Summer Conference but would like to attend only the JAM Annual Lecture, SfAM Members are welcome to register for this separately at **http://jamlecture2014.eventbrite.co.uk**.

Environmental Microbiology **LECTURE** 2014

On 13 October 2014, the annual S*f*AM *Environmental Microbiology Lecture* will take place at the Royal Society of Medicine in London. Attendees will hear from Professor Jim Prosser, University of Aberdeen.

Jim Prosser is Professor in Environmental Microbiology in the Institute of Biological and Environmental Sciences at the University of Aberdeen. His research focuses on the diversity and ecosystem function of microbial communities and on the use of molecular techniques to characterize natural communities of microorganisms in soil and aquatic environments. This research has uncovered novel microbial groups involved in biogeochemical cycling processes, in particular nitrification, which plays a central role in the global nitrogen cycle. He is also Publications Manager for FEMS and a Director of NCIMB Ltd., a microbiological services spin-out company from the University of Aberdeen.

His achievements have been recognized by election to Fellowships of the American Academy of Microbiology, the Royal Society of Edinburgh and the Society of Biology, and presentation of the Francis Clarke Distinguished Lecture (awarded by Soil Science Society of America), the Russell Lecture (Rothamsted Research) and Distinguished Scientist Lectures at the Lawrence Berkeley National Laboratory, UC Berkeley, UC Davis and the Craig Venter Institute, in addition to regular invitations to present plenary lectures at major international conferences. He was awarded a Leverhulme Trust Fellowship to carry out research at the Universities of California (Berkeley), Vienna and Oxford (2012–2013) and was awarded an OBE in 2013.

All Members of S*f*AM will have received an invitation to the lecture with this issue of *Microbiologist* and for those who are unable to attend, the lecture will be available online, soon after the event.

‘Unimaginable, unprecedented’ microbial diversity: whence, so what and can we learn from nitrifiers?

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.
- Eligibility to win any of our awards or nominate a candidate for the S*f*AM Communications Award.
- 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.

Membership CHANGES

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

BELGIUM
M. A. Argudin
H. Imberects
L. E. J. Peeters

BERMUDA
R. Parsons

CHINA
Z. Cui

CYPRUS
G. Konstantinou

DENMARK
V. D. Andersen
T. Birk
T. Buschhardt
R. Jonsson
E. Litrup
S. Schjoerring

FRANCE
M. Guyard
D. Michelon
K. Rivoal

GERMANY
S. Bechlars
A. Rhode
H. Sharp

GREECE
A. Miron

HUNGARY
M. Gyuranecz
Z. Kreizinger
E. Mihalov Kovacs
K. M. Sulyok

INDIA
P. Kumar

IRAN
F. Darvishi

IRAQ
K. Sakran Abass

IRELAND
A. M. Beglin
J. Britton
E. Bruton
J. Carey
M. Coyle
J. Crotty
M. Dalmasso
L. Fadejeva
R. S. Harrington
C. Hynes
S. Kieran
N. Kinsella
N. McDonnell
N. O'Neill
S. Owen-Abosriwil
C. Pierce

ITALY
B. Chirullo
S. Cipullo
L. Grande
V. Michelacci
S. Michelini
S. Morabito

MALTA
D. Sango Millan

MEXICO
J. A. Duran Sepulveda
A. R. Rodriguez Melo

NIGERIA
A. Adegbite
A. Adeniji
I. Ahaotu
N. N. Ahaotu
O. Awoderu
A. Azuka Romanus
D. U. Ehichioya
S. Etuk
O. Gold
I. Isaac Bamgboye
O. K. Olofintuyi
T. Oluwaniyi

NORWAY
D. J. Colquhoun
K. Saebo Pettersen
C. Sekse
A. M. Urdahl

PAKISTAN
A. Hameed
N. Obaid

POLAND
M. Lopatek

PORTUGAL
M. T. Bonifacio Viana Lopes
M. I. Montenegro
C. Morais

SAUDI ARABIA
A. Zekry

SPAIN
A. Cabal Rosel
P. J. Campioli
C. Casal Comendador
M. Dominguez
I. Moreno
L. M. Olmos
M. J. Perteguer
M. Quintela-Baluja

SWEDEN
U. Windahl

SWITZERLAND
O. Braissant

TANZANIA
J. Ahmadi

THE NETHERLANDS
A. Ammerdorffer
R. J. Bouwstra
M. Harms
R. Kuley
W. van Pelt

UK
D. Abdeta
I. Abdi
M. Abdullah
G. Abe
K. Abouc Akhtar
H. Adams
S. Adamson
A. Agapova
M. Ahmad
A. Ahmed
A. Ahmed
A. Ahmed El-Imam
S. Al Ashbal
M. F. Alba de la Torre
B. Alexander
A. Altamirano
S. G. C. Andrews
G. Anthony
S. Anwar
P. Aranega Bou
O. Banerji
A. M. Banks
J. Bannister
G. Barrett
F. Barrijal
M. Beeton
E. Bellamy
A. Berriman
H. A. Bhatti
E. L. Birbeck
L. E. Birse
M. Bond
H. L. Brown
S. M. Brugnatelli Vianini
J. Burl
G. Burnham
A. Butler
K. Carolan
C. Carr
M. A. Chambers
F. Chong
A. Chrzastek
W. S. F. Chung
M. Clark
R. Clarke
L. Clarke
T. Coello Garcia
S. Crooke
S. Cramp
V. Crescente
O. Day-West
A. Devaynes
E. Devlin
G. M. Din
N. Downey
E. Dwyer
P. Dzinzi
E. R. Elcocks
A. Elkashif
L. Elliott
E. Elmerhebi
F. L. C. Everest
S. E. Fane
O. A. Fasanmi
M. I. Fauzi
C. Fell
P. Firrell
S. Flint
J. Frankenberg Garcia
H. Frost
A. Fuller
S. Gahan
H. Gahmi
S. H. Gardner
Z. Gerrard
S. Gibson
P. E. Gjertsen Prestmo
A. Graham
D. Guiliano
D. Durung
P. Durung
J. Hall
T. W. Hall
N. Harrison
P. Harvey
C. Heywood
K. Hitri
J. Ho
G. Holt
L. H. Hopkinson
K. Hopson
G. Humphreys
S. Hussey
S. Hutchinson
G. Iceton
R. Imo
P. Ingle
J. Ingram
V. Irorere
A. Issa
C. James
M. Jarvis
T. Jeffreys
Y. Jiang
C. Jones
K. Kabir
I. Kahen
B. Kainth
T. Kalule
S. Khalifa
L. Khodadoost
A. G. Komarudin
A. Kowalczuk
K. Krakowiak
S. Kurapati
I. Kyeremeh
M. Lacey
S. Lahme
C. Le Roy
C. M. Lee
S. Long
B. S. Lopes
S. M. Lucking
N. Lyons
N. MacAogain
M. C. Macey
S. MacPhee
S. Malic
L. Marsella
D. Marshall
K. Mashanga
N. Masri
E. Matthys
J. McCann
A. McCloskey
M. T. C. McCrudden
B. McGeever
L. McKendry
J. Mehat
B. Merget
S. Minta-Jacobs
A. B. Mohammed
E. Molesti
T. Morton
S. Mukhtar
A. Nikolaou
T. Nkambule
V. Nobrega
J. Ogbanufe
J. Ogundare
O. Okeyide
D. Oliver
Y. O. Olufemi
O. Onianwa
A. Oputa
S. Patel
K. Patel
A. Poole
K. Poole
R. Potts
A. Power
Z. Prior
J. Rahman
K. Raja
L. Ramkhelwan
R. Reid
I. Robertson
A. Rodiles
P. Ryan
J. S. Sabat
Z. Safi
P. S. Salgado
A. J. Sanders
P. Sankaranarayanan
E. Sayers
B. Schelkle
B. Schnabel
S. Seeburuth
S. Shah
A. Smith
K. A. Smith
M. A. Tariq
M. Taylor
C. Teague
N. Thaxter
J. C. Thomas
H. Thornton
F. I. Ustok
C. Valentyne
S. Vasilakopoulou
H. Vaughan
L. Vaz
B. V. Vetter
M. Vignola
E. Weber
H. Whitbread
L. Wilson
G. M. Wilson
J. Wood
M. Yiannarou
S. Yousaf
Z. Yusuf
Y. Zhai
X. Y. Zhi

USA
D. Aruscavage
S. Brown
J. Flaherty
M. Henson
S. Hepp
S. Thapa
T. Williams

*Sf*AM AGM Agenda

83rd Annual General Meeting of the Society for Applied Microbiology

2nd July 2014, 5.50 pm The Grand Hotel, Brighton.

1 Apologies for absence.

2 Approval of minutes published September 2013 *Microbiologist* of the 82nd Annual Meeting held in Cardiff, 2013.

3 Matters arising from the previous minutes.

4 Report of the Trustees of the Society 2013:
(i) Report of the President.
(ii) Report of the General Secretary.
(iii) Report of the Meetings Secretary.
(iv) Report of the Treasurer.

5 Adoption of the 2013 Annual Report.

6 Election of new Members (including Honorary Members), deaths and resignations.

7 Election of the new President – Professor Christine Dodd.

8 Nomination and election of General Secretary.

9 Nomination and election of Meetings Secretary.

10 Nomination and election of Treasurer.

11 Nomination and election of new Executive Committee Members.

12 Any other business.*

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

GRANTS SPOTLIGHT: SCIENTIFIC MEETING ATTENDANCE GRANT OR PRESIDENT'S FUND?

Are you going to a scientific meeting? Do you need funding? Do you know which of our grants to apply for?

The **Scientific Meeting Attendance Grant** will fund your travel, accommodation and registration fees at any relevant scientific meeting, including *Sf*AM meetings, up to £300. If caring responsibilities would prevent you from attending, we will increase the upper limit to £600 and include the cost of alternative arrangements for care of your dependent(s).

The **President's Fund** is for scientists presenting a poster or giving an oral presentation at a relevant scientific conference, meeting or workshop, including at *Sf*AM meetings. It will fund travel, subsistence and conference fees, up to a value of £1200.

For more information about all our grants and awards, please visit **www.sfam.org.uk/grants**.

PECS ACTIVITIES at the *Sf*AM Summer Conference

Where: **Brighton, England**
When: **30 June to 3 July**

Summary of events

Monday 30 June:	Icebreaker event (after the *Journal of Applied Microbiology* Lecture)
Tuesday 1 July:	17:00–18:00, Student session – CV clinic
Wednesday 2 July:	Open PECS Committee meeting

This is the time of the year when we finally reveal our plans for PECS activities at the Summer Conference.

This year, the *Sf*AM Summer Conference will take place in a wonderful venue – The Grand Hotel in Brighton. The conference starts on Monday and since our aim is to get everyone to take as much as possible out of the social aspect of the conference, we always organize an icebreaker session on the first night. As the name suggests, the first of our events is to 'break the ice'. Whether you feel socially confident or you are a bit shy, you should definitely benefit from it. This year we decided on an activity called 'Roll with it'…more details on the day, as we don't want to spoil it for you. We will 'roll' on the first night of the conference right before the quiz. Join us for some fun!

Applying for a job, or maybe just thinking about options for the future? Please come to our student session on Tuesday. Student sessions are organized for students and early career delegates to enhance and strengthen our competitiveness in the workplace, and provide some useful knowledge and confidence necessary for the big, tough world. This year we have decided to hold a 'CV clinic'. How many times have you wondered whether your CV will 'catch the eye' of a Human Resources person and a potential employer? Or maybe you're unsure how many pages it should have or whether or not to include certain information and what outline to choose? Our experts will do their best to answer these and other questions you may have about optimizing your CV to maximize your chances of getting to the interview stage. If you are interested, please bring your CV along – we guarantee you will find our 'CV clinic' useful.

We would like to ensure all our PECS delegates have fun and know everything about the opportunities provided for them at the Summer Conference. We will also try to socialize in the evenings so look out for Members of the PECS Committee. We try to make ourselves visible, so don't hesitate to come and ask any questions. On Wednesday we will be holding an open PECS Committee meeting that all students and early career delegates are not only welcome, but encouraged, to attend. You will get a chance to meet us all in person, in one place, and hear a bit more about what we do. There are, of course, opportunities to get actively involved with us.

Lastly, if you want to ask us any questions regarding the Summer Conference, or anything else to do with PECS, don't hesitate and email us at pecs@sfam.org.uk.

See you in Brighton!

Agnieszka Piotrowska

Saving lives for more than 40 YEARS

Valerie Edwards-Jones describes her career in medical microbiology, which spans five decades of life-saving laboratory diagnostics and research

Writing this article stirred a number of emotions and I tried desperately to remember what I wanted to do when I grew up! I was a highly organized little girl (some people may have said bossy) and I was involved in a number of school societies and heavily involved in sport. I loved maths, physics and chemistry but wasn't too keen on biology. I certainly hadn't considered a career in microbiology!

In 1972, I got a job as a Junior A medical laboratory technician (see image left). I didn't really know what it entailed but it sounded interesting and I have never looked back. I started in the pathology laboratories at Dryburn Hospital, Durham. For two years I was trained in all the pathology disciplines: haematology, histopathology, biochemistry and microbiology. I also studied at college for a full 12-hour day for my Ordinary National Certificate (ONC) in Medical Laboratory Sciences. When I look back, this was very hard as I had to work every other Saturday morning, too. My salary: £485 per year!

I loved microbiology and chose to specialize in this area, doing my HNC in Medical Laboratory Sciences (Medical Microbiology specialism). A further two years, studying for my specialist Medical Microbiology examinations for the Institute of Medical Laboratory Sciences, gave me a fantastic knowledge in my subject area and I was ready for taking on management!

Things have changed over 43 years; most younger Members of the Society would not believe that we ate, drank and smoked at the bench; we wore lab coats but they were not Howie (introduced around 1978) nor were they fire retardant (there is another story but not for here). I moved to Manchester as a Senior medical laboratory scientific officer; a job that really got me hooked on the profession. I was fortunate to work at Booth Hall Children's Hospital and Monsall Infectious Disease Hospital where I gained experience and extensive knowledge in paediatric microbiology

FURTHER READING

Claydon M. A. *et al*. (1996). The rapid identification of intact microorganisms using mass spectrometry. *Nature Biotechnology*, **Vol. 14**, pp1584–1586.

Finally my TV stardom... Haha! I love having the opportunity to express my opinion to the rest of the world. I am the consultant microbiologist on the TV programme 'Embarrassing Bodies'

and tropical diseases. I can honestly say during six years in these hospitals, I learned so much.

It was whilst I worked here that I had my first son. In 1978, most women stayed at home to bring up their children. There were few nurseries and paid maternity leave was minimal. Finding someone to look after my six-week-old son when I returned to work was a challenge but I managed it (thanks Mum!). Now, 35 years later, it is so much easier to continue with your career and improved maternity benefits have allowed women to have their family and also keep their career.

I obtained a Head of Department post in Microbiology in 1984 and quickly became deputy Pathology Laboratory Manager. I thought my career would continue as a manager within the laboratories, but I found I needed something more challenging. I was already teaching part-time at Manchester Polytechnic and enjoyed this immensely so I moved into academia in 1991 after obtaining a full-time lecturing position. At the same time, I embarked on my PhD on 'Toxic shock syndrome in burned children.' I loved my PhD but it was very demanding alongside my new career as an academic. Don't ever believe anyone who says an academic's life is easy – it is not, especially at the beginning!

I loved teaching. I could pass on my experiences from my time in the NHS. I had seen some fascinating cases, such as a case of legionnaires' disease, in 1980, which resulted in the patient being in the intensive care unit for over 20 weeks.

My love for microbiology has never faltered. I know when I worked within the NHS I saved many lives and would hope that as an academic I continue to do so by training students to understand important diagnostic principles.

I have been a member of a number of learned societies for many years. I have found, for very little financial outlay, the networks I built up have helped with the development of my career. I have been involved in a number of working groups and advisory committees, and this has allowed me to influence important areas of microbiology.

My greatest achievement was probably made over a cup of coffee at work. Talking to a biochemistry colleague and his friend from Warwick University, we discussed the merits of mass spectrometry in microbiology. He had a new type of mass spectrometer (MALDI-TOF MS) so we thought we would try this in microbiology. We published the work in Nature Biotechnology and now, 20 years later, it is revolutionizing microbial identification.

I have loved my 43 years in microbiology and when I became Professor of Medical Microbiology in 2008, this was probably the most special moment in my career. I could not have done as much if I had not had the help and support of my three children and my husband.

Finally my TV stardom...Haha! I love having the opportunity to express my opinion to the rest of the world. I am the consultant microbiologist on the TV programme 'Embarrassing Bodies' and really enjoy doing this (although I don't usually watch it as I am a bit squeamish). It is a fabulous conduit to get your point across as well as having some good fun meeting a huge selection of people.

Valerie Edwards-Jones,
Manchester Metropolitan University

MICROBE2014

SfAM has long been associated with the MICROBE conference and will have a presence at this year's event. Here, conference secretary, Alan Pease, tells us what MICROBE 2014 has in store (though he doesn't give away this year's dress theme for exhibitors – look out for SfAM Staff and Committee in disguise!)

Readers of *Microbiologist* will be delighted to know that the MICROBE 2014 conference will take place at the Hilton Hotel, Sheffield, September 19–21st 2014. This is the 14th MICROBE conference held in Sheffield, and delegates at recent conferences will recognize that the Hilton Hotel is an excellent venue and hence why we continue to host conferences there. With the ongoing support of the trade exhibitors we are able to maintain the residential delegate fee at £199 for single occupancy, and for those who wish to share, there is limited availability at £149 per person. The delegate fee includes all meals and access to all aspects of the conference.

The conference will have many attributes, but the lecture programme is key to conference success and MICROBE 2014 will not disappoint. We will commence with an expert view of the '**Future of Microbiology in the United Kingdom**', and once delegates are hopefully reassured that the service is still required, we will look at future microbiological

scientific aspects, namely the molecular basis of host-pathogen relationships; bioinformatics and nucleic acid sequencing. This will be followed by a fascinating session covering zoonotic infections, ranging from seemingly traditional cryptosporidiosis and veterinary microbiology to the 'new' henipaviruses. The session will be completed by a potentially provocative talk on badgers, and their role in bovine tuberculosis.

Even the study and treatment of the traditional wound has a place for discussion. We will receive topical overviews of wound infections and surgical site infections. Then we will learn how negative pressure wound therapy (vacuum-assisted closure) can enhance wound healing.

The programme will be completed by presentations on various topics, including mycoplasma, the microbiology of food, *Trichomonas vaginalis*, hepatitis and respiratory disease.

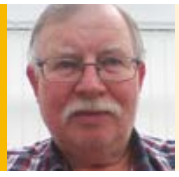
To support the information offered in the formal lecture programme, we will be giving delegates the opportunity to participate in a poster exhibition. The organizers will be offering significant prizes for those posters judged to be the best. Expressions of interest should be sent to **microbeconference@gmail.com**.

There would be no MICROBE conference without the support and enthusiasm of over 35 trade sponsors, and they will be fully participating in the stand and dress themes that the organizers have proposed.

Evenings will be an opportunity for delegates, trade exhibitors and organizers to wind down after exhausting days. A varied social programme is being offered, including a tabletop magician, a casino and dancing to the live band or disco. Alternatively, there are quieter seated areas for a drink, a chat and renewal of acquaintances.

Initial delegate bookings have already indicated that MICROBE 2014 will be as popular as its predecessors. We urge interested laboratory staff to apply soon before we are sold out; we apologize to those applicants who we were unable to accommodate at the last conference.

Further information, including our regular newsletters can be requested at **microbeconference@gmail.com**. Alternatively our web address is **www.microbe.org.uk**.



Alan Pease

The MICROBE 2014 conference will take place at the Hilton Hotel, Sheffield, September 19th–21st 2014

16th EUROPEAN CONGRESS ON **BIOTECHNOLOGY**
13-16 July 2014 • EICC • Edinburgh • Scotland
Organised by The European Federation of Biotechnology
www.ecb16.com

The European Congress on Biotechnology is the leading conference for academic and industrial biotechnologists in Europe organized by the **European Federation of Biotechnology**. The 16th biennial event will take place in the beautiful and historic city of Edinburgh, Scotland.

- **1,400+ Delegates**.
- **1,000 Scientific Posters**.
- **150+ Speakers**.
- **50+ Exhibitors**.

The scientific programme is designed to cover all aspects of biotechnology, including environmental and green biotechnology, microbial physiology, microbial synthetic and systems biology, applied biocatalysis, industrial biotechnology, biochemical engineering, medical biotechnology and much more.

The congress will provide an excellent opportunity to network, share ideas and form partnerships with: biotechnology and pharmaceutical companies, investment companies, equipment manufacturers, technology providers, medical device companies, Government and regulatory bodies, IT software solutions, biotechnology associations, learned societies in biotechnology, research institutes, universities, consultants, law firms and individual biotechnologists.

For more information, visit the ECB16 website at **www.ecb16.com**.

Corporate NEWS

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

AHVLA IPR licensing programme turning ideas into reality

The AHVLA conducts research over a wide range of important animal diseases resulting in new discoveries, the development of novel techniques and an accumulation of considerable expertise over a diverse range of disciplines contributing to improved disease control and diagnosis around the world.

As a result, AHVLA Scientific has amassed an extensive portfolio of Intellectual Property Rights (IPR) which is available to customers through our flexible IPR Licensing Programme. The IPR exists as 'know-how' in the form of products, techniques and expertise, as well as that formally protected through the patent process, both at the national and international level. Examples of IPR available include novel vaccine and challenge candidates, a wide range of monoclonal antibodies, novel molecular diagnostics complete with validation data and novel in-field diagnostic kits. Licensing of IPR is available on an exclusive basis if desired.

If you would like further details about the AHVLA Scientific IPR Licensing Programme, please contact our Customer Service Team.

Further Information

Visit: www.ahvlascientific.com
Tel: +44(0)1932 357641
Email: ahvlascientific@ahvla.gsi.gov.uk

Microbial monitoring solutions

Cherwell Laboratories offer solutions for a variety of environmental monitoring purposes including the supply and service of the SAS air sampler range. These robust, reliable air samplers are easy to operate and use readily available Contact plates avoiding costly, specialist consumables. Alternative petri dish versions are also available.

The range includes:

- **SAS Super 100 / Super 180** - primarily aimed at environmental monitoring for the cleanroom user. The SAS Super 180 offers a high sampling rate, completing a cubic metre in under 6 minutes.
- **SAS Duo 360** - dual headed air sampler designed to allow a bacterial or total viable count (TVC) plate and fungal plate to be run simultaneously, significantly reducing monitoring time.
- **SAS Super Isolator** - features a stainless steel sampling head which is located permanently inside an isolator cabinet. The sampling head is connected through the isolator cabinet out to the control unit, reducing the need for the sampler to be continually passed into the cabinet, minimising contamination risks.
- **SAS Pinocchio Super II** - a non-powered air sampling unit used to test the microbiological quality of compressed air and gas.
- **Servicing / Calibration** - to guarantee a quick turnaround we also offer our own service and recalibration service.

Further Information

Visit: www.cherwell-labs.co.uk
Tel: +44(0)1869 355 500
Email: sales@cherwell-labs.co.uk

Bargain offer for workstation users

Many Whitley options and accessories are retrofittable so if you already have a Whitley Workstation, now is the time to update it by adding a few additional items that could help in your work or just make your life a little easier.

Our advert on the inside front cover of this edition shows just some of the options that could transform your workstation. As a special deal for Microbiologist readers we are offering very attractive discounts when you buy two or more options. Call us today and we guarantee you will be pleased with the deal we can provide.

Choose from items such as:

- Anaerobic Conditions Monitor
- Data Logging
- Storage Trays
- Bespoke Trolley
- Single Plate Entry System
- Directional Spotlight
- Plate Racks and Tags

BONUS: if your new option requires installation by one of our sales engineers, why not order a one-off service at the same time to future-proof your workstation, and get 30% off.

Because not all options and accessories fit all workstations, give us a call to discuss the model, age and what options are already fitted. Then, tell us which new options you are interested in and we'll provide you with a very favourable quotation.

Further Information

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

Lab M extends prepared media offering with launch of Pinnacle™ pre-poured plates

Lab M has launched the Pinnacle™ brand, a new line of pre-poured plates. Pinnacle™ brings together Lab M's extensive experience and expertise in the development, manufacture and supply of dehydrated culture media (DCM) and the expanded plate pouring capabilities at the company's new UK headquarters. The result is a unique combination of proven, high quality DCM prepared as ready-to-use plates by the manufacturer, under a stringent quality management system in a GMP environment.

The first products to be available in the Pinnacle™ range are focused on food industry applications, an area in which Lab M has particular expertise. Listeria Chromogenic Agar for the isolation of Listeria monocytogenes and Tryptone Bile Glucuronide Agar for the isolation of Escherichia coli will be closely followed by CSIM for the isolation of Cronobacter sakazakii from milk and milk products and chromogenic ABC medium for the isolation of Salmonellae.

Also joining the range is PINNACLE™ mLGA, a selective chromogenic medium for the simultaneous enumeration of Escherichia coli and coliforms in drinking water.

As well as further commercialising its plate pouring capabilities, Lab M continues to offer a highly flexible service that enables the company to tailor media to meet a customer's specific needs. The team is skilled in delivering to non-standard specifications, including the production of deep-filled plates.

Further Information

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

Optimizing urine microbiology – The Whitfield Street Laboratory experience

Whitfield Street Laboratory has adopted the Mast **Uri**® System for the direct culture, identification and sensitivity testing of urine pathogens. This joint laboratory formed between The Doctors Laboratory (TDL) the UK's largest private pathology provider and University College London Hospitals (UCLH), a large prestigious London Teaching Hospital report that the Mast **Uri**® System has had a significant impact on the workflow and service provided.

Implementation of the Mast **Uri**® System has proved to be a valuable adjunct and has given greater capacity to test samples on both the Mast **Uri**® System and Kiestra. In today's environment WSL understand that there is no 'one size fits all' and continually seeks to optimise laboratory automation and maintain a competitive edge. Staff at WSL found the Mast **Uri**® System easy to use and were delighted with the streamlined workflow. It also fitted well into a 24-hour working day and greatly reduced follow-up work.

For details on these or any other products within the Mast portfolio, please contact Mast on **sales@mastgrp.com**.

Further Information

Visit: www.mastgrp.com
Tel: +44(0)151 933 7277
Email: sales@mastgrp.com

Microbiologics, Inc. debuts new molecular standards product line- Helix Elite™

Microbiologics, a leading global manufacturer of prepared quality control microorganism products, debuts its first molecular product line, Helix Elite™. These molecular standards are intended to facilitate the development, validation, and monitoring of molecular assays. The Helix Elite™ molecular product line currently includes 13 molecular standards for microorganisms that are difficult to grow or cannot be cultured such as Cryptosporidium and Norovirus.

These synthetic standards are developed using a unique patented bioinformatic algorithm that combines the genetic diversity of diagnostic sequences from the target organism. Helix Elite™ molecular standards can be used as internal or external positive controls in a defined reaction or spiked into matrices and are applicable for a broad range of assays and instruments.

Microbiologics' CEO Brad Goskowicz commented, "Microbiologics is leveraging its experience as a global provider of microbial cultures and reagents to provide innovative products of the highest quality to support molecular diagnostics. With the addition of Helix Elite™, Microbiologics is now positioned to offer a full-line of controls, from microorganisms and attenuated strains to genomic and synthetic molecular standards."

Further Information

Visit: www.microbiologics.com
Tel: +44(0)1320 253 1640
Email: info@microbiologics.com

Convenient specimen collection and processing with "Snap 'n Cap"

Medical Wire's novel specimen transport devices including ∑-Transwab®, Fecal Transwab®, ∑-Virocult®, and ∑-VCM® feature "Snap n' Cap", the convenient swab capture system. Once the swab specimen is taken from the patient, the swab is simply placed in the transport tube, snapped off, and the screw cap "captures" the swab.

When the cap is removed at the laboratory, whether by hand or automatic decapper, the swab is lifted out of the way allowing access for sampling. The cap, now with integral swab can also be transferred to compatible tubes such as our new Selenite Broth (MWSEL).

The cap with swab can also be easily handled and processed by conventional techniques such as manual plating.

The tube with captured swab is more compact for transport and is ideal for any future storage and retrieval requirements.

"Snap n' Cap" swab capture is integral to ∑-Transwab®, the specimen collection and transport system for aerobes, anaerobes and fastidious microorganisms, Fecal Transwabs® (enterics), ∑-Virocult® (viruses), and ∑-VCM® (viruses, chlamydia, mycoplasma and Neisseria).

Further information

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

New partnership between NCIMB and Web Scientific

NCIMB are pleased to announce an exciting new arrangement with Life Sciences supplier Web Scientific to supply NCIMB's Microsnap range of Quality Control cultures.

Microsnap is an easy to use format for frequently used QC microorganisms. It's a simple all plastic device comprised of a lower chamber containing the freeze dried culture and an upper chamber containing resuscitating fluid and attached swab. On mixing, the rehydrated culture can be used to inoculate growth media. Microsnap is an easy, safe and reliable single application device, individually vacuum packed in foil packages for a shelf life of up to 24 months. Microsnap has applications within food and water testing, media QC, pharmaceutical, industrial and environmental testing and research, education and teaching purposes.

Web Scientific is a leading supplier of life science reagents, consumables and low cost laboratory equipment. Providing a diverse range of products for the microbiologist, all accessible on their extensive online catalogue and available through a convenient online ordering process.

Further Information

Visit: www.ncimb.com
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Email: enquiries@ncimb.com

TCS Biosciences Ltd

Here at TCS Biosciences Ltd, we have nearly 50 years' 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
Tel: +44(0)1296 714222

Science Communication and Public Engagement **WORKSHOP**

The Physiological Society
Hodgkin Huxley House
30 Farringdon Lane
London
EC1R 3AW

19 June 2014

10:30 **Arrival and coffee**

11:00 **Welcome and introduction to communicating science,** Nancy Mendoza, S*f*AM

11:30 **Communications Award presentation and talk,** Ron Cutler, Queen Mary Universty of London

11:45 **Communications Award presentation and talk,** Adam Rutherford, BBC

12:00 **Using social media to engage with the public,** Diane Saunders, TGAC

12:45 Lunch

13:30 **Parallel sessions part I**

SESSION A – Public engagement in schools: Delivering the World of Microbiology programme (Aston University)

An interactive workshop which will give participants the skills and understanding to be able to build partnerships with schools in their local area and deliver the World of Microbiology programme.

SESSION B – Wikipedia: Bringing accurate, evidence based information to the public (Wikimedia)

An interactive workshop introducing Wikipedia as an important source of information and teaching participants how to edit entries and the dos and don'ts of doing so.

15:15 Coffee

15:30 **Parallel sessions part II**

16:30 **Close**

Booking is via Eventbrite at http://www.eventbrite.co.uk/e/sfam-science-communication-and-public-engagement-workshop-tickets-11105237063

Admission to the workshop is free for S*f*AM members. However, cancellations within 48 hours prior to the event will incur a £30 charge.

For further information please contact us at communications@sfam.org.uk or on +44(0)1234 326661.

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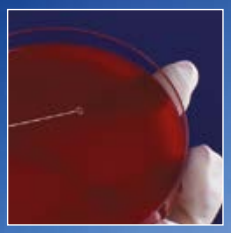
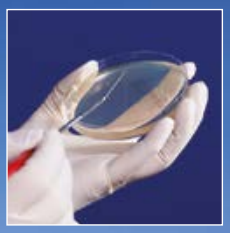
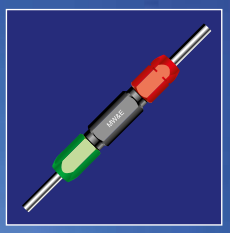


Precision



Versatile



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