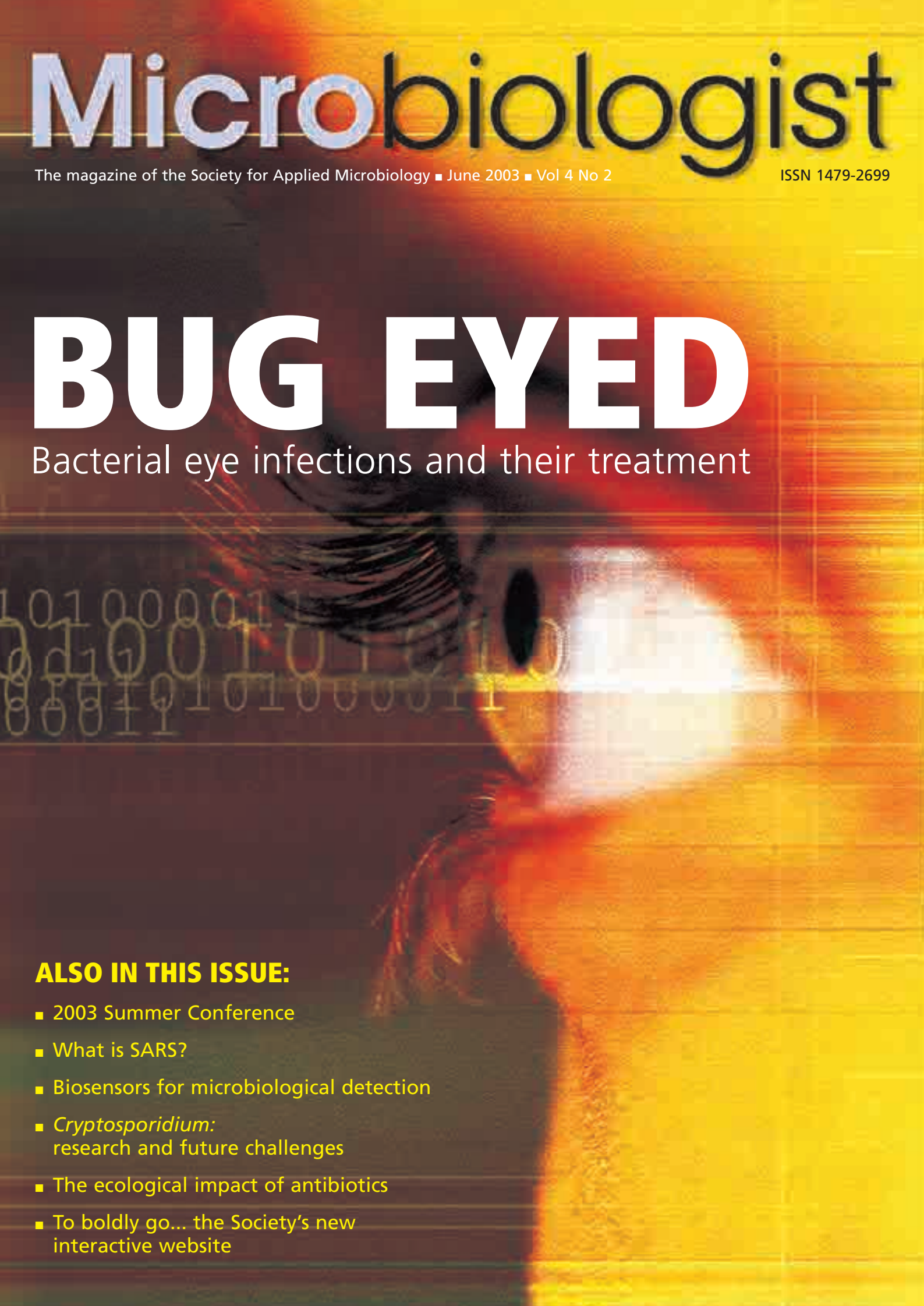
Microbiologist

The magazine of the Society for Applied Microbiology ■ June 2003 ■ Vol 4 No 2 ISSN 1479-2699

BUG EYED

Bacterial eye infections and their treatment



ALSO IN THIS ISSUE:

- 2003 Summer Conference
- What is SARS?
- Biosensors for microbiological detection
- *Cryptosporidium:* research and future challenges
- The ecological impact of antibiotics
- To boldly go... the Society's new interactive website

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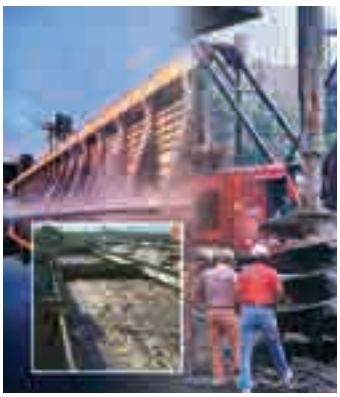

FEATURES

Microbiologist
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Friday 4 July 2003

Vol 4 No.4 December
Friday 12 September 2003

Vol 5 No.1 March
Friday 12 December 2003

Vol 5 No.2 June
Friday 12 March 2004

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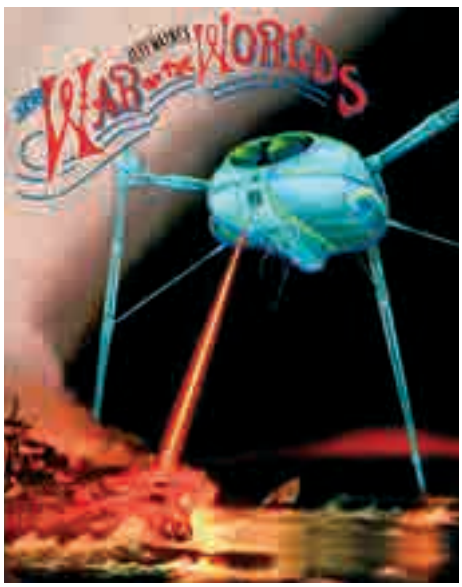
Microscopic attack!

Anthony Hilton admires the versatility of microorganisms

MANY OF YOU will have watched with curiosity and concern as the first global pandemic of the 21st century crept across parts of East Asia, North America and parts of Europe in the form of an atypical pneumonia of unknown aetiology (see page 18 for a review of this virus). At the time of writing it is unknown whether the current SARS outbreak has been contained but we can only hope that procedures put in place to prevent its spread are successful. Those of you who attended the Summer Conference on *"Pathogens in the Environment and Changing Ecosystems"* in Nottingham in 2002 will recall the excellent lectures outlining the difficulty in containing such diseases where spread is facilitated by travel tourism and climate change. This is exacerbated by data from epidemiological studies which suggest that the primary route for spread of the SARS virus is by direct contact or by aerosols spread over short distances. Furthermore, the SARS virus can apparently linger outside an infected person's body for at least 24 hours and can survive on common surfaces at room temperature for possibly days. These factors taken together will send shivers down the spine of any microbiologist who appreciates the significance of what has been unleashed upon us.

For me it has frightening parallels to H.G Wells story of the "War of the Worlds" (1898) that was popularised by Jeff Wayne's musical version in 1978 and one of my favourite records as a boy.

"A mighty space it was, and scattered about it, in their overturned machines, were the Martians, slain after all man's devices had failed by the humblest creatures on the earth: bacteria. Minute, invisible, bacteria. Directly the invaders arrived and drank and fed, our microscopic allies attacked them. From that moment, they were doomed."



To the unprepared, pathogenic microorganisms no doubt represent a formidable enemy, however in the developed world we are fortunate in that, for the large part, we live in a dynamic relationship where we are mostly the victor. In other regions of the world they are not so fortunate. Ultimately, however, you can't help but admire the versatility of microorganisms; they never fail to exploit an opportunity and extract the maximum possible benefit from it. Whether it is the development of resistance to our most effective antibiotics or the emergence of new pathogens, seeminginly overnight, at least we can draw some comfort that there will always be a role in the future for a microbiologist.

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Bio wars

FROM: R W A Park
SUBJECT: Sfam statement on Biological Warfare [*Microbiologist* March 2003]

Of course, like the vast majority of people, I do not like the idea of war, and I have a half-formed idea that biological or chemical warfare is somehow worse than 'conventional' warfare. What a load of rubbish though! It is not obvious, to say the least, that I would prefer to die looking at my guts spewing out of a wound in my abdomen caused by shrapnel than dying of pneumonia, "the old man's friend", given me by an enemy. I therefore considered the SfAM statement on biological weapons in this light. Is it not possible that a humane (relatively) form of biological warfare could be developed? While I remain emotionally opposed to the idea of biological weapons I feel uneasy about the proposed inclusion of the statement to bind members. Consider, for example, the difficulty of a similar statement for the Institute of Mechanical Engineers or the Royal Institute of Chemistry. Should all biologists reject the idea of Nobel prizes since they are funded from weapon technology?

I consider that, well-meant though it is, the statement should not be included as a requirement for membership of our Society.

Geographically challenged

FROM: Paul A Gibbs
SUBJECT: Who moved Lisbon?

As a long term Member of SfAM, and interested in most things the Society does, I noted that the report of the International Symposium on Waterborne Pathogens (March issue) by Palwinder Kaur, states that Lisbon is in Spain! As frequent visitor to Portugal, I think its inhabitants might be rather annoyed that their capital city is misplaced. Where did Palwinder fly to I wonder?
Keep up the high standards of the scientific reporting, but please check the geography!

[Sorry about that, we must have used an 11th Century map! - Ed]

Double standards?

FROM: A J W Gonzales
SUBJECT: Sfam statement on Biological Warfare [*Microbiologist* March 2003]

Whilst I applaud the good intentions conveyed by the Society's proposed new statement on Biological warfare, I am surprised that no one has considered the double standards implicit in it should it be adopted as a condition of membership and the possible implications that it may have for international members. If you doubt me, consider that although the United States renounced the "development, production and stockpiling" of biological weapons by signing the Biological Weapons Convention in 1972, the US military has recently begun to revive investment in biological weapons research and development. In 1981, the US Army's Biological Defense Research budget was a mere $15 million. Under the Bush senior Administration, this increased to $80 million in 1991. In the wake of the Iraq conflict, President Bush proposed a massive budget increase of $2.9 billion to build new laboratories for "counter-terrorism research and development" most of which will focus on bio-terrorism. At the same time the US has progressively undermined international efforts to abolish biological weapons. In November 2001, at the Fifth Review Conference of the BWC in Geneva, the US rejected a verification protocol for legally binding international inspections and investigations of all parties.

By their very nature biological weapons are "dual use" - that is, offensive capabilities are produced in the process of testing or creating defensive measures against biological agents. Currently as many as twenty laboratories in the United States handle and manipulate one of the most lethal strains of anthrax. A recent genetic analysis published in Science concluded decisively that one of these labs was the source of the anthrax spores used in the September 2001 US mail attacks.

Recent disclosures by the New York Times of three previously classified bio-weapons projects, including the production of a genetically engineered anthrax strain resistant to all existing vaccines and the development of a model bio-weapons delivery system, raise serious questions about the defensive intentions of the United States and by implication this country. Where America leads - we tend to follow - as recent events have all too clearly demonstrated.

In the light of this I do not believe that the statement put forward by the Society should be a condition of membership in its present form.

Playing God?

FROM: Simon B Groves
SUBJECT: "Playing God?" [*Microbiologist* March 2003]

It's no surprise to me that Craig Venter's work has prompted suggestions that he's a mad scientist playing God. These opinions are unlikely to be allayed by his statement that he will ensure his living organism lacks the specific genes it needs to infect people or to live outside the laboratory. If it is unacceptable for Venter to create life, presumably it's equally unacceptable for him to destroy it? But what does playing God actually mean? Surely, we've been playing God for ages? Childhood vaccinations, intensive care and birth control make the decision of who should live and who should die. Would we have it any other way? We need to get beyond emotive arguments against research into important biological issues. Isn't the accusation of "playing God" simply an unscientific appeal used to stifle debate about new technologies? We need to think clearly about the attempt to create a microorganism with a minimal genome and should welcome Venter's research. It's long overdue.

Answers to the March Microbreak

Organism A ***E. coli* O26**. Typical reactions of an *E. coli* but serotype O26 can be urea +ve.

Organism B ***Salmonella typhi*.** *S. typhi* differs from other serotypes in that they are citrate -ve, ornithine -ve and anaerogenic.

Organism C ***E. coli*.** Typical *E. coli*.

Organism D ***Shigella flexneri* 6 (Newcastle).** Newcastle A+G, indole -ve, mannitol -ve.

Organism E ***Shigella flexneri*.** Flexner (serotypes) 1-5 are anaerogenic, mannitol +ve, indole variable.

Organism F ***Salmonella paratyphi* A.** Differs from other *Salmonella* in that they are lysine and citrate -ve.

Organism G ***Salmonella* sp.** Typical *Salmonella* reactions.

Organism H ***Shigella sonnei*.** Typical reactions.

Organism I ***Plesiomonas shigelloides*.** Anaerogenic, mannitol -ve, lysine +ve, ornithine +ve, ONPG +ve, indole +ve.

Organism J ***Shigella dysenteriae* (serotypes 3-12).** Anaerogenic, mannitol -ve, indole -ve.

Organism K ***Shigella dysenteriae* type 1.** Anaerogenic, mannitol -ve, ONPG +ve

Organism L ***Citrobacter freundii*.** Typical reaction, differs from *Klebsiella* by ornithine and lysine reactions

Organism M ***Salmonella pullorum*.** Tend to have typical *Salmonella* reactions but can be citrate negative.

Thank you to all entrants of the microbreak biochemical reactions challenge. The winning entry was provided by **Phil Voysey** who receives a £30 book token for his efforts. Well done.

Double Trouble

A new type of quiz this time to tax your grey-matter. Unscramble the words to reveal the Genus name of a bacterium and write the name in the box provided. Then take the **ringed letters** and unscramble them to reveal the **hidden word**. All correct entries received in the Society Office by 25th July will again be stuffed into the editor's lab-coat pocket and the winning entry drawn by an independent referee. Answers will appear in the September issue of ***Microbiologist***. Once again, a **£30 book token** is up for grabs - so get unscrambling!

LANLAOLESM

HISHEACIECR

BAPCOMYRCELTA

BIVIRO

NUPSOODAESM

RPNOAMEET

NONAHOMTAXS

GELOOAOZ

RIBHOIMUZ

NAESISREI

MAEXOALRL

SKBELLEILA

NIIWEAR

EUROSPT

COCLAPYCHOSTUS

RIISUMTODLC

BAIPIMCEOIRNURPOT

HECDOBORATR

MOLPSAYCAM

RTIIEALS

The hidden word is:

A £30 book token is waiting for the person whose entry is drawn from the editor's lab-coat pocket first! The closing date for entries is **Friday 25 July 2003**. The answers will appear in the next issue of the ***Microbiologist***.

Name: _____

Address: _____

Simply photocopy this page and send it to: 'Microbiologist Double Trouble Quiz',
Society for Applied Microbiology,
The Blore Tower, The Harpur Centre, Bedford MK40 1TQ, UK.

Remember, you could win a £30 Book Token!

New Members

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

Eire

Ms M E Cannon

France

Mr A Blackwell

Serbia

Mr N Djurkovic

South Africa

Mr H I Atagana

Sweden

Dr S Englund

United Kingdom

Mr J A Anderson;
Dr M Anyim;
Miss R Compton;
Miss A Corbett;
Mr A Elgerbi;
Mr C R Harrington;
Miss T A Okubanjo;
Dr R K Simpson;
Ms A E Storey;

U S A

Dr P Bodnaruk; Ms J Hill;
Dr B Stewart-Brown

UK Corporate

Campden & Chorleywood Food Research Association (CCFRA)

Europe Corporate

Chr. Hansen

the **President's Column**

Dr Peter Silley examines the problem of antibiotic resistance and considers the ecological impact of antimicrobial use

IN OCTOBER 2000 a small group of experts met in France under the auspices of the "Maurice Rapin Institute" to consider the issues surrounding the ecological impact of antibiotics. Clinical Microbiology and Infection published the outcome of their deliberations as a special supplement (7th Maurice Rapin Colloquium) in which the experts commented on the broad consensus that has emerged over the last decade which recognizes that the future of antibiotic treatment will depend on the evolution of resistance, not only of pathogens targeted by therapy, but also and possibly mainly, amongst the commensal flora. The evaluation of the ecological impact of antimicrobial use must consider the emergence and spread of resistance strains and genes and modifications in the distribution of the human commensal flora as well as the environmental flora.

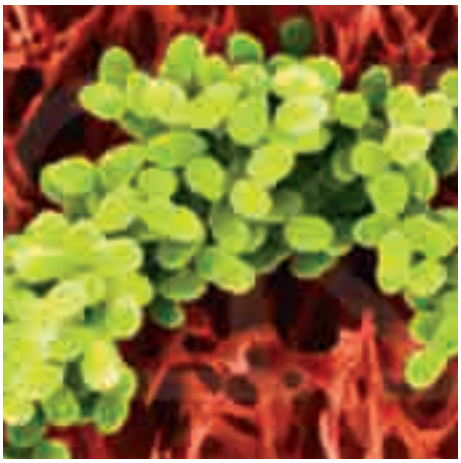
Whilst these are issues that are now being considered of great importance within the development of antimicrobials for human use they have long been considered of relevance in veterinary medicine. Indeed it has for many years been fundamental to the safety dossier for veterinary antibiotics that sponsors submit data on the impact of antimicrobial residues on human gut flora. The rationale has simply been that tissues of animals treated with antibiotics may contain residues which could be ingested through the food supply. Data thus needed to be submitted to the Regulatory Authorities which determined an acceptable daily intake (ADI) which would have no deleterious effect on the human intestinal flora. It is clear that specific microbiological tools are needed for such assessments and whilst there is at present no consensus on the type of studies that best relate to predicting impact on public health these issues are being vigorously debated most notably by the VICH.

One of the outcomes of the 7th Maurice Rapin Colloquium was that in themselves *in vitro* bacteriological assays and animal models were considered insufficient to explore the overall ecologic impact of antibiotics, although it was accepted that such studies could provide invaluable information. I would support that hypothesis and through work in my own laboratories over the last ten years we have generated significant data using a range of in vitro models with numerous antimicrobial compounds.

The selection of resistant bacteria is a complex phenomenon that depends on the microorganism, the specific characteristics of the molecule under investigation and the drug concentrations available to the target bacteria. Andremont *et al* (2001)[1] emphasized that no definitive information can be drawn from the knowledge accumulated on older molecules within the same class of antibiotics implying that a whole new data set must be generated for each new antibiotic under investigation even if it is a member of a well studied class. Data generated in our laboratories also emphasizes the need to ensure that model systems mimic as closely as possible the type of drug delivery encountered in man thus making use of pharmacokinetic/pharmacodynamic parameters. Ideally studies examining the ecological impact of antibiotics should be comparative and take into consideration dose response studies.

The normal human microflora is a stable ecosystem under normal circumstances, where the microorganisms are relatively constant although interpersonal variations exist. The ecological system can be disturbed due to changes in diet, radiation, surgery or administration of antimicrobial agents.

Opportunistic infections may then occur, especially in immunocompromised patients. Several factors have an influence on the extent to which an antimicrobial agent will affect the normal microflora. The incomplete absorption of orally administered agents will disturb the flora. Parenterally and orally administered antimicrobial agents, which are excreted in the salivary glands, the bile, the intestinal mucosa or the sweat glands, may also alter the normal microflora. Emergence of antimicrobial resistance among bacteria in the normal flora, and dissemination of resistance genes by naturally occurring transfer of DNA in these dense microbial communities can contribute to an increased load of resistant and potentially pathogenic microorganisms. A second effect is the reduction of colonization resistance, permitting potentially pathogenic microorganisms to cause infection as well as overgrowth of already present microorganisms such as yeasts, enterobacteria, enterococci and *Clostridium difficile*. It is not always possible to predict the pharmacodynamic effect of antibiotics on the normal microflora based on *in vitro* activity data of the agent. For example, vancomycin, a

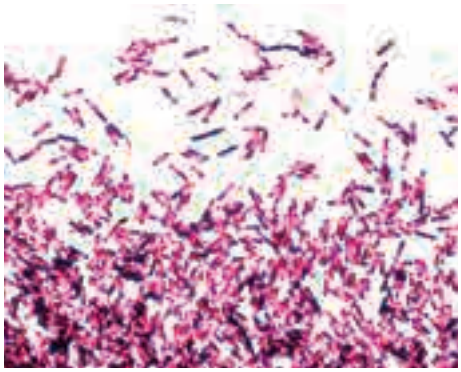


strict Gram-positive agent, has in separate studies been shown to significantly suppress or eliminate the number of intestinal *Bacteroides* of healthy volunteers. Another example is that clinafloxacin, a fluoroquinolone with a similar antibacterial spectrum as moxifloxacin, has been shown to strongly reduce the number of intestinal *Bacteroides*, a finding that was not recorded for moxifloxacin. Careful investigations of the effect of antimicrobial administration on the normal microflora are therefore important. Many studies have been published concerning the ecologic impact on the human microflora by antimicrobial agents.

The pharmacokinetic properties of an antimicrobial agent are crucial to the extent that the drug will affect the normal microflora. However, the extent of ecologic disturbances in the normal microflora cannot always be predicted from pharmacokinetic data. The concentrations in oral tissues may not only be dependent on serum concentrations and the level of secretions via salivary glands, but also on local concentrations following intake of active drugs. Orally administered drugs with incomplete absorption may reach the colon in high concentrations, but parenterally administered agents may also reach significant levels in the gut via biliary or mucosal secretions. Inactivation of the drug by inhibitory enzymes, eg β-lactamases, produced by bacteria in the normal flora, or binding of the agent to bacterial or intestinal contents, may significantly reduce the availability of active drug. Furthermore, it has recently been shown that many antimicrobial drugs are excreted in sweat glands that may lead to emergence of resistance in the skin microflora.

It is beyond refute that antibiotic resistance poses a serious threat. In 1992, the CDC estimated that as many as 23,300 hospital patients died of antibiotic-resistant infections in the US.[2] Since then, the number of antibiotic-resistant infections and associated deaths has risen every year. A major risk factor is the volume of antibiotic use. The more antibiotics that are used, the more they select for resistance. When resistance develops with well-reasoned antibiotic therapy, it is regrettable. When it happens because of inappropriate or excessive use of antibiotics, it represents the waste of a precious resource. Whilst the use of veterinary antimicrobials has come in for much criticism in recent years one of the most inappropriate uses of antibiotics has been for viral upper respiratory infections. There are an estimated 100 million antibiotic prescriptions outside hospitals in the US each year, of which nearly 50 million are for colds, the flu, bronchitis, middle ear infections, and other illnesses usually due to viruses.[2]

As microbiologists we must become involved in the public debate surrounding such issues as antibiotic use. Sixty years ago, society received the "miracle" of



antibiotics. Today, however, we are painfully aware of increasing levels of reduced in vitro efficacy in part because of overuse of this precious resource. Microbiologists must continue searching for new antibiotics, alongside finding better ways to conserve those active compounds available to us.

Peter Silley

References:

- 1 Andremont A, *et al.* (2001) *Clin Microbiol Infect* 7 Suppl 5: 1-6
- 2 Levy S B, (1998) *Sci Am*, 278: 46-53.

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JAM & LAM seek new home

We have received offers from two members donating a full set of JAM and LAM (dating from 1982 and 1984) free to a good home or institution. Please contact Julie Wright at the Society office for more details.

Dr Chris Collins receives MA

The University of Canterbury has conferred upon Dr Chris Collins the degree of Master of Arts for his work and thesis on Chlorera and the sanitary revolution in nineteenth-century England. Of particular note is the fact that Dr Collins submitted the thesis to the university on his 83rd birthday. Dr Collins is an Honorary Member who joined the Society in 1963.

Could YOU benefit?

Did you know that the Society has many generous grants and prizes available to members? To find out if you are eligible and could benefit visit the website at:

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Last Post

The more observant of our members will have realised that the regular review of BSI and ISO standards so faithfully compiled by David Post is no longer a feature in *Microbiologist*. Those of you who wish to keep abreast of BSI updates will be able to access the BSI information from the link from our new SfAM website.

On behalf of the Society I want to thank David for his diligence in providing copy in this area going back a good number of years and for his continued support of the Society. David will not, however, be disappearing from the scene. As Society Archivist he has an important role to play and as well as his ongoing archivist work David will be providing articles for future issues of *Microbiologist*. You can read his article on the development of the early Society newsletter to the current *Microbiologist* on the opposite page (11).

Thanks once again David.

Peter Silley

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Winning Caption!

"Unexplained glee on failure of 'Viagra Biodegradation' research project"

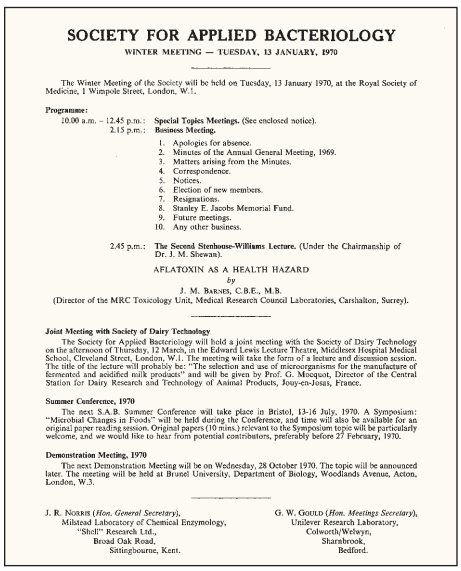
Thanks to all of you who submitted an entry for the caption competition published in the March issue. Many were unfit to print but raised a smile in the editorial office nevertheless! The winning caption was provided by **Dr Martin Cockcroft** of Q-One Biotech Ltd who receives a bottle of champagne with our compliments.

From N to M

The story of the Society news

David Post traces the efforts of the Society to keep its members informed of its affairs and news over the years

BEFORE WE ALL TAKE the high standard of *Microbiologist* for granted I think it might be interesting to review how far the Society has travelled in its efforts to keep members informed of its affairs and other news. The first printed notices we have in the archives date from 1970 and on a single sheet of white paper give details of the winter meeting, advance notice of the forthcoming Summer Conference to be held at Bristol, and the Autumn Demonstration Meeting scheduled for 28th October at Brunel University. There is also one other item of news, an announcement of a joint meeting with The Society of Dairy Technology but no trace of the more general news that is now a feature.



SOCIETY FOR APPLIED BACTERIOLOGY

WINTER MEETING — TUESDAY, 13 JANUARY, 1970

The Winter Meeting of the Society will be held on Tuesday, 13 January 1970, at the Royal Society of Medicine, 1 Wimpole Street, London, W.1.

Programme:

10.00 a.m. – 12.45 p.m.: **Special Topics Meetings.** (See enclosed notice).

2.15 p.m.: **Business Meeting.**

1. Apologies for absence.
2. Minutes of the Annual General Meeting, 1969.
3. Matters arising from the Minutes.
4. Correspondence.
5. Notices.
6. Election of new members.
7. Resignations.
8. Stanley E. Jacobs Memorial Fund.
9. Future meetings.
10. Any other business.

2.45 p.m.: **The Second Stenhouse-Williams Lecture.** (Under the Chairmanship of Dr. J. M. Shewan).

AFLATOXIN AS A HEALTH HAZARD

by

J. M. Barnes, C.B.E., M.B.

(Director of the MRC Toxicology Unit, Medical Research Council Laboratories, Carshalton, Surrey).

Joint Meeting with Society of Dairy Technology

The Society for Applied Bacteriology will hold a joint meeting with the Society of Dairy Technology on the afternoon of Thursday, 12 March, in the Edward Lewis Lecture Theatre, Middlesex Hospital Medical School, Cleveland Street, London, W.1. The meeting will take the form of a lecture and discussion session. The title of the lecture will probably be: "The selection and use of microorganisms for the manufacture of fermented and acidified milk products" and will be given by Prof. G. Mocquot, Director of the Central Station for Dairy Research and Technology of Animal Products, Jouy-en-Josas, France.

Summer Conference, 1970

The next S.A.B. Summer Conference will take place in Bristol, 13-16 July, 1970. A Symposium: "Microbial Changes in Foods" will be held during the Conference, and time will also be available for an original paper reading session. Original papers (10 mins.) relevant to the Symposium topic will be particularly welcome, and we would like to hear from potential contributors, preferably before 27 February, 1970.

Demonstration Meeting, 1970

The next Demonstration Meeting will be on Wednesday, 28 October 1970. The topic will be announced later. The meeting will be held at Brunel University, Department of Biology, Woodlands Avenue, Acton, London, W.3.

J. R. Norris (*Hon. General Secretary*), Milstead Laboratory of Chemical Enzymology, "Shell" Research Ltd., Broad Oak Road, Sittingbourne, Kent.

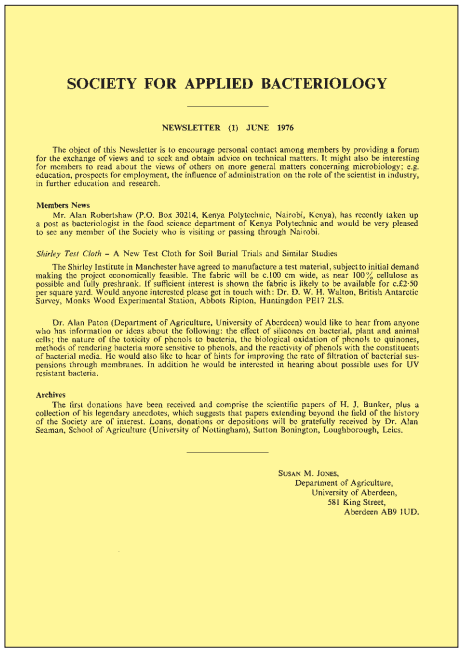
G. W. Gould (*Hon. Meetings Secretary*), Unilever Research Laboratory, Colworth/Welwyn, Sharnbrook, Bedford.

By January 1972 the notices had expanded almost imperceptibly to actually carry the title *"Notices"* and in addition to the notification of future meetings an invitation was issued to student's organisations to apply for affiliated membership of the Society for Applied Bacteriology; presumably an early attempt to encourage student participation that is now such an important part of Society activities.

Spring 1973 saw the title of the news sheet extended to *"General Notices"*, I imagine in recognition that items for publication were expanding beyond just details of meetings. In a further development of student involvement the first invitation to them to apply for a grant to assist attendance at the Summer Conference made its appearance. The first item not directly related to the Society was published in this issue, notification of a food microbiology course to be held at the University of Surrey. This continued to be an important event for many years. Further development of the general notices saw an increase in their number, so much so that they required their own piece of paper separate from the notification of future meetings; members were mailed a two-page document held together by a staple which constituted a considerable advance in presentation!

The December 1975 issue carried an announcement of the intention to form a collection of archives and called for a

volunteer Archivist. It was announced that *SAB Newsletter* number 1 would accompany the next *General Notices*. By this time the notices included a lengthy list of meetings to be held by other microbiology societies as well as the usual details of forthcoming SAB activities. *Newsletter* 1 duly appeared in June 1976, printed on a half sheet of yellow foolscap.



SOCIETY FOR APPLIED BACTERIOLOGY

NEWSLETTER (1) JUNE 1976

The object of this Newsletter is to encourage personal contact among members by providing a forum for the exchange of views and to seek and obtain advice on technical matters. It might also be interesting for members to read about the views of others on more general matters concerning microbiology; e.g. education, prospects for employment, the influence of administration on the role of the scientist in industry, in further education and research.

Members News

Mr. Alan Robertshaw (P.O. Box 30214, Kenya Polytechnic, Nairobi, Kenya), has recently taken up a post as bacteriologist in the food science department of Kenya Polytechnic and would be very pleased to see any member of the Society who is visiting or passing through Nairobi.

Shirley Test Cloth – A New Test Cloth for Soil Burial Trials and Similar Studies

The Shirley Institute in Manchester have agreed to manufacture a test material, subject to initial demand making the project economically feasible. The fabric will be c.100 cm wide, as near 100% cellulose as possible and fully preshrunk. If sufficient interest is shown the fabric is likely to be available for c.£2·50 per square yard. Would anyone interested please get in touch with: Dr. D. W. H. Walton, British Antarctic Survey, Monks Wood Experimental Station, Abbots Ripton, Huntingdon PE17 2LS.

Dr. Alan Paton (Department of Agriculture, University of Aberdeen) would like to hear from anyone who has information or ideas about the following: the effect of siloxnes on bacterial, plant and animal cells; the nature of the toxicity of phenols to bacteria, the biological oxidation of phenols to quinones, methods of rendering bacteria more sensitive to phenols, and the reactivity of phenols with the constituents of bacterial media. He would also like to hear of hints for improving the rate of filtration of bacterial suspensions through membranes. In addition he would be interested in hearing about possible uses for UV resistant bacteria.

Archives

The first donations have been received and comprise the scientific papers of H. J. Bunker, plus a collection of his legendary anecdotes, which suggests that papers extending beyond the field of the history of the Society are of interest. Loans, donations or depositions will be gratefully received by Dr. Alan Seaman, School of Agriculture (University of Nottingham), Sutton Bonington, Loughborough, Leics.

Susan M. Jones,
Department of Agriculture,
University of Aberdeen,
581 King Street,
Aberdeen AB9 1UD.

This was apparently the first use of colour in paperwork sent to members. Dr. Susan Jones wrote about the object of the Newsletter, it being the intention to encourage personal contact amongst members by providing a forum for exchange of views and to seek and obtain advice on technical matters. This first Newsletter contained the news that the first donation for the archives had been received by Dr. Alan Seaman who had answered the call for an Archivist.

Newsletter number 2 was published with the *General Notices* in September 1976, the size increased to a complete foolscap sheet. It contained an announcement about the formation of a Cosmetics and Pharmaceutical sub-group of the SAB, presumably a forerunner of the interest groups which are now such an important part of the Society. Amongst a list of useful references on laboratory safety is the report of the Committee of Enquiry into the Smallpox Outbreak in London in March and April 1973. In keeping with the aims of the *Newsletter* it contained a plea from a Mr. Sharkey of Ireland for a second-hand Hirst spore trap. I wonder whether he ever got one?

Unfortunately no *Newsletter* appeared in March of the following year or with any subsequent issue of *General Notices*. Could it be that the aims of the *Newsletter* could not be sustained because of a lack of contributions, a situation all too familiar to editors? During 1977 and 1978 *General Notices* continued on an uninterrupted basis with a gradually increasing number of entries. Minor changes in page size and print style were tried until, by 1982, old-fashioned foolscap had been superseded and all subsequent issues were printed in black on white A4.

During the period 1982 to 1993 when *General Notices* reverted to an integral part of notices about meetings the most noticeable development was in the gradual rise in the number of pages and the occasional use of improved paper quality and print style. However, the Society was continuing to develop in other important respects and in June 1982 the appointment of an Administrative Secretary was announced. At this time biotechnology was becoming a major issue and the *Notices* drew attention to publication of a number of reports on the subject.

November 1993 saw an enormous and eye-catching leap in the presentation of general information to members made possible by the increased facilities which came with the acquisition of the Bedford office and through the enthusiasm of the Executive Secretary, Dr. Ann Baillie. The Society news with the title *"Notices and News"* had transformed into one with a semi-gloss Royal Blue cover (who cared that the ink came off and left one with blue fingers!) illustrated with black and white photographs and with a profusion of news accompanied by black and white photographs of SAB personalities. Each subsequent issue came with further improvements in presentation.

Another title change was made, to *SAB Notices and News*. Paper quality improved making possible superior reproduction of black and white photographs. Sections printed on coloured papers made it easier to browse

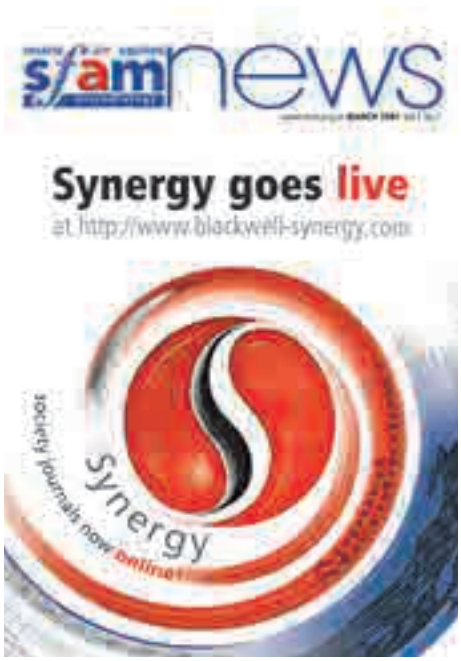
the contents. Most noticeably, the increasing use of coloured photographs meant that the covers became more and more attractive. The content expanded and became more varied when the Society's present Designers (Pollard Creativity) took over the preparation of the artwork from Dr Baillie in March 1997 and the June 1997 issue carried an eight-page supplement on the Autumn Meeting.

A particularly important contribution by Dr. Jack Hopton, my predecessor as Archivist, traced the development of the Society and noted with pleasure the change in name of the *Journal of Applied Bacteriology* to *The Journal of Applied Microbiology*.

Closely following the name change for the Journal came the name change of the Society in June 1997. The last issue of *Notices and News* of the Society for Applied Bacteriology appeared in June 1997 and reverted to the title of *Newsletter* thus restoring the name of the first publication in 1976 which had attempted to widen the scope of information available to members.

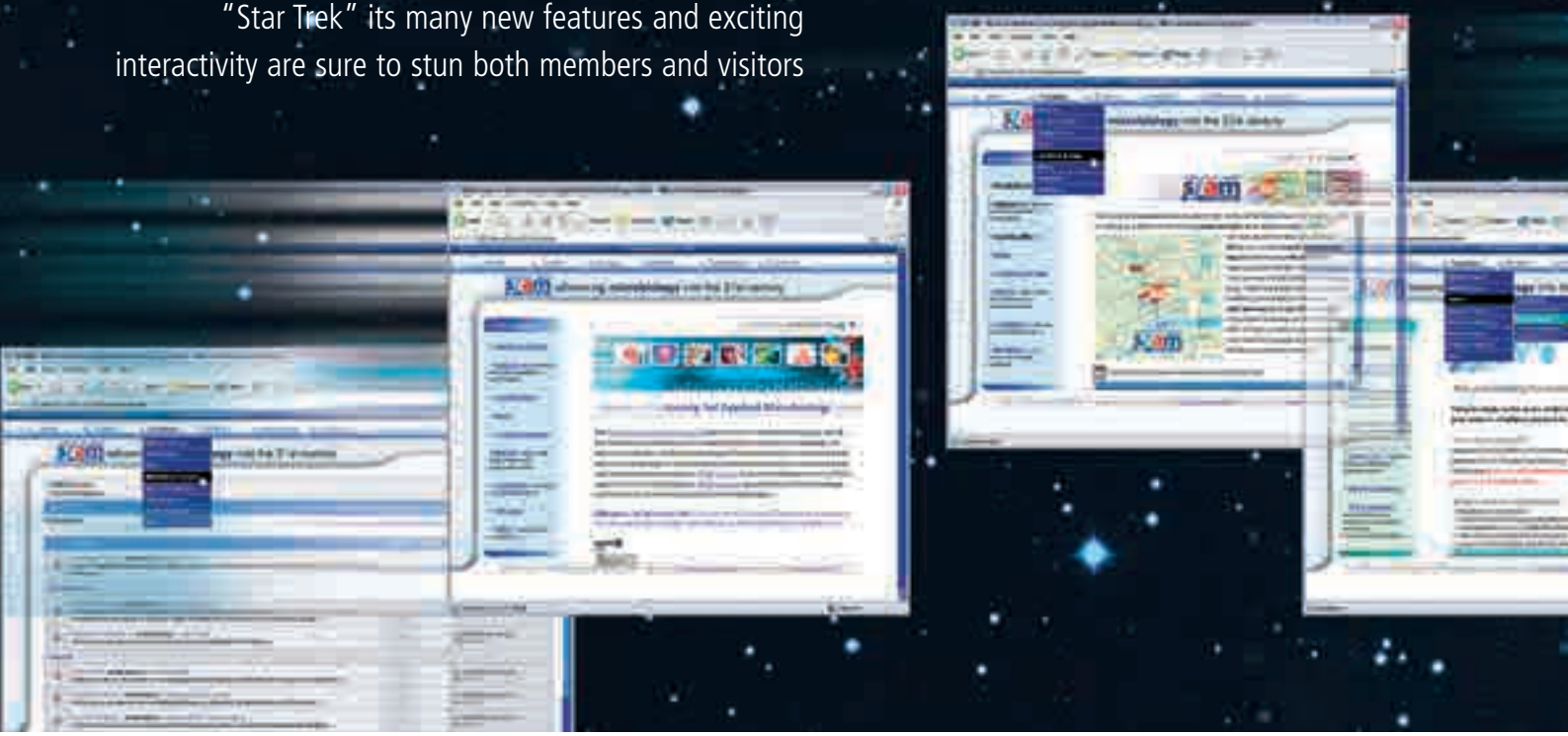
By September 1997 the Society had changed its name and the *SfAM Newsletter* was published for the first time. One further title change occurred, to *SfAM News*, in March 2000 and with the quality continuing with each issue this title remained until *Microbiologist* was born in December 2002 The rest, as they say, is already history.

David Post
Society Archivist



To boldly go...

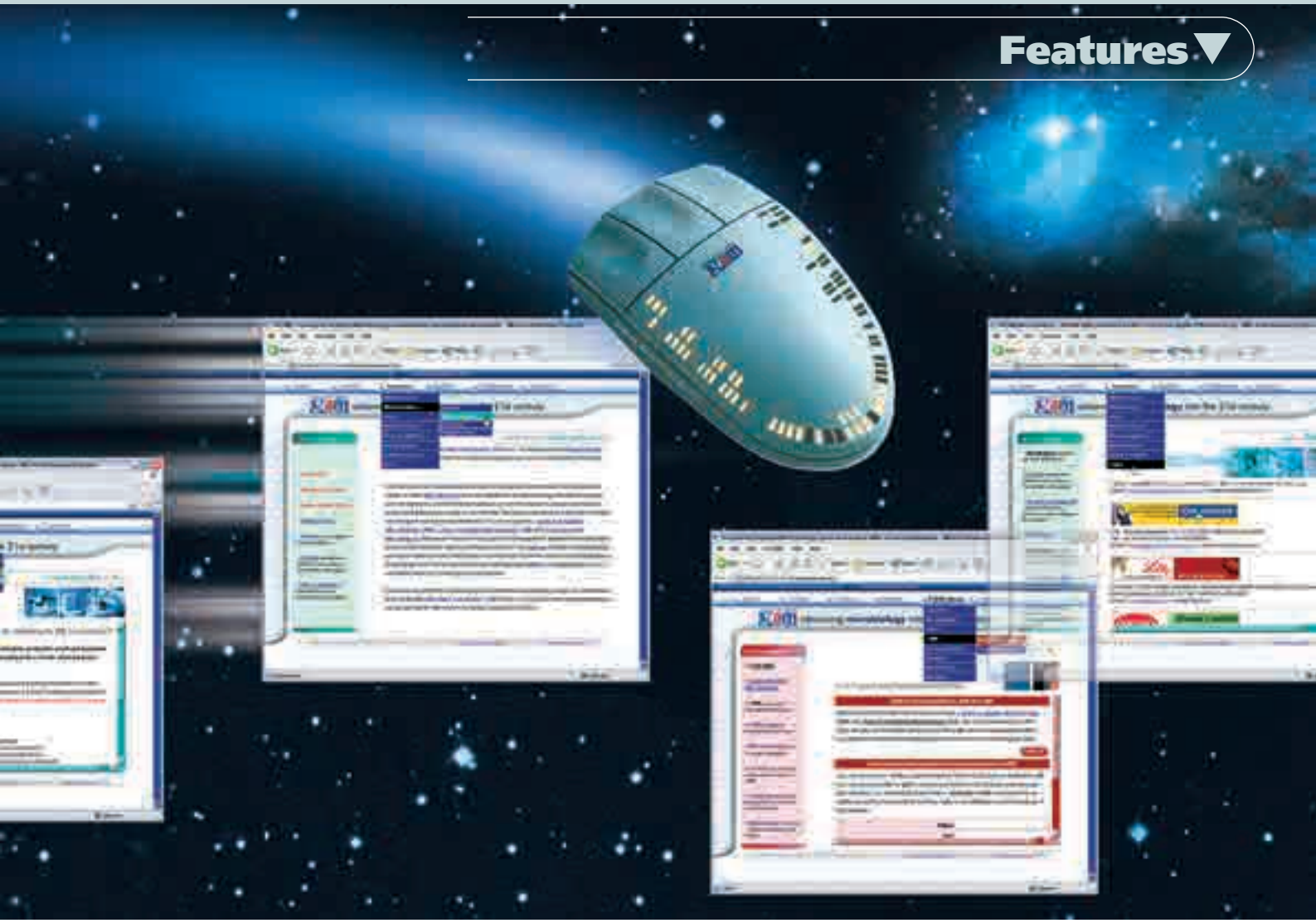
Anthony Hilton reviews the Society's new **website** and finds that although it may not be as futuristic as "Star Trek" its many new features and exciting interactivity are sure to stun both members and visitors



THE SOCIETY'S NEW WEBSITE should be live by the time you read this. Those who are familiar with the old site are in for a few surprises; those who have never "surfed" before are strongly encouraged to do so. There is something for everyone on the new site including a brand new "members only" area.

So what's new? Well, firstly, let's look at what you won't see on the new site. The old home page with its links to articles, reports and topical news has gone. As has the unwieldy navigation panel which made it difficult to get to information easily or quickly. In their place there is a brand new homepage and a powerful drop-down site-wide navigation menu that gives one-click access to any page on the site no matter what page you're on. This menu is divided into six main sections: **'Home'** - which links back to the homepage, an easy to read site map and a really useful online Help page, **'Society'**, **'Services'**, **'Students'**, **'Publications'** and **'Contact Us'**. Within each of these six sections there are further drop-down links which take the visitor directly to specific pages such as *'Committee'*, *'Meetings'*, *'Feature Articles'*, *Blackwell's Synergy*, the *Journals* and much more. One thing that should pleasantly surprise those of you still using older dial-up modems is how much more quickly the new pages load. Which is no small feat given the sheer amount of information and interactivity built into the new website. For those of you who are interested in statistics the new site contains 243 web pages, over 400 images and 1,200 links! One of the biggest changes is the creation of what I am told is called an *'Admin back-end'* in webmaster jargon. Although this does not directly affect visitors it will allow Society administrators to control much of the content of the website from their desktops merely by logging into a

The new homepage ■



secure area. Journal editors, for instance, can now add forthcoming titles to the publications pages of the site without having to go through the Society Office or the webmaster. Our membership co-ordinator, Julie Wright will also be able to see at a glance who has not paid their subscription and send then an automated email reminder - so you have been warned!

Warp drive

Those of you who have been with us for many years will probably want to forget the Society's very first venture into cyberspace. Our first website and was built in 1996 on behalf of the Society by Blackwell Science and contained a few very simple brochure pages describing the Society and its aims and objectives. Members could do little more than read and read and read... That changed in 1999 when the website was completely re-built and put under the Society's direct control. Now members could book their place at meetings and visitors could at last apply for membership online. But late in 2002 it became clear to Committee that the website had to do a lot more if it was to meet the needs of the membership in the new century. The mere provision of static content and the inability for members to do much more than download various forms was clearly not the cutting edge of what was possible. After careful planning and lengthy consultation with our enthusiastic Creative Communications partner - Pollard Creativity, we began construction of a fully interactive, database-driven website in December 2002. For the first time in the Society's 72 year history it is possible for members to interact with one another in real time from anywhere in the world simply by logging into the new Member's Forum. In addition, we now have a secure online Membership database which will greatly reduce the amount of time currently spent administering the needs of our growing

The About us page ■

The administration area ■

Powerful new features for members!

- Pay your membership subscription online
- Book and pay for meetings by credit or debit card
- Apply for and advertise job vacancies
- Create your own CV and upload it for prospective employers
- Advertise your services or skills on a new "Microbiological Consultancy" List
- Apply online for all Society Grants, Awards and Prizes
- Join our discussion forums to network with colleagues from around the world.
- Read the titles of forthcoming papers before they are published in the Journals.
- Search for titles published in LAM and JAM before 1980.
- Access the new online manuscript submission service which allows Authors to submit their work directly to the journals.
- Apply to review books for *Microbiologist* and read the latest book reviews online.

worldwide membership. Designated Committee members can access these records at any time, from any location to pull out data which will be invaluable in improving the services we offer to our members.

Ten forward!

As I said earlier, the biggest change visitors will notice are the many new 'Members only' areas, most of which are accessed from the new **'Services'** and **'Students'** sections. A particularly important new feature is the ability for members to update their interests and membership details online which will provide a growing database for meetings organisers to better meet the needs of the membership. In addition, members can also pay their subscriptions and book and pay for meetings online. Our web designers have arranged matters so anyone can view the new "Members only" content but only members can log in to the private areas with a username and password, thus protecting valuable information but still allowing casual visitors to learn about the many benefits the website has to offer. Check out the panel on the left to see what members can do that they couldn't do before.

These new benefits (which are mostly FREE) are a major step forward for the Society and provide a level of service to the membership which I am sure other Societies can only envy!

Explore new worlds

The members areas are only one aspect of the new website. The public pages of the site have all been re-created from scratch to provide visitors and members alike with comprehensive and detailed information on every aspect of the Society and its activities. Each page has a side panel which gives instant access to related pages and related information and there are innumerable links scattered across most pages which allow visitors to click straight to additional resources without the need to hunt them up in the site menu. Indeed, I don't think that I have ever come across a website which is easier to use than this! One of the nicest new features is the Members online Help page. Not only is it divided into sensible sections for easy scrolling, it really does answer every question that occurred to me as well as several that didn't. The same goes for the new contact page (accessible from any web page) which provides simple and clear information on contacting the Society and Society staff. There is also a new feedback form which allows visitors to ask specific questions and make suggestions. The online application forms for joining the Society or applying for grants and awards are extremely well laid out and easy to use. The only drawback is that those

Jobseekers page and (right) using online help ■

members who wish to pay their subscriptions by Direct Debit or cheque must download and print out an Adobe Acrobat PDF application form. Unfortunately it is simply not practical to add online Direct Debit or cheque payments at this time. The Links page has been completely overhauled to provide a wide-ranging resource for microbiologists seeking information on the World Wide Web and includes a very attractive series of discreet web banners for our corporate members with detailed contact information for each one. Committee was especially pleased with the pages devoted to the journals, to Synergy and to *Microbiologist* (Publications section on the menu). Not only is there far more content than was available on the old site, but it is extremely easy to get to. The copious help for Blackwell's Synergy will be particularly useful for new members who choose to receive our online journals and the guidelines for author's online submission are most welcome.

Engage!

So what of the future? The dynamic structure of the new site means it will be possible to add new functionality and new features in line with the developing needs of the Society and the membership without having to re-build the entire website. Some of the additional features which are planned include a site-wide search function, online payment by Direct Debit or Cheque, online submission of articles to Microbiologist, more resources for students and an online "gift shop" selling small items like pens, tee-shirts, calendars, scarves and mugs. Later we hope to add live webcasts of speakers at Society meetings and even interactive online virtual meetings. There really is no limit to what could be provided in the future as information technology delivers ever more sophisticated and powerful means of interactivity and communication. What is important is that the website continues to meet our needs and to that end I welcome your comments and suggestions!

Finally, I would like to express my personal thanks and that of Committee to our dedicated design company, Pollard Creativity and their programmers - Freetimers Internet. Both these organisations have worked extremely hard to deliver a website of which we can all be justly proud and which I am sure will exceed your expectations.

The new website is an ambitious project for the Society and I hope that this preview has given both members and visitors alike a foretaste of the tremendous new opportunities it opens up for us all - happy exploring!

Anthony Hilton
Honorary Editor

Further information:

- Website design and construction: Pollard Creativity.
www.pollardcreativity.com
E: sfam@pollardcreativity.com
- Website dynamic programming and database construction: Freetimers Internet.
www.freetimers.com
E: enquiries@freetimers.com

■ Searching for titles in Lam and Jam

What is SARS

Emma Hilton reviews the ongoing SARS epidemic

> "The terror of the unknown is seldom better displayed than by the response of a population to the appearance of an epidemic, particularly when the epidemic strikes without apparent cause"
>
> ***Edward Kass 1977***[1]

SEVERE ACUTE RESPIRATORY syndrome (SARS), an atypical pneumonia of unknown aetiology, has been described as the first global epidemic of the 21st century. The unknown killer bug has swept through parts of East Asia, South-East Asia, North America and has even reached parts of Europe, infecting around 5000 people and killing 321 (WHO statistics, 28th April[6]). In Britain, six suspected cases of SARS have been reported, but all have recovered, whereas in Canada 148 cases have been identified resulting in 18 deaths.

SARS is a respiratory illness with a typical incubation period of 2-7 days and an onset not unlike other common wintertime respiratory viral infections. Typical onset consists of a fever (>38°C), which may be accompanied with other symptoms including chills, headache, malaise, and respiratory symptoms including cough, shortness of breath or breathing difficulties. Unlike other acute-acquired typical or atypical pneumonia, this disease does not respond to empirical antimicrobial treatment.

The pathogenic cause of SARS is thought to be viral spreading with patterns suggestive of droplet transmission or direct or indirect contact transmission. The SARS outbreak is unusual in several ways, not least by the appearance of clusters of patients with pneumonia who are health care workers or family contacts[3]. On March 17th, an international multi-centre project was established to expedite identification of the causative agent of SARS. The most recent and significant development in isolating the SARS pathogen came when Peiris and colleagues[3] examined the case notes and microbiological findings of 50 patients aged 23-74 years with the disease; these cases represented more than five separate epidemiologically linked transmission clusters. The Hong Kong scientists isolated and characterised a coronavirus not previously identified in humans or animals from two of the 50 cases. Coronaviruses are enveloped RNA viruses, and a known cause of the common cold in humans. By use of serological and reverse-transcriptase PCR specific for the coronavirus, 45 out of 50 patients with SARS, but no control patients, had evidence of infection. The Centers for Disease Control and Prevention (CDC) has now sequenced the genome for the coronavirus believed to be responsible for the global epidemic SARS.

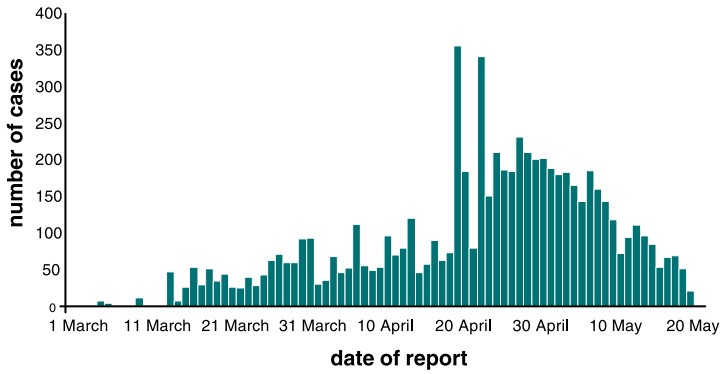
Peiris and colleagues[3] also commented on the noteworthy clinical characteristics of SARS that help distinguish it from other winter infections. Firstly the upper respiratory symptoms and positive ausculatory findings were mild in comparison with the accompanying chest radiographic changes. Secondly, the presence of lymphopenia, leucopenia, thrombocytopenia, and elevated liver enzymes and creatinine kinase may also raise the suspicion of clinicians to SARS. Gastrointestinal symptoms were present in 10% of patients tested and thus the possibility of viral RNA in the faeces, and a faeces-oral route of transmission cannot be ruled out. Early therapy with intravenous ribavirin and high-dose glucocorticosteroids has been suggested as beneficial, however this is still to be fully confirmed.

While this represents a significant development in identifying the causative agent of SARS, other viruses may be involved potentially acting as opportunistic secondary invaders and contributing to disease progression. Previous other laboratory investigations have identified human metapneumovirus[4], *Chlamydia* spp[5], and researchers at laboratories in Germany and Hong Kong have also detected particles of a virus from the Paramyxoviridae family in samples from SARS patients.

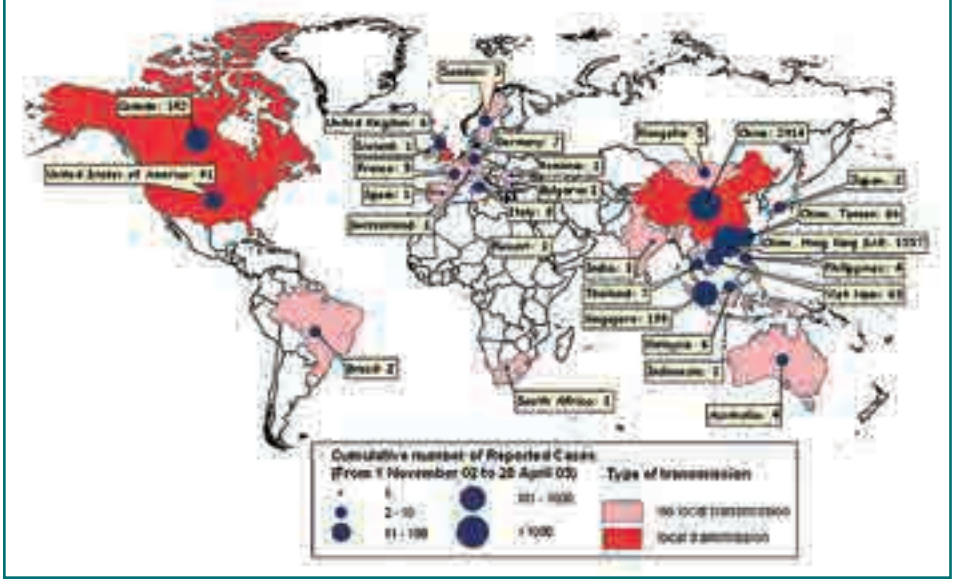
Despite the wide-scale panic it is important to place SARS in context with other killer diseases. In the USA alone 64,664 deaths occurred as a result of influenza in the 1998-1999 season (U.S. CDC), lung cancer claims around 35,000 lives per year in Britain, and, in Africa, over 3,000 children die daily from Malaria[6].

Emma Hilton
Aston University

Probable Worldwide cases of SARS 1st March 20 May 2003
(based on data supplied by the World Health Organisation)



This graph includes all cases from Hong Kong SAR, Macao SAR and Taiwan, China, but only those cases elsewhere in China reported after 3 April 2003. (1,190 cases between 16 November 2002 and 3 April 2003 not shown). Also includes 161 probable cases of SARS which have been discarded and for whom dates of report could not be identified.



SARS FAQ

(frequently asked questions)

■ **What is SARS?** This is the term being used to describe a new serious respiratory illness - Severe Acute Respiratory Syndrome.

■ **What are the symptoms?** High fever, dry cough, shortness of breath, breathing difficulties, changes in chest x-ray indicative of pneumonia.

■ **How is it spread?** SARS has been described as less contagious than influenza with an incubation period of 2-7 days. Close contact to an infected person appears to be the most likely cause for the spread of SARS. So far, the majority of cases have been hospital workers or carers of SARS patients.

■ **What causes SARS?** The main contender for the causative agent of SARS is a new enveloped coronavirus. Coronavirusus are also associated with the common cold.

■ **How many deaths from SARS?** To date, 5050 cases of probable SARS have been identified, and these have resulted in 321 deaths.

References:

■ 1. E.H. Kass. (1977) N. Engl. *J. Med.* 297 pp. 1229-1230.

■ 2. *Centers for Disease Control and Prevention*. March 24, 2003: http://www.cdc.gov/od/oc/media/pressrel/r030324.htm http://www.sciencedirect.com/

■ 3. Peiris J S M., *et al.* (2003) *Lancet* 361: 1319-1325

■ 4. Poutanen S M., *et al.* (2003) *N. Engl. J. Med.* March 31.

■ 5. *Centers for Disease Control and Prevention*. April 4, 2003: http://www.cdc.gov/od/oc/media/transcripts/t030404.htm http://www.sciencedirect.com/

■ 6. World Health Organisation: http://www.who.int/en/

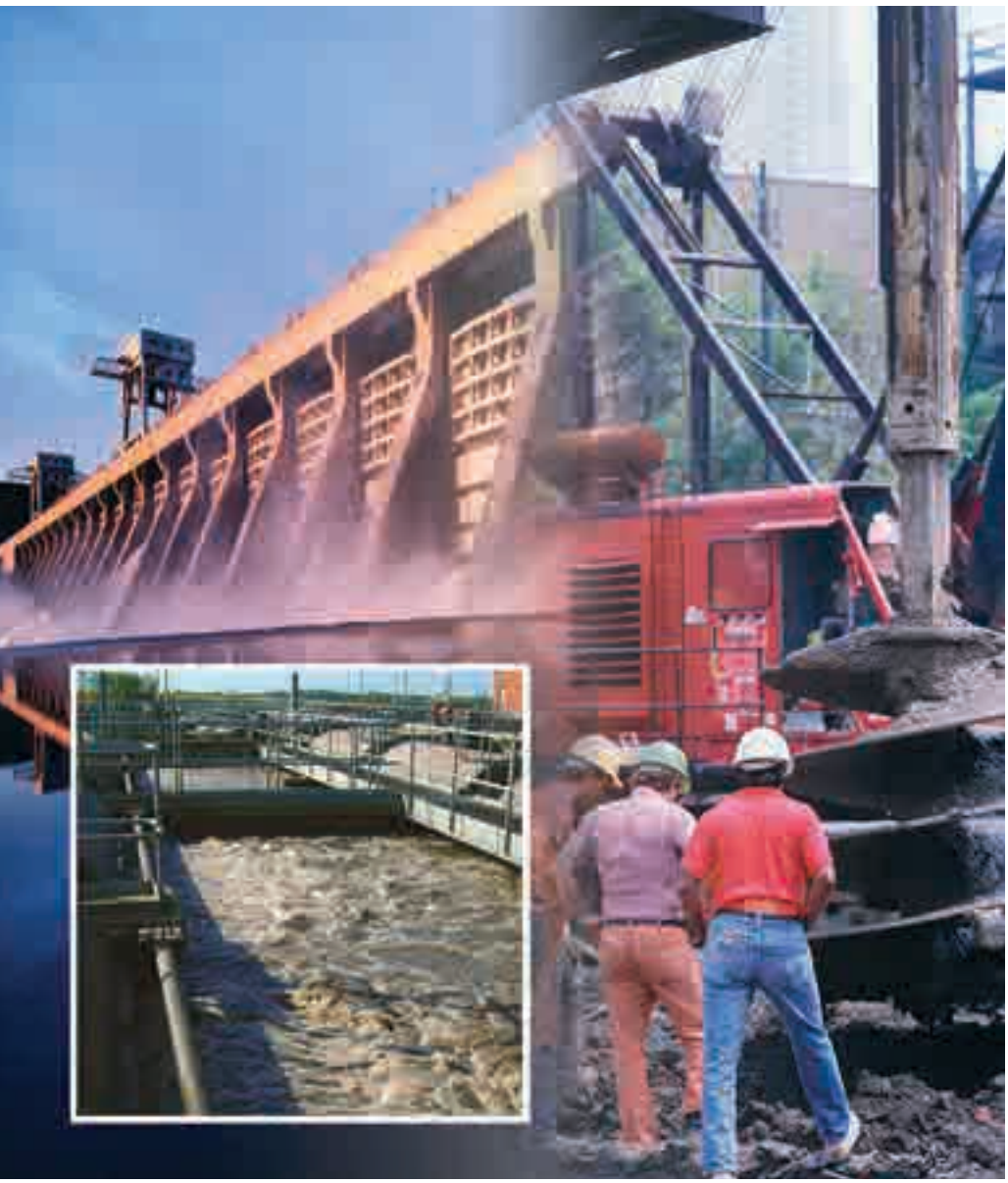
This conference will help microbiologists appreciate the very significant contribution they can make to modern engineering practices

MICROBIOLOGY of ENGINEERED ENVIRONMENTS

Incorporating 2nd International Congress on Microbiology in Civil Engineering

University of Surrey, Guildford, UK ● 14 - 17 July 2003

This Meeting has been awarded CPD accreditation to the value of 2.4 CREDITS



BOOK YOUR PLACE NOW!

There is a Booking form for this meeting on page 23. The last day for registrations is **Friday 13 June 2003. A Late booking fee of £30.00 applies after this date.**

THE 2003 SUMMER CONFERENCE will be held 14th - 17th July, 2003 at the University of Surrey, Guildford. This is intended to present an opportunity for cross-disciplinary dialogue between microbiologists and engineers of all persuasions. Both disciplines have had major impacts on public health and this will form the focus of an opening debate at the first evening mixer. Speakers who have already agreed to give invited papers include international experts covering the whole range of topics, both academics and those actively engaged in engineering projects and processes. The conference will attract a wide-ranging audience demonstrating just how important microbes and their activities can be in almost all engineered environments and help microbiologists appreciate the very significant contribution they can make to modern engineering practices.

Programme

This programme was up to date at the time of publication but may be subject to change. For the very latest information and an online booking form please visit the Society website at www.sfam.org.uk

Monday 14th July 2003

Registration: From 1400 hrs

Evening Debate:

"Modern public health: a result of practical engineering or microbiological science?"

For the Microbes:
Dr John Lee, Head PHLS Water & Environmental Microbiology Research Unit, Central Public Health Laboratory, 61 Colindale Avenue, London NW9 5HT, UK

For the Engineers:
Professor Sandy Cairncross, Professor of Environmental Health, London School of Hygiene and Tropical Medicine, Keppel Street, London WC1E 7HT, UK

Chairman:
Professor Duncan Stewart-Tull, Hon Research Fellow, Brian Laboratory, University of Glasgow, Garscube Estate, Bearsden, Glasgow G61 1GH, Scotland, UK

Tuesday 15th July 2003

Introductory overview

09.00 - 09.40 Biofilms and consortia: central themes in engineered systems.
Hilary Lappin-Scott, Professor of Environmental Microbiology, Department of Biological Sciences, University of Exeter, Exeter, Devon EX4 4PS, UK

Microbiology of Wastes, Landfill and Remediation

09.40 - 10.20 Waste stabilisation ponds: their application in the UK and World-wide
Dr Tom Curtis, School of Civil Engineering and Geosciences, University of Newcastle, Newcastle-upon-Tyne, NE1 7RU, UK

10.20 - 10.50 Coffee and poster session

10.50 - 11.30 Permeable reactive barriers in remediation.
Prof. Robert Kalin, Questor Unit, Department of Civil Engineering, University of Belfast, Belfast, N. Ireland, UK

11.30 - 12.10 Membrane bioreactors for waste and leachate remediation
Simon Judd, Reader in Water Sciences, Cranfield University, Cranfield, Bedfordshire, MK43 0AL, UK

12.10 - 12.50 Offered papers

12.50 - 14.00 Lunch and poster session
(Authors present from 1330 - 1400)

14.00 - 14.45 Natural attenuation and bioremediation of petrolium-contaminated sites: distinguishing fact from fiction
Dr Gordon Lethbridge, HSE Consultancy Group, Shell Global Solutions (UK), Cheshire Innovation Park, P.O.Box 1, Chester, Cheshire, CH1 3SH, UK

14.45 - 15.30 Phytobial remediation: exploitation of modified rhizospheres
James M Lynch, Professor of Biotechnology, School of Biomedical and Life Sciences, University of Surrey, Guildford, Surrey, GU2 7XH, UK & G E Harman, University of Cornell, USA

15.00 - 15.30 Tea and poster session

16.00 - 16.40 Policy and regulatory aspects of soil and groundwater bioremediation
Alwyn Hart, National Groundwater and Contaminated Land Centre, Environmental Agency, Olton Court, 10 Warwick Road, Solihull, West Midlands, B92 7XH, UK

16.40 - 17.20 Microbial metal winning, bacterial mining and reclamation of metals
Martin Hughes, Department of Chemistry, King's College, University of London, The Strand, London WC2R 2LS, UK

Wednesday 16th July 2003

Water and Wastewater Processing

09.00 - 09.45 Biologically stable production and distribution of drinking water
Dr Jan Hofman, Karin Bosklopper and Jan Peter van der Hoek, Amsterdam Water Supply, Condensatorweg 54, 1014 AX Amsterdam, The Netherlands

09.45 - 10.30 Polyaromatic hydrocarbon mobilisation by biofilms in water distribution systems
Dr Matthias Maier and Dr Barry Lloyd, Stadtwerke Karlsruhe, Daxlander Strasse 72, 76127 Karlsruhe, Germany

10.30 - 11.00 Coffee and poster session

11.00 - 11.30 Novel disinfection systems; free radicals to high frequency pulses
Dr David Holt, Research and Development, Thames Water Utilities, Spencer House, Manor Farm Road, Reading, RG2 0HP

11.30 - 12.00 Design and operation of activated sludge plants to optimise biological phosphorus removal
Peter Pearce and Stephen Williams, Thames Water Utilities, Spencer House, Manor Farm Road, Reading, RG2 0JN, UK

12.00 - 13.00 Student oral presentations

Programme

13.00 - 14.00 Lunch and poster session
(Authors present from13.30-1400)

Buildings and the Construction Industries

14.00 - 14.45 *Pseudomonas* and other microbial problems in building water services
Janice Calvert, Oakland Calvert Consultants Ltd, Unit 20, Greenwich Centre Business Park, Norman Road, London, SE10 9QF, UK

14.45 - 15.30 Microbiological problems associated with pre-commission, cleaning and balancing of closed systems on construction sites
Elizabeth Day, 6 Chapel Lane, Westcott RH4 3PJ, UK

15.30 - 16.00 Tea and poster session

1600-1645 Cooling towers: *Legionella* and litigation.
Mark Iddon, Water Management Society, Mill House, Tolson's Mill, Fazeley, Tamworth, Staffs, B78 3QB, UK

16.45 - 17.45 W.H.Pierce Memorial Prize Lecture

17.45 - 18.30 Annual General Meeting of the Society

19.00 - 20.00 Trade Reception

20.00 - Society Conference Dinner

Thursday 17th July 2003

Buildings and the Construction Industries continued

09.00 - 09.45 Wooden constructions: what happens now all the biocides are banned?
Janice Carey, Building Research Establishment, Bucknalls Lane, Garston, Watford, WD25 9XX, UK

09.45 - 10.30 Microbial interactions with structural stone and concrete.
Thomas Warscheid, LBW-Bioconsult, Baumschulenweg 10, 26167 Oldenburg, Germany

10.30 - 11.00 Coffee and poster session

11.00 - 11.40 Microbial problems in tunnels and groundworks
Stefan Jefferis, Geotechnical Consultant Group, Talbot Lodge, Ardley Road, Middleton Stoney, Bicester, Oxfordshire OX25 4AD, UK

11.40 - 12.20 Allergenic fungi in buildings and air-conditioning systems
Dr Malcom D Richardson, Associate Professor of Medical Mycology, Department of Bacteriology & Immunology, University of Helsinki, Haartman Institute, Haartmaninkatu 3 PO Box 21, 00014 Helsinki, Finland

12.20 - 13.00 Toxigenic moulds in built enviroment
Maurice Moss, British Mycological Society, 18 Dagden Road, Guildford, Surrey, GU4 8DD, UK

End of Conference

BOOKING FORM and INVOICE

Summer Conference 14 - 17 July 2003

'Microbiology of Engineered Environments'

Only ONE person per form please. If additional forms are required please photocopy this one

CLOSING DATE FOR REGISTRATIONS

Friday 13 June 2003. A LATE BOOKING FEE of £30.00 will operate after this date. **NO REFUNDS will be given after Friday 13 June 2003**

FEES

	Full Members	Student, Honorary & Retired Members	Student Non-Members	Non - Members
Whole Conference Rate: inclusive of registration fee, coffee breaks, lunch, dinners, Society dinner and accommodation for the entire Conference.	£300.00	£150.00	£300.00	£500.00
Day Rate: 08.30 - 17.00 hrs per day or part thereof - inclusive of registration fee, coffee, lunch and tea)	£75.00	£40.00	£75.00	£150.00

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	£400.00	£120.00

Overnight Accommodation. En-suite room per night inclusive of breakfast and dinner.	
Monday or Tuesday night:	£65.00
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Charges - please tick the applicable box(es)	Mon	Tues	Wed	Thur	Total Amount
☐ **Whole Conference Rate** (This includes accommodation, meals and the Society Dinner for the entire Conference):					£
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Title:_____ **Family Name:**_____ **First Name:**_____

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YOUR PAYMENT

● **For all participants: The Society DOES NOT INVOICE for conference fees. Please treat your completed booking form as an invoice. Cheques must be in £ STERLING ONLY and made payable to 'The Society for Applied Microbiology'. Foreign cheques/ drafts MUST be negotiable for the full amount due. Please note that AMERICAN EXPRESS and DINERS CARDS are NOT ACCEPTED.** However the following credit and debit cards are acceptable: VISA, Mastercard, Eurocard, Delta, Electron, JCB, Maestro and Solo.

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Joint Sfam/SGM One Day Regional Meeting

Transport of Microbes through soils and the environment

September 18, 2003, Lancaster University, UK

The invited papers will be for 30 minutes and offered papers for 15 minutes. Offered papers are open to anyone but we hope that most will be filled by PhD students and postdoctoral researchers. There is a poster sessions which will be viewed during lunch and coffee breaks.

A prize (jointly funded by SFAM and SGM) is available for the best oral presentation by a microbiologist in the early stages of their career.

Outline Programme

- **Introduction and overview**
  Keith Jones
- **Aspects of methodology**
  Prof. Roger Pickup
- **Offered papers**
- **Pathogen transport processes**
  Dr. Sean Tyrrel and Dr. John Quinton
- **Offered papers**
- **Lunch**
- **Transport of *E. coli* O157 through the environment**
  Prof. Ken Killam
- **Offered papers**
- **Summing up and discussion**
  Kirk Semple

Further information

Please contact the organisers: Keith Jones (k.jones@lancaster.ac.uk) or Kirk Semple (k.semple@lancaster.co.uk)

Costs

The cost to participants will be £15 which will cover lunch, coffee breaks and abstract information

sfam January Meeting 2004

society for applied sfam microbiology

Microbial Interactions with Medical Devices: a matter of life & death

7 - 8 January 2004, Venue to be confimed

OVERVIEW

The acquisition of infections from contaminated surfaces is an age-old but increasingly relevant problem. From the home to industry and healthcare, surfaces play a critical role in the transmission of disease and contamination in many environments.

The development and increased use of medical devices has undoubtedly been of great benefit to patient care. However, inappropriate use and care of devices can increase the risk of infection leading to increased mortality, prolonged hospitalisation and increased costs. The causes and prevention of microbial contamination of surfaces involve a wide variety of organisms and strategies.

This meeting will address both the current areas of concern associated with contamination of medical devices and the application of new technologies to prevent and/ or control microbial contamination of surfaces.

The programme will include special sessions on ophthalmic and dental devices, and 'smart' surfaces.

Further information

Further details will be posted on the Society's website as soon as they are available. Meanwhile, if you would like to contribute to this meeting, or require further information, please contact Lynne Boshier at the Society Office - email: lynne@sfam.org.uk.

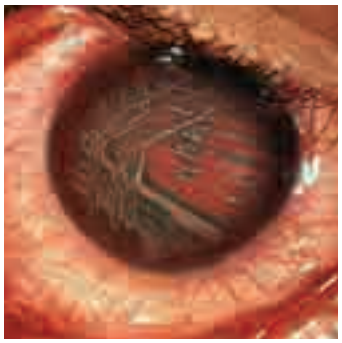
Venue

After the positive feedback following the winter meeting 2003 held in a hotel setting, the 2004 meeting will follow the same format.

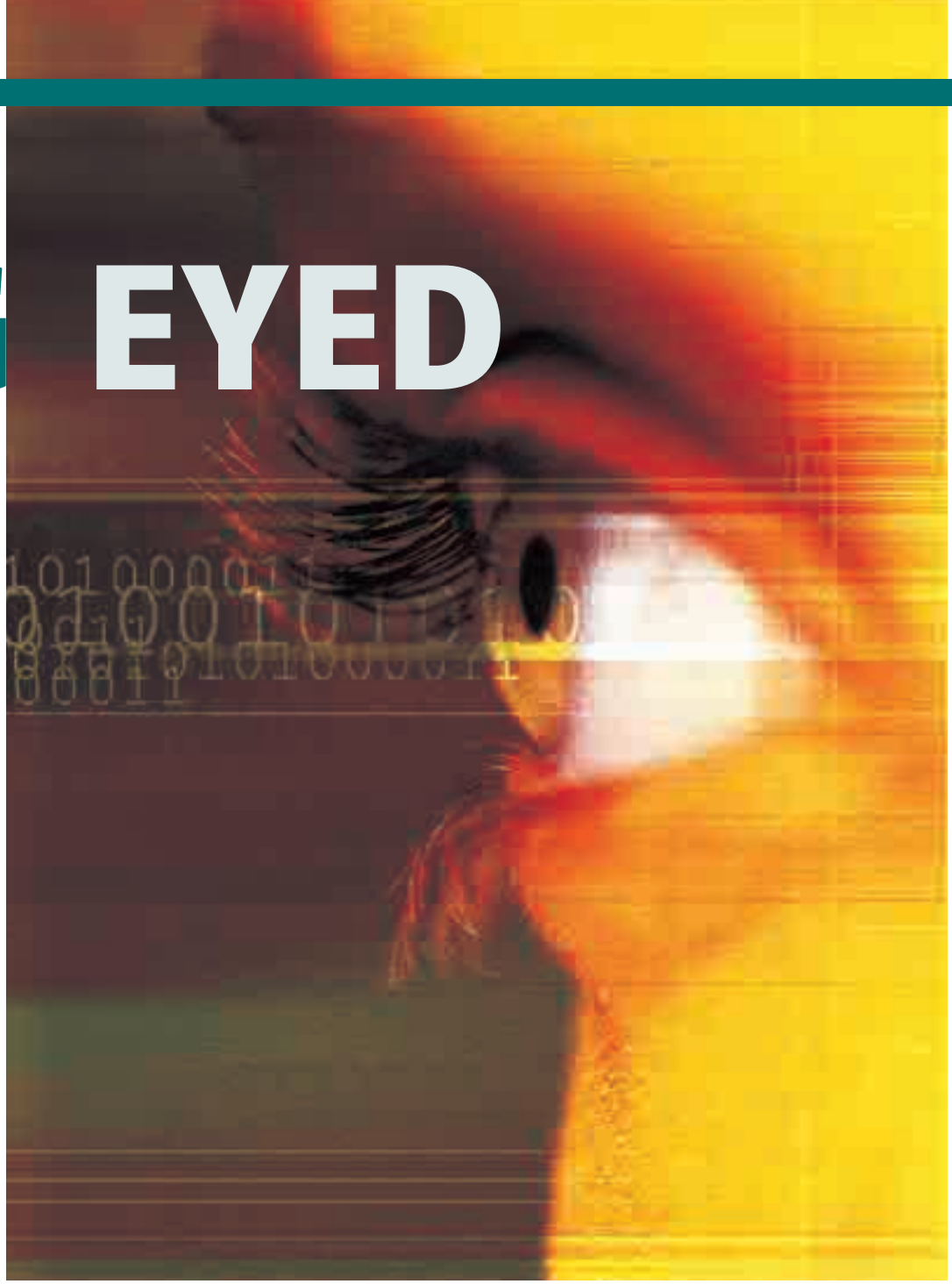
For the latest information please visit us online at:

www.sfam.org.uk

BUG EYED



R A Armstrong reveals the bugs responsible for bacterial eye infections together with their treatment



THE SURFACE OF THE EYE is rich in proteins, carbohydrates, lipids, and electrolytes and consequently, supports a rich commensal flora of microorganisms.

Species commonly present on the surface of the eye include diptheroids, *Moraxella*, *Staphylococcus*, and *Streptococcus*. The presence of a commensal flora, together with the physical action of the lids and the chemical effect of tears, normally prevent colonization by pathogenic bacteria. Nevertheless, infections of the external structures of the eye are common and result from either the acquisition of a particularly virulent microorganism or uncontrolled growth of an existing bacterium due to lowered host resistance. In addition, the globe of the eye is relatively impermeable to microorganisms, but if breached by trauma or surgery, the contents of the eye, such as the aqueous and vitreous, also provide an excellent medium for the growth of bacteria and subsequent infection. Furthermore, an infection within the eye may be 'endogenous', i.e., a consequence of a systemic disease transmitted to the eye via the blood stream or lymphatic system. This article is a brief introduction to the eye infections most commonly caused by bacteria (summarised in the Table on page 29) together with their treatment.

Eye infections caused by bacteria

The eyelids

Infection and subsequent inflammation of the eyelashes, termed blepharitis, and often caused by *Staphylococcus epidermidis*, is one of the most common infections seen by ophthalmologists, a significant proportion of cases being secondary to infection of the meibomian (fat) glands of the lids. Blepharitis can also lead to the development of a 'stye', a localised painful infection of the follicles, or a meibomian gland cyst characterised by inflammation of the lids and accompanied by a white discharge from the glands themselves. Blepharitis caused by *Staphylococcus* may also lead to a chronic inflammation of the outer membranes of the eye, *viz.*, conjunctivitis and keratitis affecting the conjunctiva and cornea respectively. In elderly people, or occasionally in immune depressed patients,

the skin of the lids may become involved in an acute infection called 'erysipelas' caused by species of *Streptococcus* toxic to blood cells.

The conjunctiva

The conjunctiva is the outer membrane of the eye and covers the white fibrous sclera. This membrane is continuous with that of the cornea and also extends on to the upper and lower lids. Infection of this membrane is often exogenous and due to the introduction of a virulent bacterium or the proliferation of an opportunistic species as a result of lowered host resistance. The result is an acute conjunctivitis (Fig 1). Many types of bacteria may be responsible for this condition, the most important being species of *Pneumococcus*, *Streptococcus*, *Staphylococcus*, *Meningococcus*, and *Gonococcus*. In addition, *Haemophilus influenzae*, *Streptococcus pneumoniae*, *Klebsiella pneumoniae*, and *Chlamydia trachomatis* have been identified as pathogens causing conjunctivitis in early infancy ('*ophthalmia neonatorum*' Krohn *et al.*, 1993).

Studies have suggested that these bacteria are often transmitted to the eyes of the new born after birth and are not acquired from the birth canal of the mother. Uncomplicated bacterial conjunctivitis in adults can be treated with a variety of compounds including chloramphenicol and norfloxacin. Conjunctivitis caused by *Chlamydia* can be treated with tetracycline, erythromycin or quinoline derivatives. Generally, however, in the treatment of uncomplicated conjunctivitis, there is little difference in the effectiveness of the commonly used antibacterial agents (Leeming 1999).

The cornea

The cornea is the transparent region of the eye through which light is transmitted to the retina. *Staphylococcus aureus*, *Streptococcus pneumoniae* and Gram-negative coliform bacteria are the most important causes of inflammation of the cornea and of corneal ulceration. Tissue destruction results from a combination of secreted bacterial enzymes, toxins, and host immune reactions with patients using extended wear contact lenses being at particular risk of this type of infection (Fleiszig and Efron 1992). The organism most commonly associated with a corneal ulcer underneath a contact lens is *Pseudomonas aeruginosa* (Fig 2), the virulence of which may be attributable to the formation of a novel exoprotein protease IV (O'Callaghan *et al.*, 1996). Untreated, the cornea may be penetrated, and this can result in a permanent loss of vision in some cases. *Flavobacterium indologenes* (Lu and Chan 1997) and species of Serratia (Parment 1997) are also possible causes of keratitis. In addition, in *Mycobacterium tuberculosis* infection, characteristic nodules may form in the cornea with the development of new blood vessels in the superficial and deeper layers followed by corneal scarring. Bacterial keratitis due to Gram-positive cocci can also occur in children and predisposing factors for this condition include trauma, severe systemic illness, contact lens use, non-inflammatory disorders of the cornea, and previous ocular surgery. Keratitis caused by Gram-positive bacteria is treated with vancomycin and Gram-negative infections with gentamycin. In addition, ciprofloxacin, a broad-spectrum antibiotic, may be used in some circumstances.

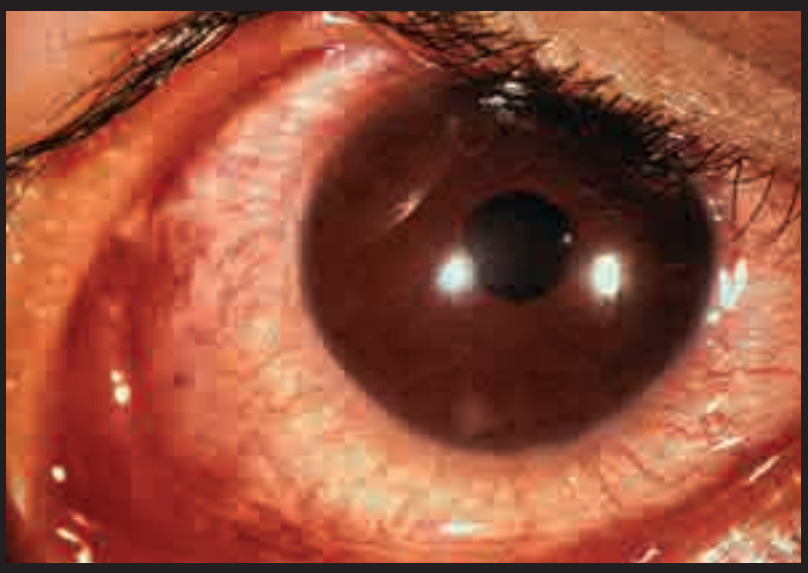


Fig 1. *An acute conjunctivitis caused by bacterial infection. The conjunctiva on the surface of the eye and of the lids is swollen and the eye is red. (Reprinted with permission from Mandell G.L. and Bleck T.P. 1995)*

Anterior segment of the eye

The commonest causes of bacterial infection within the eye are intraocular surgery, penetrating injury, or spread from the blood stream. The anterior segment of the eye contains the aqueous, a substance rich in carbohydrates, sugars, proteins, and inorganic nutrients. Inflammation may affect individual structures within the eye, e.g., iritis (inflammation of the iris), but the reaction rarely remains confined to a single region and often results in a more general inflammation (often termed 'endophthalmitis' if the infection remains contained within the eye). The inflammatory process progresses rapidly and without treatment, a total loss of vision may be the result. In addition, the ocular surface contributes significantly to the transmission of microbes during cataract surgery; the most frequently recovered organisms being *Staphylococcus epidermides* and *Propionibacterium acnes* (Fig 3). Delayed-onset postoperative endophthalmitis can also be caused by species of Actinomyces (Roussel *et al.*, 1991) and *Corynebacterium* (Salvanet-Bouccara *et al.*, 1992). Current therapies for the treatment of intraocular infection are often unsuccessful. Topical antibiotics, given before an operation, may be ineffective at eradicating microbes in the anterior chamber. Hence, whether or not a patient develops an inflammatory disorder after eye surgery may

depend, in part, on the degree of host resistance. Intravitreal vancomycin can be used to treat *Propionobacterium acnes* endophthalmitis. The sensitivity of *Corynebacterium* endophthalmitis to antibiotics, however, varies greatly (Salvanet-Bouccara *et al.*, 1992).

The vitreous body

The vitreous body is the gel-like connective tissue that occupies the posterior segment of the eye. Inflammatory reactions within the vitreous (vitritis) result in liquefaction, opacification, shrinkage, and tissue necrosis. Bacterial infections of the vitreous may progress very rapidly and often result in an abscess. Initially, the vitreous is invaded by neutrophils and eosinophils but later lymphocytes and phagocytes appear and there may be proliferation of fibroblasts encysting the developing abscess. Vitritis may also be a primary manifestation of ocular syphilis in patients who are HIV positive (Kuo *et al.*, 1998).

The optic disc and nerve

The optic nerve leaves the eye at the optic disc ('blind spot') and conveys visual information from the eye to the visual cortex of the brain. The optic nerve can be affected by infections spreading from the eye, orbit, or brain resulting in inflammation of the optic disc (papillitis). Tissue damage elsewhere in the eye results in the release of toxins that diffuse into the optic nerve head causing swelling of the disc and accumulation of lymphocytes around blood vessels. Bacteria such as *Staphylococcus*, *Pneumococcus*, *Meningococcus*, and *Mycobacterium* are often associated with this condition.

The orbit

Acute inflammation of the orbit ('orbital cellulitis') is usually derived from a source of infection in the paranasal sinus, the eye, teeth, or middle ear. A major cause in adults is *Staphylococcus aureus* infection originating in an adjacent sinus. In children, however, the condition may be caused by *Haemophilus influenzae* but the incidence of this bacterium has decreased over the last decade with species of *Streptococcus* now predominating (Donahue and Schwartz 1998). Preorbital cellulitis caused by *Staphylococcus aureus* can be treated with ampicillin.

Conclusions

There have been significant changes in the micro-organisms associated with the eye over the last 20 years, e.g., the incidence of *Staphylococcus aureus* has declined (Huberspitzy *et al.*, 1992) but there has been a resurgence of ocular tuberculosis and syphilis. In addition, contact lens wear has encouraged the development of *Pseudomonas*, *Serratia*, and *Acanthamoeba* infections. Bacteria, not normally associated with the ocular flora, e.g., *Flavobacterium indologenes*, have also been isolated from the eye (Lu and Chan 1997). Hence, continuous monitoring of the ocular flora is an essential part of predicting future eye infections.

Interactions between different microorganisms at the eye surface may be important in determining whether a patient develops a particular infection. For example, a layer of the bacterium *Pseudomonas* in a biofilm on a contact lens may enhance the adsorption of the protozoan *Acanthamoeba* and increase the risk of inflammation of the cornea (Simmons *et al.*, 1998). Hence, basic research into the interactions of microbes at the ocular surface is needed to understand the risk factors that may encourage a particular ocular infection.

A major concern is that bacteria that cause eye infection are acquiring resistance to current antimicrobial therapies. Approximately 75% of ocular *Staphylococcus* species are now resistant to tetracycline; one of the most commonly used preparations. In addition, considerable resistance to antibiotics has been reported in recent years in bacteria causing keratitis. In bacterial isolates from corneal ulcers, 50% of bacteria were resistant to all the common antibiotics with the exception of the fluoroquinolines (Satpathay and Vishalakshi 1995). In addition, *Flavobacterium indologenes* has developed resistance to most antibiotics (Lu and Chan 1997) while *Streptococcus pneumoniae* and some strains of *Pneumococcus* are resistant

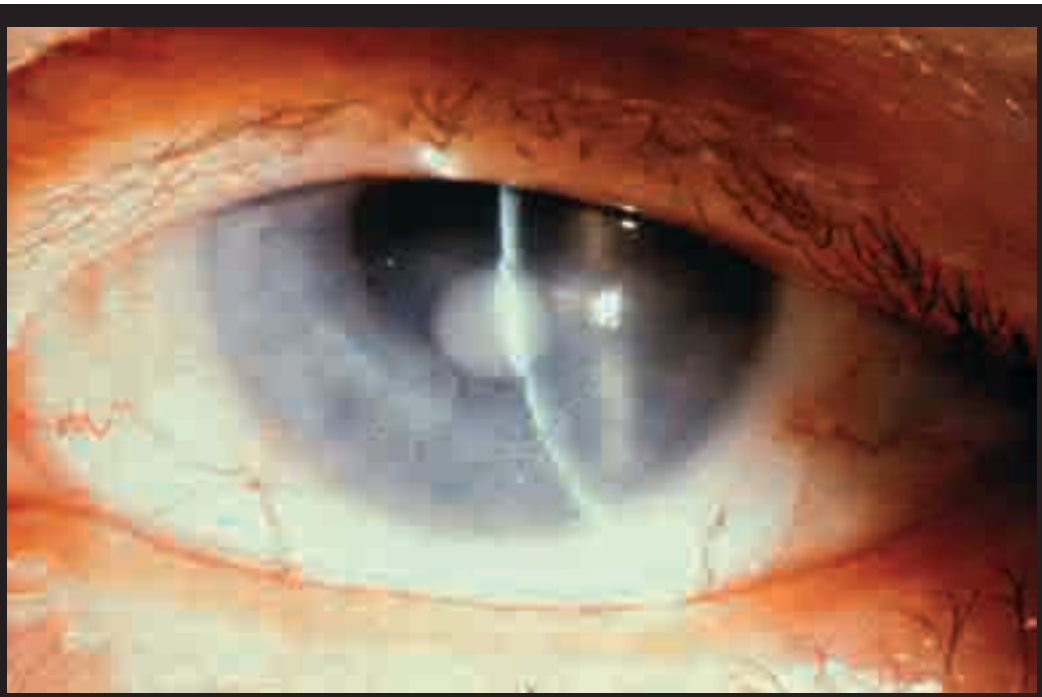


Fig 2. *A bacterial corneal ulcer under a contact lens. The most common organism associated with this condition is Pseudomonas (Reprinted with permission from Mandell G.L. and Bleck T.P. 1995)*

Major eye infections caused by bacteria

Region	Eye Infections
Lids, Lacrimal apparatus	*Staphylococcus blepharitis*, esp. *S. epidermidis*. May develop into a stye or meibomian gland cyst. Syphilis *(Treponema).* Erysipelas caused by haemolytic *Streptococcus*.
Conjuctiva	Acute conjunctivitis caused by *Pneumococcus, Streptococcus, Staphylococcus*, or *Gonoccocus*. Granulomatous inflammation associated with tuberculosis and syphilis. Conjunctivitis in infants caused by *Haemophilus influenzae, Streptococcus pneumoniae, Klebsiella pneumoniae, Neisseria,* or *Chlamydia.*
Cornea	Keratitis and corneal ulceration caused by *Staphylococcus aureus, Streptococcus pneumoniae, Pseudomonas, Mycobacterium, Flavobacterium indologenes,* or *Serratia.*
Uvea	Endophthalmitis caused by *Propionibacterium acnes, Staphylococcus epidermides, Actinomyces* and *Corynebacterium.* Purulent uveitis caused by *Staphylococcus.* Endogenous granulomatous uveitis associated with leprosy and tuberculosis.
Vitreous Retina	Inflammation and abscess formation. Acute septic retinitis. Chronic bacterial retinitis associated with tuberculosis, leprosy, or syphilis.
Optic disc/nerve	Papillitis and optic neuritis caused by *Staphylococcus, Pneumococcus, Meningococcus*, or *Mycobacterium.*
Orbit	Orbital cellulitis caused by *Staphylococcus aureus, Haemophilus influenzae,* or *Streptococcus. Actinomyces* infection.

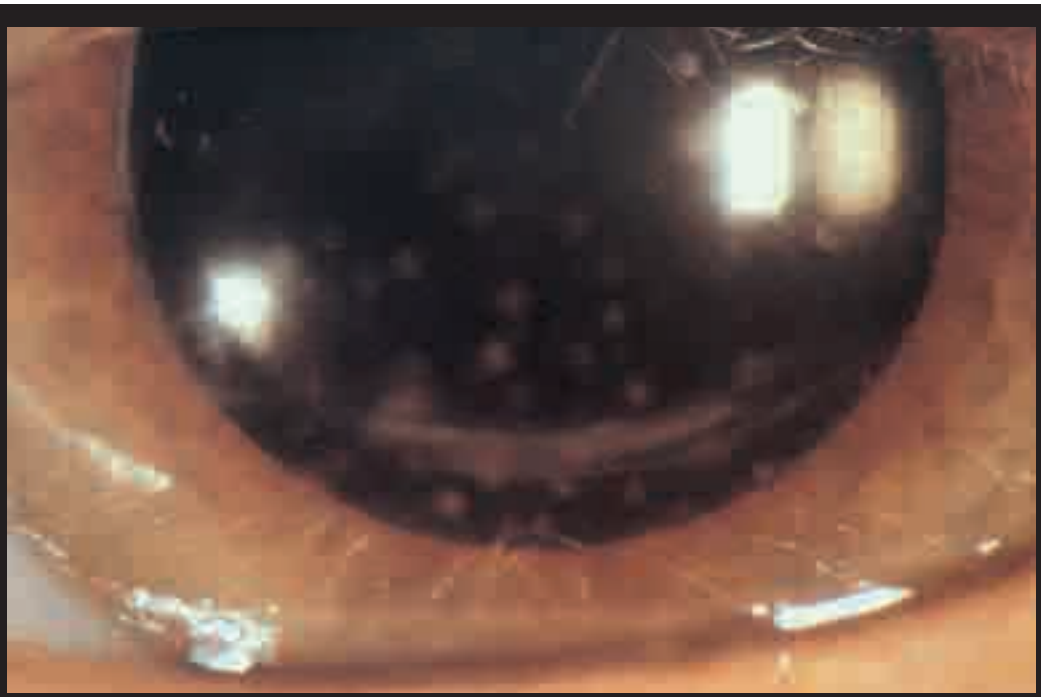


Fig 3. *Inflammation of the anterior segment of the eye associated with cataract surgery and caused by Propionibacterium acnes. The image shows inflammatory deposits on the inner surface of the cornea and a white plaque-like infiltrate associated with the lens implant. (Reprinted with permission from Mandell G.L. and Bleck T.P. 1995)*

to penicillin. Furthermore, approximately one third of *Staphylococcus* strains are resistant to gentamycin. Hence, new antibiotics will be required in future to combat many of the commonest pathogenic agents that cause ocular disease.

R A Armstrong
Vision Sciences
Aston University

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Additional references are available on request. Please contact the Editor.

Anil Deisingh discusses the use of biosensors for the detection of bacteria

Biosensors for microbial detection

THE CENTERS FOR DISEASE CONTROL in the USA has estimated that 76 million people suffer foodborne illnesses annually, with 325 000 being admitted to hospitals of whom more than 5000 die. Furthermore, it has been estimated that the yearly cost of these illnesses is US$ 5-6 billion in direct medical expenses and lost productivity. *Salmonella* infections account for $1billion of these costs. *E. coli* O157 :H7 causes 20 000 illnesses and 500 deaths per year in the USA. In the UK, the Public Health Laboratory Service has indicated that in 2001, there were 85 468 food poisoning notifications which represent a 600% increase from 1982. In the last decade, therefore, increased efforts have been made towards the development of new approaches for the rapid detection of microbes in food and other environments. These include immunological assays, MALDI TOF-MS (see SFAM News, September 2002) and biosensors, among others. In this article, we discuss the use of biosensors for the detection of bacteria and, to a lesser extent, viruses.

A biosensor can be defined as *'a compact analytical device incorporating a biological or biologically-derived sensing element (such as an enzyme, antibody, microbe or DNA) either integrated within or intimately associated with a physicochemical transducer'* (Turner *et al.*, 1987). Upon interaction with a chemical species, the physicochemical properties of the sensing layer (mass, optical properties, resistance etc) change and this is detected by the transducer. The changes are then converted into an electrical signal which is then processed. The transducer may be optical (e.g., optical fibre), electrochemical (e.g., ion- selective electrodes), heat-sensitive (e.g., calorimetric) or piezoelectric (e.g., acoustic wave). The table on page 30 gives further examples of the various transducers. The main parts of a typical biosensor are shown in Figure 1 on the next page. The objective of any biosensor is the production of either discrete or continuous electronic signals which are proportional to a single analyte or a related group of analytes (Turner *et al*, 1987).

There are many advantages associated with the use of biosensor technology as a sensitive detection method. These include:

- Specificity as a result of using biological sensing elements which can distinguish between the analyte under investigation and similar molecule.
- Rapid response times, usually with results being obtained as real-time measurements.
- Simplicity of construction as both transducer and the region for selective chemistry are located on a single platform. This makes it possible to have reagentless measurements and also for on-the-spot analyses
- The ability to provide continuous data with minimal perturbation of the analyte. The biological element can be re-used for different analyses which provides biosensors with a major advantage over immunoassays.

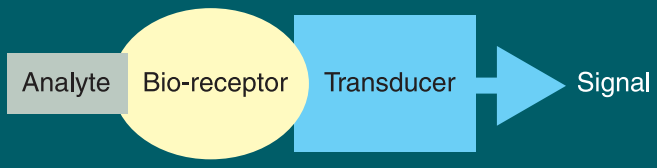
Applications of Biosensors

In general, the discussion will centre around the types of transducers listed in the Table on page 30. Some types, such as electrochemical, optical and piezoelectric, will be given priority as they are having great impact upon the detection of microbes.

Electrochemical

Potentiometric biosensors are usually based on ion-selective electrodes.

Figure 1. The main parts of a typical biosensor



Transducers used in Biosensor development

Category	Principle	Examples
Electrochemical	(a) potentiometric: depends on changes in potential of a system at a constant current (I=0)	Ion-selective electrodes, ion-selective field effect transistors, LAPS
	(b) amperometric: detects changes in current as a function of concentration of electroactive species	Solid electrolyte gas sensors, electronic noses
Optical	Link changes in light intensity to changes in mass or concentration, therefore, fluorescent or colorimetric molecules must be present	Optical fibres, surface plasmon resonance, absorbance luminescence
Piezoelectric	Sensitive to changes in mass, density, viscosity and acoustic coupling phenomena	Surface acoustic wave sensors
Thermal	Detect changes in temperature	Calorimetric sensors

These devices measure the change in ion concentration during a reaction. Generally, a simple sensor consists of an immobilized enzyme membrane surrounding the probe of a pH meter where the catalysed reaction will generate or absorb hydrogen ions. This leads to a change in pH which can be easily read. Three main types of ion-selective electrodes are often used in biosensors: normal glass pH electrodes, glass pH electrodes coated with a selective gas-permeable membrane and solid-state electrodes consisting of a thin membrane of a specific ion conductor. It is also possible to use metal oxide semiconductors (MOS) which can be used to measure charge on a surface which will cause a current flow proportional to the charge. MOS devices are small and so they have fast response times due to reduced diffusion. However, the sensitivity of these can be affected by the ionic strength and concentrations of the solutions being analysed.

Potentiometric biosensors have been widely used for bacterial analyses. Examples include the detection of bacterial contamination in milk using an L-lactate biosensor, bacterial growth and sequence-specific biosensing of DNA. Electrochemical detection of DNA hybridization involves the monitoring of a current under controlled potential conditions. The hybridization is detected via increased current of a redox indicator or by changes in conductivity or capacitance.

In this article, however, we would like to concentrate on the use of light-addressable potentiometric sensors (LAPS) which are proving popular as a platform for detecting microbes. These are semiconductor-based systems with an electrolyte-insulator-semiconductor (EIS) structure. When a current is applied across the EIS region, a depletion layer is formed at the insulator-semiconductor interface. The capacitance of the depletion layer changes with the surface potential which is a function of the ion concentration in the electrolyte. In order to determine the capacitance, the semiconductor is illuminated by modulated light and the current is measured. LAPS have several advantages when compared with other sensors: the surface is flat, there is no need for wires or passivation and they can measure pH and concentration.

Researchers at the USDA have used a LAPS system in combination with an immunoligand assay (ILA) to detect live *E. coli* O157:H7. They have reported that both live and dead bacteria can be detected in 30-45 minutes. In this system, bacteria are captured onto a filter membrane by using specific antibodies. A silicone-based sensor is then placed adjacent to the membrane and, upon illumination, small changes in acidity are detected. The signal is proportional to the number of bacteria present and it was possible to detect 2 000 dead or 25 000 live *E. coli* O157:H7 organisms/ ml (Gehring *et al.*, 1998).

In a recent development, a LAPS approach was used to detect *E. coli* in drinking water (Ercole *et al.*, 2002). An immunoassay was developed such that there was specificity to a particular capsular protein present in the bacterium. The transducer, based on the LAPS principle, was able to detect the production of ammonia by a urease- *E. coli* antibody conjugate. It was claimed that 10 cells /ml were detected in 1.5 hours.

Generally, amperometric biosensors work by enzymatically generating a current between two electrodes. They have fast response times, dynamic ranges and sensitivities similar to potentiometric biosensors. Many amperometric biosensors depend on dissolved oxygen concentration which can pose a major problem. To overcome this situation, mediators are employed. These transfer electrons directly to the electrode thereby eliminating the need for the reduction of an oxygen co-substrate. The most commonly used mediators are the ferrocenes. Amperometric biosensors have been used for the detection of *E. coli* in water (screen-printed electrodes), bacterial vaginosis, studies of bacterial contamination, detection of agents of biological warfare (e.g. anthrax) and detection of *E. coli* heat-labile enterotoxin and other neurotoxins. Amperometric biosensors have also been used to study bacterial luciferase reactions, nanoscale bacterial surface proteins and growth and viability of bacterial populations.

Optical

Optical biosensors are usually based upon optical fibres or surface plasmon resonance (SPR), although it is common to find luminescence, fluorescence and absorbance also being used. Optical fibres are long, thin strands of pure glass

which can transmit light over long distances. Advantages to their use include cheaper cost, thinness, reduced interference by other signals, low power usage, lightness and flexibility. They are ideal as biosensors because they give rapid signals with high specificity for the organism of interest. Reported uses of these biosensors include the detection and quantification of bacteria in meat and poultry e.g. *Salmonella*, *E. coli* and *Listeria*. Many of these are based on the use of antibodies for the specific recognition of the pathogen. By immobilizing several antibodies on different fibre probes, it is possible to detect several bacterial species simultaneously. These are array biosensors which are now widely researched. It is common to obtain results in less than 2 hours, although preparation time may be longer depending on the need for incubation. It is possible to obtain detection limits as low as 100 cfu /ml.

An interesting recent development has been described by Walt's group at Boston University (Epstein *et al*, 2002). They have described the use of a fibre optic biosensor microsphere array which is capable of zeptomole (10^{-21} mol or ~ 600 DNA molecules) detection limits. This method has the potential to provide high-throughput DNA analysis of bacteria with the advantages of small size, flexibility and a detection limit which is two orders of magnitude lower than other reported values.

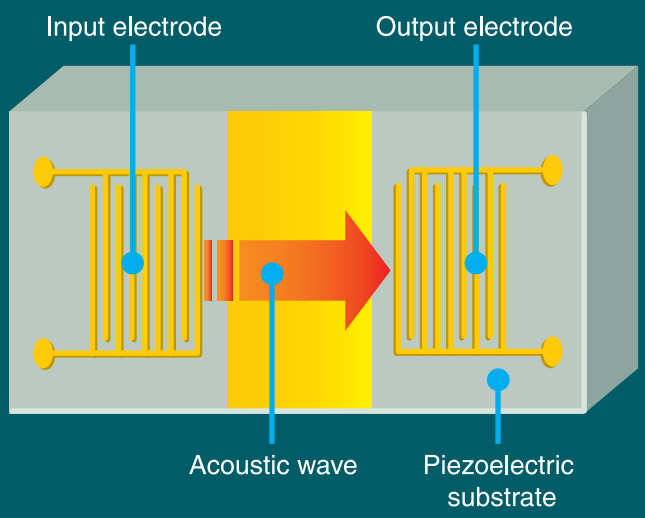
Surface plasmon resonance (SPR) techniques are having a major impact on the development of new optical biosensors. SPR occurs when light is reflected off thin metal films in such a way that a fraction of the light incident at a defined angle can interact with the delocalised electrons in the metal film (plasmon). This leads to a decrease in the light intensity. The change in the SPR signal is directly proportional to the immobilized mass on the metal film. SPR can measure, in real-time, the interactions of biomolecules with interfaces as a result of changes in the refractive index. A commercially available immunosensor SPR system is the *BIACore* apparatus which was jointly developed by Professor Lundstrom of Linkoping, Sweden and Pharmacia Corporation. This is now used in some academic and industrial laboratories.

SPR biosensors have been used for the real-time detection of *E. coli* O157:H7 using antibodies bound to the sensor surface, for detecting bacteria and viruses in the marine environment, classification of polycyclic aromatic hydrocarbon (PAH) toxicity using immobilized luminescent bacteria, determination of denitrifying bacteria in soil and the sequence-specific binding of human immunodeficiency virus type I. These examples show the wide range of analyses which may be performed with SPR technology.

Several configurations of SPR sensors are in development and these include SPR fibre optic probes, SPR planar probe sensors, multichannel sensing devices and combination of SPR sensors with other methods such as anodic stripping voltammetry and critical angle refractometry.

Conventional SPR systems are expensive and large with the result that many laboratories are unable to obtain such specialized equipment. Texas Instruments have developed and commercialized a miniature SPR sensor called the Spreeta™. This costs about US $50 and includes all the required components such as light source, polarizer, prism, sensing area and angle detector in an area of about 2 cm^2. The sensor can measure properties such as refractive index changes, avidin-biotin binding, antibody-antigen dissociation kinetics, specific detection of small molecules, protein binding and attachment of DNA complements. This device may prove very useful in the detection of microbes.

Figure 2. A Typical surface acoustic wave device



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Piezoelectric-based acoustic wave devices

Acoustic wave devices have been commercially used for more than 60 years with the telecommunications industry being the largest consumer, primarily in the mobile phone sphere. These devices are sensitive to changes in mass, density, viscosity and acoustic coupling phenomena. As the acoustic wave propagates through or on the surface of the material, the velocity and /or amplitude of the wave are changed. Changes in the velocity can be monitored by measuring the frequency of the sensor which can then be related to the physical parameter under consideration. Piezoelectric acoustic wave sensors apply an oscillating electric field to create a mechanical wave which can propagate through the substrate and is then re-converted to an electric field to allow for measurement.

Quartz is the most frequently used piezoelectric crystal because it can act as a mass-to-frequency transducer. AT-cut crystals (+ 35° 15´ orientation of the plate with respect to the crystal plane) are favoured because of the excellent temperature coefficients in the range 10 - 50°C. One of the first piezoelectric sensors was the

Figure 3. A quartz crystal containing gold electrodes

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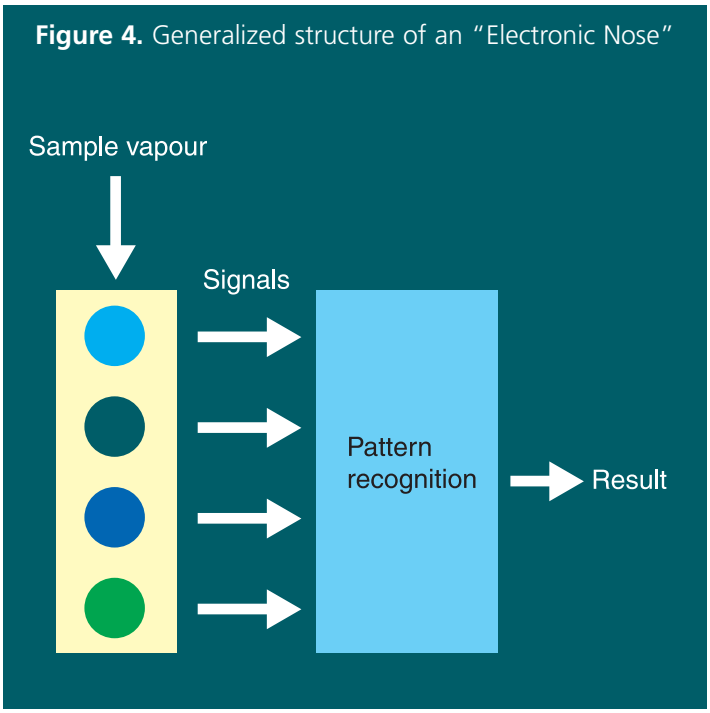
thickness-shear mode (TSM) sensor which, if the substrate is quartz, may commonly be termed the quartz crystal microbalance (QCM) or bulk acoustic wave (BAW) sensor. A typical surface acoustic wave device is shown in Figure 2 while Figure 3 is a representation of a quartz crystal containing gold electrodes. Other piezoelectric substrates include lithium tantalite, lithium niobate, silicon carbide and gallium arsenide.

Several researchers have reported on the use of acoustic wave biosensors to detect microbes. Sequences of *E. coli* O157:H7 have been successfully detected using a PCR-acoustic wave sensor combination (Deisingh & Thompson, 2001). A DNA sequence unique to *E. coli* O157:H7 was amplified by PCR. Immobilization of a probe for the bacterium on the sensor by the biotin-neutravidin interaction was used to detect hybridization of the sequence generated by PCR. This approach can be used to detect the organism in food, water and clinical samples. Pathirana and co-workers (2000) have developed a biosensor for *Salmonella typhimurium* based on the use of a polyclonal antibody immobilized on the surface of a QCM acoustic wave device. The sensor had a detection limit of about 350 ± 150 cells /ml and the response was linear between bacterial concentrations of 10^2 and 10^7 cells/ ml. Cambridge investigators have developed a sensitive detection of the herpes simplex virus type 1 (HSV 1) by using the interaction between the virus and specific antibodies attached to a QCM. The QCM was used to detect the acoustic noise produced when the interactions were broken as the oscillation was increased (Cooper *et al*, 2001). The method, termed rupture event scanning (REVS), is quantitative over at least six orders of magnitude.

Electronic nose

An electronic nose may be defined as 'an instrument which comprises an array of electronic chemical sensors with partial specificity and an appropriate pattern recognition system, capable of recognizing simple or complex odours' (Craven *et al*, 1996). Figure 4 shows the generalized structure of an electronic nose.

Figure 4. Generalized structure of an "Electronic Nose"



Pattern recognition techniques include principal components analysis (PCA), artificial neural network (ANN), discriminant function analysis and fuzzy logic. The sensor array will sense the vapours from a sample and provide a series of measurements; the pattern recognition system will then compare the measurement pattern with known patterns (standards).

The electronic nose provides a low-cost alternative for analyzing volatile organic compounds when compared with GC-MS. Other advantages, when compared with a human nose, include the ability to detect toxic and odourless compounds and the inability to become tired. However, for all its perceived advantages, commercial success has not been easy. This is mainly due to poor reproducibility and stability, calibration problems and difficulty with interpreting the results. There are several examples of the use of electronic noses in microbiological analysis. Many species such as *E. coli*, *Proteus*, *Pseudomonas* and *Staphylococcus* have been correctly identified by neural network techniques. Additionally, *Helicobacter pylori*, implicated in ulcer formation, has been diagnosed by breath tests, as was infection due to tuberculosis by analyzing the odours generated from sputum samples. Further applications include the quality classification of stored grain, freshness of fish, process control of bread and cheese and bacterial growth on meat and vegetables.

Conclusion

Biosensors are making a great impact on the development of rapid, sensitive assays for the detection of microorganisms. Although much success has been achieved in terms of research, commercial development has been slow. Kits are now available for several organisms such as *E. coli* O157:H7 and *Salmonella typhimurium* and it is hoped that more will become available shortly. New developments include integrated systems (see "lab on a chip" article in the March issue of *Microbiologist*), the use of molecular beacons and nanosensor production. These should ensure even more rapid and specific detection.

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Cryptosporidium

Research & *Cryptosporidium:* future challenges

Human cryptosporidiosis has emerged as an important gastrointestinal infection in the 1990s, due to the ingestion of contaminated water and foodstuffs containing the protozoan parasite, *Cryptosporidium parvum*. This pathogen has particular clinical significance for immunocompromised persons, including AIDS patients and cancer patients receiving toxic chemotherapeutic drug regimens. Employment of contaminated water in the production of foodstuffs may represent an important potential source of entry into food processing.

OVER THE LAST 25 YEARS the food industry has been challenged by the emergence of novel foodborne microbiological pathogens such as thermophilic *Campylobacter* spp. in the late 1970s and thereafter and *E.coli* O157 in the 1990s. One of the significant reasons for the emergence of such pathogens has been major improvements in detection systems, primarily in clinical microbiology which have identified such organisms as important human causal agents of gastrointestinal disease. Cryptosporidiosis is the most recent and significant microbiological pathogen to emerge, which has consequently caused concern within the food processing sector. This concern is founded on three parameters, (i) that the causal agent of this infectious disease can be transmitted through contaminated water and food, (ii) that when ingested the causal agent is capable of causing a high degree of morbidity in healthy populations and mortality in vulnerable populations, and (iii) that there is no effective antimicrobial treatment to eradicate this agent from the gastrointestinal tract in symptomatic individuals.

Research into all aspects of the parasite, its lifecycle, detection, epidemiology, etc., is proceeding at an accelerated pace, hastened by several outbreaks, which have been highly reported in the media, including Milwaukee, Sydney, Mullingar and Belfast. Currently there are approximately over 3,000 papers in total in the literature with regard to this organism, whereby approximately 38 new manuscripts are produced globally each month, compared to approximately 46 new papers a month with regard to the bacterial gastrointestinal pathogen, *Campylobacter*, which is the most common cause of acute bacterial gastroenteritis in the developed world. Thus, one can appreciate the attention which this parasite is presently receiving from the research community throughout the world. Nevertheless, there are still several anomalies that are associated with this organism, with particular reference to food and water safety.

Do all species within the *Crytosporidium* genus pose a threat to food safety?

Cryptosporidium parvum, an oocyst-forming apicomplexan protozoan, is an obligate intracellular parasite that infects the microvillus border of the epithelium in the gastrointestinal tract of humans and various animal hosts. To date, the genus, *Cryptosporidium*, consists of at least 10 recognised species. Human infection, however, is predominately caused by *C. parvum* and human illness caused by *Cryptosporidium* has now been reported in more than forty countries in six continents. Not all *Cryptosporidium* parasites have the same potential as gastrointestinal pathogens. Five *Cryptosporidium* parasites, including the *C. parvum* human and bovine genotypes, *C. meleagridis*, *C. felis*, and *C. canis*, are the most common causes of human cryptosporidiosis. Others such as *C. muris*, *C. andersoni*, a cervine genotype and a pig genotype, have been found in a few human cases. Thus far, only the human and bovine genotypes of *C. parvum* have been identified as the cause of foodborne and waterborne outbreaks, indicating that they are probably more infectious to humans than other *Cryptosporidium* parasites. Within human and bovine genotypes of *C. parvum*, there is different virulence potential for causing human disease. Among nearly 50 subgenotypes of the *C. parvum* human genotype identified so far, only several subgenotypes have wide geographic distributions, and one such subgenotype has been found to be responsible for seven foodborne and waterborne outbreaks in North America and Europe, indicating that certain subgenotypes of the *C. parvum* human genotype are more infectious than other subgenotypes. Likewise, among the 30 subgenotypes of the *C. parvum* bovine genotype identified so far, only one or two have wide geographic distributions and one of these subgenotypes was responsible for two waterborne outbreaks in the U.S. The wide geographic distribution of these *Cryptosporidium* parasites is probably indicative of their biological fitness.

What role can molecular biological techniques play in aiding the epidemiology of the disease?

Recently, molecular tools have been developed to detect and differentiate *Cryptosporidium* parasites at the species, genotype and subgenotype levels. These tools now make it possible to determine the identity of *Cryptosporidium* parasites infecting humans, track the source of contamination in waterborne, foodborne and daycare outbreaks, compare the pathogenicity, infection patterns and disease spectrum among *Cryptosporidium* species/genotypes, characterize the transmission dynamics of *Cryptosporidium* infection in endemic areas, and assess the public health importance and contamination sources of *Cryptosporidium* oocysts in water. Using these molecular tools, several workers have characterized *Cryptosporidium* parasites from different human populations in several geographic areas. Thus far, only the human and bovine genotypes of *C. parvum* have been identified in cryptosporidiosis outbreaks in North America and Europe. In contrast, these two *Cryptosporidium* parasites as well as *C. meleagridis*, *C. felis* and the *Cryptosporidium* dog genotype have been identified in sporadic cases of cryptosporidiosis in both immunocompetent and immunocompromised persons living in the U.S., UK, Portugal, France, Japan, Switzerland, Peru and Kenya. Several cases of *Cryptosporidium* pig and cervine genotypes and *C. muris/C. andersoni* infection in humans have also been identified, suggesting that many *Cryptosporidium* species and genotypes have the potential to infect humans, and that zoonotic infections can play a significant role under certain circumstances. Geographic differences have been observed in the proportion of infections due to zoonotic or anthroponotic parasites, probably due to differences in exposure. Intensity and duration of oocyst shedding tends to be longer for infections with the *C. parvum* human genotype than for those with zoonotic genotypes. After an initial *Cryptosporidium* infection, some children experienced subsequent infections with homologous and heterologous *Cryptosporidium* parasites, often within a year of the first infection. Although many lineages of the *C. parvum* human or bovine genotype are detected in sporadic cases from the same geographic area, only one or two subgenotypes have been found in each foodborne or waterborne outbreak examined. One subgenotype of the *C. parvum* human genotype has been involved in multiple waterborne and foodborne outbreaks in the U.S. and UK, indicating that certain *Cryptosporiodium* parasites may have higher

transmission potential than others. In contrast, many *Cryptosporidium* species and genotyps have been found in water, most of which are probably not human pathogenic. Direct genetic linkage of *Cryptosporidium* oocysts found in water with parasites in affected humans has been made in several waterborne outbreaks. These findings reveal the utility of molecular tools in the differentiation of *Cryptosporidium* parasites and in epidemiologic studies of cryptosporidiosis.

What is the role of foodstuffs in the aetiology of human cryptosporidiosis?

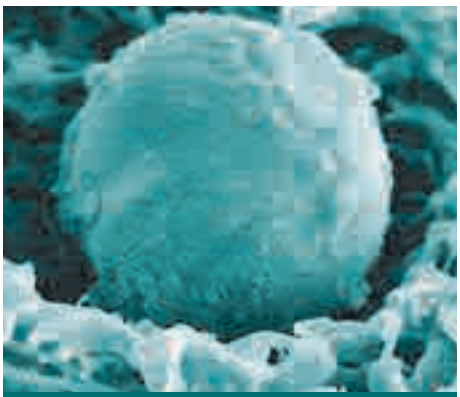
Cryptosporidium oocysts have been isolated from several foodstuffs (see Table below) and these have mainly been associated with fruit, vegetables and shellfish. The association of oocyst contamination of these produce is particularly important from a public health viewpoint, as these products are frequently consumed raw without any thermal processing to inactivate contaminating oocyts. Mollusc filter feeders such as oysters, mussels and clams pose a risk because they can concentrate pathogens which are removed from large volumes of potentially contaminated water. Such waters may be polluted with sewage, industrial and agricultural run-off, and storm run-off water, on a regular basis. In addition, *Cryptosporidium* has been implicated in several cases and outbreaks of human gastrointestinal disease, either by direct isolation of oocyts from the suspected foodstuff or by epidemiological association.

Table: *Cryptosporidium* associations with foodstuffs

Food Type	Country	Comments	Reference
Vegetables	Costa Rica	Cilantro leaves. 5.2% (4/8), Cilantro roots 8.7% (7/80), Lettuce 2.5%, Radish 1.2%, Tomato 1.2%, Cucumber 1.2%	Monge & Arias (1996), Monge & Chinchilla (1996)
	Peru	14.5% of vegetables examined contained *C. parvum* oocysts	Ortega *et al.*, (1997)
	Norway	19/475 (4%) of fruits and vegetables examined positive. 5 Lettuces, 14 Mung beansprouts. Oocyst density low (3 oocysts per 100g food)	Robertson & Gjerde (2001)
Shellfish: Clams	Spain	Dosinia exoleta, Venerupis Freire-Santos pullastra, Venerupis rhomboideus, Venus verrocosa	Freire-Santos *et al.*, (2000)
	Italy	Ruditapes philippinarum	Freire-Santos *et al.*, (2000)
Mussels	Spain	Mytilus galloprovincialis, genotype 2	Gomez-Bautista *et al.*, (2002)
	N. Ireland	Mytilus edulis, genotype 1	Lowery *et al.*, (2001)
	Canada	Zebra mussel (Dreissena ploymorpha), 220g oocysts/g tissue of genotype 1	Graczyk *et al.*, (1999)
	USA	Bent mussel (Ischadium recurvum)	Graczyk *et al.*, (1999)
	Ireland	Marine mussel (Mytilus edulis)	Chalmers *et al.*, (1997)
Oysters	USA	Crassostrea virginica (Chesapeake Bay) Genotype 1 and genotype 2	Fayer *et al.*, (1999)
	Spain	Ostrea edulis	Freire-Santos *et al.*, (2000)
	UK	Ostrea edulis	Freire-Santos *et al.*, (2000)
Cockles	Spain	Cerastoderma edule genotype 2	Gomez-Bautista *et al.*, (2000)
Meat & Meat products	Europe	Association shown between meat from small ruminants, including sheep and goats and *C. parvum*	Pepin *et al.*, (1997)

Is there a role for novel techniques for testing the viability of oocysts?

Assessment of viability of this organism is important, as this may be related to the infectivity potential to humans of any positive water source or food item being consumed. Previously, there have been problems in the phenotypic identification of viable from non-viable oocysts. Historically such determinations were performed by animal challenge studies or by excystation. However more recently, inclusion of the DAPI test (4'6-diamidino-2-phenylindole), which demonstrates viability through the presence of a fluorescent sky-blue coloration due to permeability of this molecule in viable oocysts, has been a valuable marker of oocysts viability. However Korich *et al* (1990) found vital dye exclusion to be unreliable as a viability indicator during study of the affects of disinfectants on oocyst survival.



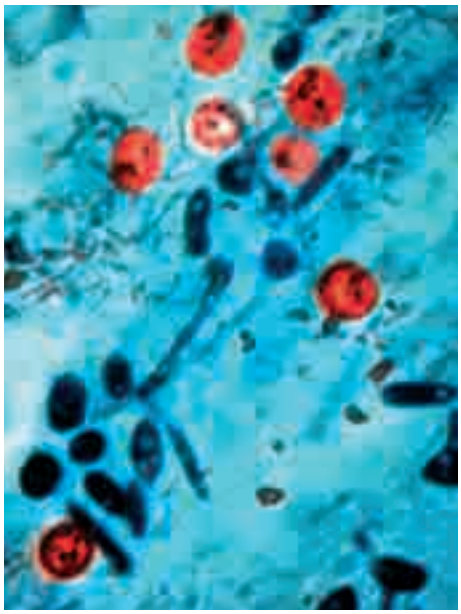
Cryptosporidium oocyst

Emerging molecular technologies, including NASBA, (nucleic acid sequence-based amplification) may allow for reliable determination of the viability of oocyts. NASBA methodology is a novel technique in diagnostic microbiology, which as yet has not been applied to the molecular diagnosis of *Cryptosporidium parvum*. NASBA methodology offers the potential of a highly sensitive and specific method for the detection of *Cryptosporidium parvum*, without the need for highly complex reference laboratory facilities. This method effectively 'deskills' complex molecular techniques, yet concurrently maintains

the advantages of both specificity and sensitivity of molecular assays. This method would allow for differentiation of viable from non-viable oocysts and potentially offers a more reliable assay to the DAPI technique to assess viability, as well as allowing for quantitation of numbers of viable oocysts in a water or food source. Such an approach in these circumstances would allow for the immediate introduction of an intervention or several control strategies, thereby minimising risks to public health and maintaining corporate due diligence.

What role can HACCP play in improving food safety with respect to *Cryptosporidium*?

Cryptosporidium present several potential hazards within the food processing sector. These hazards may be subdivided into (i) those where the parasite is introduced to the foodstuff through contaminated raw ingredients, e.g. unwashed lettuce destined for 'ready-to-eat' (RTE) salads, (ii) where the parasite is introduced during food processing due to addition of contaminated water, as an important ingredient of the foodstuff, e.g. in soft drinks production, (iii) where the parasite is introduced during food processing, as a contaminant of cleaning of equipment with non-potable water or contaminated potable water, (iv) introduction of the parasite through pest infestations, e.g. cockroaches, house flies, mice and rats, and (v) introduction of the parasite to processed foodstuffs from positive food handlers. The associated risk from each of these potential routes of entry of oocyst into the foodstuff should be controlled through an integrated HACCP approach for the reduction/ elimination of viable oocyts in the final food product. Where manufacturers are producing RTE foodstuffs requiring no further processing, e.g. domestic cooking, then the critical control points in such circumstances are required to be absolute, i.e complete elimination of the hazard from the RTE foodstuff. Manufacturers should also be aware that the globalization of food production, including the sourcing of raw materials from several different countries. This may open new mechanisms for the transmission of this parasite, therefore food processors must be diligent in sourcing ingredients with stringent HACCP-controlled specifications and a commensurate degree of product sampling/testing, to verify the efficacy of such controls. Although industry should strive to obtain this objective even when processing raw foodstuffs , e.g. raw meats, the critical control points in such circumstances are in practice less stringent, as these foods will receive sufficient cooking to render viable oocysts non-infective. However, contaminated raw produce may pose an important cross-infection hazard with the potential indirect transmission through contaminated utensils and work surfaces. However, the effectiveness of any such control is reliant on a satisfactory method of isolation and detection from the foodstuff.



Where do we go from here?

At a strategic level, it is important that each nation has the ability to reliably genotype and subgenotype human and food/water/animal/environmental *Cryptosporidium*, using a standardized molecular methodology. It is therefore important that as we develop such capabilities, we do so in unison, so that there is added-value to the epidemiological data, whereby comparisons may be made locally, nationally and internationally. Presently, there is no consensus on detection, genotyping and subgenotyping methodology. Further work is urgently required on all these aspects.

With the development of improved laboratory detection systems for both isolation, identification and viability testing, coupled with food-related outbreaks, more attention is being placed on the potential transmission of this agent through foodstuffs. Thus, food testing laboratories will experience an increased demand for having such assays in place to routinely monitor for this organism and more importantly, its viability. As the majority of modern detection systems are based on a variety of molecular platforms, including PCR, RT-PCR, NASBA and the LightCycler, this may prove a diagnostic challenge for a number of food industry laboratories, which predominantly rely on conventional detection systems based on culture.

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Additional references are available on request. Please contact the Editor.

Resistance of microbial communities

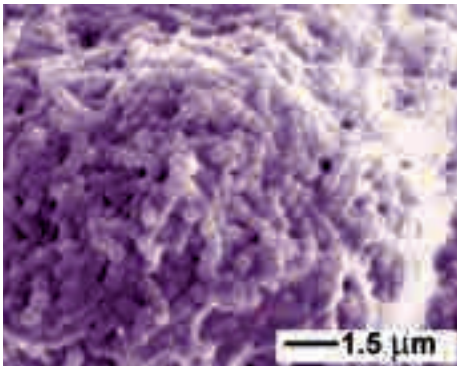
PROFESSOR PETER GILBERT (University of Manchester) was nominated by Dr Jean-Yves Maillard (University of Brighton) to deliver an sfam sponsored lecture entitled *'The Society for Applied Microbiology Lecture on Resistance of microbial communities'*. Present at the talk were staff, research scientists, postgraduate and undergraduate students. Professor Gilbert began with a very interesting introduction focussing on how bacterial biofilms form and their composition (polymers including polysaccharides). It was interesting at this stage to note how biofilms offered many advantages for the survival and success of the invading pathogen. It was made clear that biofilms are found in many areas of every day life including surfaces of manufacturing machinery (especially within the food industry), teeth plaques and damaged skin.

Increasingly we see antiseptics and biocides being added to everyday products, and there has been clear retail evidence that the addition of these agents help improve sales and increase the appeal of these products. It is for this and other reasons that a great deal of research activity has involved investigating the use of these biocidal agents and their subsequent affect on microbial resistance.

Professor Gilbert had highlighted some of the possible ways in which microorganisms can confer resistance to others within a biofilm community. These mechanisms were dependent on the properties of the biofilm and nature of the invading organism. Some examples of agent failure leading to possible resistance to that agent included:

- 1.Restrictive accesses, not allowing permeation of agent.
- 2.Enzymatic degradation of the agent.
- 3.The use of efflux pumps, where the organism is able to pump out the agent and avoid death.

It had been demonstrated that the unnecessary exposure and use of these biocidal agents had the potential to increase microbial resistance leading to more virulent strains.



SEM micrograph of a Streptococcus mutans biofilm at 28 hours onto the surface of a hydroxyapatite disc (used as implant material).The Biofilm was grown in TBS +0.15%(w/v) sucrose + 67 mM Sorenson's phosphate buffer, under gentle agitation (120rpm) at 37°C. Magnification x 10,000.

A number of published works have now clearly demonstrated that cross-resistance between biocides and antibiotics occur, especially when bacteria are exposed to sub-minimal inhibitory concentrations of biocides. An example of this included the mutations in the fatty acid biosynthesis pathway in *E.coli*.

Professor Gilbert thought it unlikely that cross-resistance between biocides and antibiotics would present a major problem in the successful treatment of infectious diseases. Biocides have been used for many centuries and as yet there have been no reported incidences of cross-resistance, this may be due to the more complex interactions that occur between biocides and organisms.

The talk was very thought provoking and even though the concern of super bugs may be exaggerated and premature, we begin to question whether more can be done to reduce the reckless use of these agents during everyday manufacturing. Perhaps simply going back to good old elbow grease cleaning will further ensure the longevity of these agents over the coming years.

Finally, I would like to express the thanks of all those who attended to the Society for sponsoring this lecture.

Jean-Yves Maillard

School of Pharmacy and Biomolecular Sciences, University of Brighton, UK

Could you benefit from a sfam Sponsored Lecture Grant?

The Society has funds to assist groups, clubs and societies with an interest in microbiology to invite notable speakers to give guest lectures. Normally, up to **£150** can be made available for this purpose and a condition of the award is that the lecture appears in the group's programme as 'The Society for Applied Microbiology' lecture.

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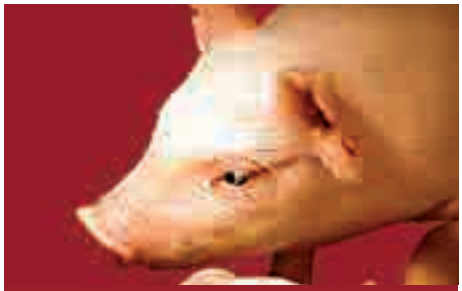

Verner Wheelock describes how Denmark is setting new standards in the reduction of the use of antibiotics in pig production

Danish bacon

IN DENMARK PIG PRODUCTION IS BIG BUSINESS and makes a major contribution to the national economy. The producers are pro-active and in recent years have taken a number of steps to address food safety issues that may be linked to the consumption of pork and bacon. In the light of concerns about human pathogens which originate from farm animals there is special interest in Danish developments because of the initiatives which have been taken in Denmark to devise controls on *Salmonella*. Furthermore the recent decision to cease using antibiotic growth promoters is particularly relevant because of the growing awareness of the resistance to antimicrobials in pathogens that can infect humans.

Zoonoses

Every year Denmark produces a Zoonoses Report which draws together data on the prevalence of zoonoses in humans, animals and food. All major food animals and food of animal origin are monitored continuously for *Salmonella*. The resulting collection of 10 - 20,000 Salmonella isolates per year is serotyped and isolates of *S. typhimurium* and *S. enteritidis* are phage typed. A comparison of *Salmonella* types isolated from food animals and food with isolates from humans, makes it possible to produce estimates of the number of human cases attributable to certain animal sources. In 2001 the registered number of human salmonellosis caused by zoonotic serotypes was 2,918 (54.5 cases per 100,000 inhabitants) which represents a continuous decline from 1997 when 5,015 cases were registered.

In finishing pigs, a nation-wide *Salmonella* programme was launched in 1995, which consists of control of Salmonella in feedstuffs, and surveillance and control in breeding, multiplying and finishing pig herds. The objective is to reduce the numbers of *Salmonella* in pork to a minimum. Over 600,000 samples are analysed every year, and herds are assigned to one of three levels:

- **Level 1** - a herd with no or few reactors where intervention is not required. In 2001, 97.3% of herds were allocated to this category.
- **Level 2** - a herd with a higher proportion of reactors, a reduction plan is recommended.
- **Level 3** - the proportion of reactors in the herd is unacceptably high, a reduction plan is recommended.

Herds in Level 3 have a penalty charge of 4% deducted from the payment for each pig at slaughter. From August 2001, a charge of 2% has been imposed on Level 2. The object of these charges is to provide a financial incentive for the pig farmers to take the necessary corrective action.

DANMAP

Danish Integrated Antimicrobial Resistance Monitoring and Research Programme

This collaborative programme was established in 1995 because of international concern that the widespread use of antimicrobial agents in animal production may promote resistant bacteria or resistance genes that may be transferred to bacteria pathogens to humans. The objectives are to:

- Monitor the occurrence of antimicrobial resistance in bacteria in livestock animals, food and humans.
- Monitor the consumption of antimicrobials for humans and animals.
- Detect and quantify the spread of resistant bacteria and resistance genes from animals to man.
- Provide guidelines for medical and veterinary antimicrobial chemotherapy to ensure that antimicrobials continue to be used prudently.
- Publish reports annually.

Since 1995, there have been significant reductions in the amounts of antibiotics used in Danish animal production. The Danish Veterinary Institute has studied the impact of these changes on the incidence of resistance in a number of different bacteria. The results demonstrate that it is possible to reduce the occurrence of antimicrobial resistance in a national population of animals when the selective pressure is removed.

Antibiotic Growth Promoters (AGPs)

In April 1995, the Danish National Committee for Pig Breeding, Health and Production (National Committee) took the

decision that producers should cease to use avoparcin as a growth promoter in pig feeds. t also recommended that AGPs should not be used in finisher feeds. This led to a reduction of approximately 40% in the consumption of AGPs contained in finisher feeds. In late 1997 all producer members of the Danish co-operative slaughterhouses which handle over 95% of all pigs decided to abolish the use of AGPs in the feed of finisher pigs weighing over 35 kg. In 1998, the National Committee took the decision to prohibit the use of AGPs in weaners from 1st January 2000. The ban on AGPs in finisher pigs was achieved without any significant problems. However with weaners difficulties were encountered: namely the production efficiency was slightly reduced and there was an increased incidence of diarrhoea and mortality. Despite these problems, concerted efforts are being made to address them and there is no question of re-introducing AGPs.

A recent report by the Danish Veterinary Institute has summarised the impact of the ban on AGPs as follows:

- Antibiotic resistance amounting bacteria in animals has been drastically reduced
- The total use of antibiotics has been reduced to less than half in the period from 1998 to 2001
- The growth rate of fattening pigs has continued to increase - feed efficiency has not changed
- The theoretical extra cost to producers is estimated at 5 - 6 Danish Kroner (€0.7) per pig
- Before the use of AGPs was terminated 100% of weaner pigs received antibiotics. Now only 12% of weaners are treated with antibiotics
- Consumer prices for pork have not increased because AGPs are no longer used

Controls on the use of veterinary medicines

Virtually all veterinary medicines used in therapy are Prescription Only Medicines (POMs) and must be distributed through pharmacies. The pharmacy sells medicine either to veterinarians for use in their practice, or directly to the farmer on presentation of a prescription. Since 1995, veterinarians have had no financial incentive to sell medicines as the law limits the mark-up. Denmark collects very detailed information on the use of antimicrobials and this demonstrates that there was a reduction in usage of about 40% observed as a result of this change in the legislation.

However, there has been some increase in the usage of antimicrobials in food animals as a result of the decision to cease using AGPs. This is partially due to the increased usage of tetracyclines which may be related to the withdrawal of AGPs in weaners. Nevertheless the amount of animicrobial used per pig is about 3.6g which is much less than in most other major pig producing countries.

In 2000, a new national system - **VETSTAT** - was established to collect even more details on the usage of all prescription medicines prescribed or used by veterinarians. With this system each sale of a veterinary medicine has information on the type of medicine, the formulation, pack size, target animal species, age group and type of disease. Where appropriate, a code identifying the farm and the prescribing veterinarian will also be included. The ultimate objective is to minimize consumption and to optimise usage in Danish farm animals.

Conclusion

The World Health Organisation (WHO) has devised Global Principles for the Containment of Antimicrobial Resistance in Animals intended for Food. Essentially these are recommendations to reduce the overuse and misuse of antimicrobials in food animals for the protection of public health. Denmark can be regarded as a model to which other countries aspire.

Verner Wheelock
Verner Wheelock Associates Ltd

This article is based on a major report entitled: **"Food Safety and Pig Production in Denmark: Controls on antibiotics, veterinary medicines and *Salmonella*"** prepared for the Danish Bacon and Meat Council. A copy can be obtained by sending an email to: Verner Wheelock email: office@vwa.co.uk.

Once again, our members have used a **President's Fund** grant to attend a variety of meetings and conferences around the globe. To find out how ***you*** could benefit from this valuable award check out the panel below or visit our website.

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Please note that this Fund is open to members of all ages! It is not only our student members who require our help. Senior microbiologists often find difficulty in funding attendance at meetings, and the President's Fund is there to help them. **If YOU are in this position, why not apply to the President's Fund?**

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1 The applicant must have been a member for at least a full subscription year before the event to be attended and must be a fully paid-up member at the time of application.

2 A successful applicant cannot re-apply to the Fund for three years from the date of the award.

3 Preference will be given to applicants who are contributing to the meeting they wish to attend and/or are unable to obtain funds elsewhere.

4 Application forms, together with an abstract of any intended contribution to be made, must be received by the Society Office not less than six weeks before the date of the event.

5 Student member applicants must enclose a letter of support from their supervisor or head of department on the letterhead of their institution.

6 The maximum grant available is normally £500.

7 Under exceptional circumstances this maximum may be exceeded.

Applications for a grant from this Fund can be made via the Society website or using the official form available from the Society Office.

18th International ICFMH Symposium. Food Micro 2002: 'Friends and Foes': Microbial adaptation to changing environments

18-23 August 2002, Lillehammer, Norway

This Symposium was held in Lillehammer, Norway in August 2002, a summer visit to the site of the 1994 Olympic Winter Games, in the shadow of two impressive ski jumps and a view of the majestic Lake Mjøsa at the start of the Gudbrandsdalen Valley; certainly a wonderful setting. The conference tried to balance the positive and negative roles of microbes in food - "friends and foes". Microorganisms cause great concern in modern food supply worldwide as pathogens or spoilage organisms, but can also contribute to alternative combat strategies and preservation of food. The main emphasis of the symposium was on change and dynamics; how microbes interact with and respond to the environment and each other. Plenary sessions were spread throughout the conference on a broad range of subjects including: food pathogens, antibiotic resistance, food spoilage, predictive microbiology and stress. **Ian Booth** (University of Aberdeen, UK) gave a very stimulating talk on "Stress and the single cell", introducing the concept of intrapopulation diversity being essential for survival on exposure to stress. This talk considered the fact that microbial cultures are heterogenic and addressed the routes by which heterogeneity is generated in bacterial populations. Population heterogeneity is essential for adaptability of bacteria; this allows a cell to switch on new protein synthesis to cope with an environmental change. For the food industry and others a practical importance of this is the ability of a small fraction of any population to survive exposure to stress, it is this tail population which must be considered as distinct from the susceptible population and as the main threat in the proliferation of foodborne disease.

Robert Tauxe (CDC Atlanta, USA) gave an overview of "Emerging foodborne pathogens", addressing the changes in foodborne infections over time. The emergence of new pathogens and the adaptation of known pathogens is of great concern, new pathogens can emerge because of changing ecology, or by the transfer of mobile virulence factors e.g. bacteriophage, or the development of antibiotic resistance. Foodborne disease control requires vigilance in public health in both the developed and the developing worlds, attention to food safety farm to table and an understanding of pathogens and zoonoses. The take home message was that we should expect the unexpected!

The subject of antibiotic resistance was discussed by **Henning Sørum** (Norwegian School of Veterinary Science, Norway) with a talk; "Antibiotic resistance in food-related bacteria - a result of interfering with the global web of bacterial genetics" Humans consume food from a variety of environments and the antibiotic resistance found in food-related bacteria reflects this. Resistant bacteria arise due to the constant influx of resistance genes into the human microflora via the food chain; hence the impact of antimicrobials as feed additives is of increasing concern. Even after the ban on use of several antibiotics, resistant strains are still being found and in the case of vancomycin the fear is of VRSA strains developing since vancomycin is currently the only drug available to treat MRSA. The message was clear therefore, we must reduce antibiotic use in all aspects of food production.

Food spoilage was addressed by **Lone Gram** (Technical University of Denmark, Denmark) in a talk regarding the interactions of food spoilage bacteria. This topic is of great interest to the food industry since any sensory change to a food product rendering it unacceptable will cost the producer significantly; around 10-15% of foods are lost post-harvest or post-processing to spoilage. It is a complex process involving physical, chemical and microbiological changes, however predictions can be made and this review covered the role of microbial interactions in determining spoilage. Three examples were covered; the production of iron-producing siderophores, metabiosis and cell-to-cell communication (quorum sensing). In particular, acylated homoserine lactones (AHL) involved in bacterial quorum sensing was suggested to be important in spoilage reactions and the possible development of novel

preservation techniques based on quorum sensing inhibitors was advocated.

Tom McMeekin (University of Tasmania, Australia) gave an interesting presentation on modelling, both descriptive and quantitative, and the need for validation and control. He explained the necessity for the model to describe the behaviour of the population and responses of the population to the environment, and then the application of computer software to allow mining of the model. Predictive microbiology forms the pinnacle of the triangle balancing HACCP guidelines and the requirement for risk assessment. Modelling is essential and useful but it needs to be validated and controlled as many models exist yet some are unfounded.

Parallel sessions were run throughout the conference, in order to cover the vast array of topics of the speakers. These sessions also allowed an array of young microbiologists a chance to present their work at an international meeting. Discussion workshops on topics as diverse as fermented foods, antibiotic resistance, pathogen ecology, rapid methods and risk mitigation strategies, provided the opportunity for informed discussion on a topic of interest. Risk assessment was an important topic in discussions during the conference and **Eric Ebel** gave a presentation on risk assessment of *E. coli* O157:H7. Mitigation strategies and the utilisation of information from outbreaks to examine trends of particular food pathogens were discussed in an attempt to predict and understand risk analysis and its implementation in foodborne disease outbreaks.

The final talk was presented by **Dominique Dormont** (CEA, France) on "Prions, BSE and food"; it was an excellent talk and very stimulating for the final presentation of the conference. Discussing the biochemical and biophysical properties of prions, molecular markers of TSE's, possible inactivation methods and the mechanisms behind infectivity, this talk covered the important aspects of an emerging area. The risk of BSE for humans was discussed as were the many consequences of new variant vCJD. If a link is proven, then it will show that certain animal prions are capable of crossing the species boundary and this will require strict maintenance of offal bans throughout the world and careful surveillance of BSE. This also raises the question of risk with medical practices of tissue grafting, organ transplant and blood transfusion, if the vCJD agent is found to be present in tissue other than CNS. Unfortunately, little is known about the infectivity of TSEs and no test is available for diagnosis, so it may be impossible to assess the risk. Prions represent a very exciting enigma, however this enigma is a frightening issue for biologists in many fields.

The science was not the only reason this conference was such a success. The well organised social programme gave visitors a small taste of Norwegian culture and hospitality. Setting aside a day for excursions was a nice change from the lectures and I had a wonderful time rafting the Sjøa, even if I did get a little wet!

I should like to take this opportunity to thank the Society for awarding me this President's Fund Grant to allow me to attend this interesting and enjoyable conference.

Rosslyn M Birch
University of Aberdeen

IWA-AWWA International Symposium on Waterborne Pathogens Cascais/Lisbon, Portugal, 22-25 September 2002

Firstly, I would sincerely like to thank the Society for the grant that enabled me to attend this Symposium. Cascais is a charming coastal resort about twenty kilometers north from Lisbon. The nearby town of Estoril, where I was accommodated, used to be an upper-class resort with grandiose villas. Now it is a beach resort with a Casino and a beautifully illuminated palm park. Unfortunately the tight symposium schedule and still tighter personal finances allowed me no opportunity for either swimming or gambling...

The morning session focused on regulations, monitoring and compliance. It outlined contemporary approaches to regulations for drinking water, with case studies to provide advice to decision makers on methods for monitoring and compliance. The afternoon session dealt with the latest advances in disinfection treatment technology, and disinfectant residual management in distribution systems. Among the speakers were several international experts. **Dr Marion Savill** from New Zealand spoke of "Public Health Risk Management Plan", emphasizing on risk assessment and contingency plans. **Gertjan Medema** from The Netherlands spoke about new technologies, presenting an interesting low pressure UV-technology. **Maria Joao Rosa** from Portugal gave an overview of different membrane techniques on disinfection efficiency and residual management. Each session theme was followed by a vivid panel discussion.

The keynote speech was delivered by **Professor Paul R Hunter**, with the theme "What Do We Need to Know About Emerging Infectious Diseases in Water Supplies?" He listed several factors in the emergence of infectious diseases. Ecological changes, including those due to human impact, have influenced the quality of source waters. The changes in human demographics and behavior have increased the demand of water, thus necessitating the use of possibly more vulnerable water sources. The changing prevalence of other diseases, HIV as an example, has brought about populations more susceptible to waterborne diseases. Increase in international travel and commerce has augmented the spread of some waterborne diseases. The changes in technology have given us tools for better diagnosis, like molecular methods or *Cryptosporidium* staining. but developing technology has also facilitated the spread of waterborne diseases, like legionellosis through air-conditioning.

The morning session was dedicated to risk assessment, and the afternoon session centered on detection methods, which was also the topic for the morning session on the second day. The first presentation by **Dr. Gunther F Craun** from USA "Waterborne Disease Outbreak Surveillance: Thirty Years Experience in the United States, 1971-2000", gave us a nice, lively and humorous overview from the historical point of view. **Prof. Nicholas Ashbolt** from Australia spoke about "Application and Refinement of the WHO Risk Framework for

Recreational Waters". **Dr. Christobel Ferguson**, also from Australia, discussed about prioritization of pathogen research in the Sydney Watershed, introducing a new concept of pathogen budget.

The afternoon session and the morning session of the second day were dedicated to detection methods. **Dr. Timothy M Straub** (USA) presented an interesting and promising new technique in his talk "Using DNA Microarrays to Detect Multiple Pathogen Threats in Water" and **Dr. E E Muller** from South Africa spoke about "Repetitive Sequence Analysis of *E. coli* O157:H7 Isolated From Water Sources and Animal Reservoirs". The topic of **Dr. Kevin Connell (**USA), "Standardizing and Validating Research Techniques for Pathogen Monitoring in Water" was very enlightening, as the quality control of laboratory analyses is gaining ever more importance. Then **Dr. Frank Schaefer** (USA) spoke about a very current theme: "Laboratory Guidelines for Analysis of Bio-terrorism Samples".

In the afternoon session of the second day with the topic "Source Occurrence/ Protection" there were two very interesting speeches by Dutch researchers. D**r Gertjan Medema** spoke about "Quantitative Assessment of the Risk of Legionella and Fecal Pathogens to Sewage Treatment Workers". The theme of **Dr. W Hijnen** was "Quantitative Assessment of the Removal of Microorganisms by Full-Scale Water Treatment".

The morning session of the last day was titled "Emerging/Re-emerging Pathogens" and contained many interesting contributions about re-emerging old pathogens. **Dr. Gordon Nichols** (UK) spoke about "Crohn's Disease, Johne's Disease, *Mycobacterium avium* sp. paratuberculosis and Water" and D**r. M-L Hänninen** from Finland presented "Waterborne *Campylobacter* Epidemics: Assessments of Drinking Water Quality". Also the presentation by **Dr. M A Efstratiou** from Greece, "*Salmonella*: Extent of sewage treatment that can protect public health in recreational waters", comparing different relations of presence/absence of *Salmonella* to various indicator parameters.

The last session of the focused on disinfection. **Dr. Jeffrey S Rosen** (USA) spoke about "Role of Variability in Design, Implementation and Interpretation of Microbial Inactivation Studies". Both **Dr. DA Batticelli** (USA) in his presentation titled "Application of Surrogate Microorganisms for UV Reactor Validation" and **Dr. Peter Gehringer** (Austria), speaking about " Viral Indicators for Radiation Induced Water Disinfection Processes" discussed about problems connected with effective implementation and quality control of UV disinfection. **Dr. Jose Menaia** from Portugal gave us an excellent, very illustrative introduction to biofilms in his talk "Assessing the Significance of Biofilms: A Discussion of Present Knowledge and Concepts". The closing comments were delivered by **Professor Paul Hunter,** who said wittily: *"This is a very emotional moment for me. I have been married for over 20 years, and cannot remember when I have had the last word on anything."*

I would like to thank sfam for awarding me a President's Fund Grant to attend this conference.

Dr Peter Wyn-Jones,
University of Sunderland.

The 8th International Congress of Plant Pathology: 2-7th February 2003. Christchurch, New Zealand

The Congress was held in the Christchurch Town Hall/Conference Centre Complex on New Zealand's South Island. The conference aimed to look at current problems associated with plant diseases and their impact on primary food production, considering in particular the biosecurity implications of movement of plant crops and products between countries. The conference was a valuable opportunity to meet with Plant Pathologists from Pacific rim countries and discuss particular problems associated with farming crop plants in tropical regions.

The congress opened with a series of introductions from the ISPP Chairperson, members of the conference Organising Committee and the honourable **Pete Hodgson**, the New Zealand Minister for Research, Science and Technology. The Presidential Address was given by **Professor L Burgess** of Sydney University who discussed the vital role of Plant Pathologists in promoting biosecurity during worldwide trade in agricultural products. He discussed the importance of the World Trade Organisation Agreement on the Application of Sanitary and Phytosanitary measures to ensure that global trade does not become a biosecurity concern or a hazard to ecosystem balance. The vital role of the Plant Pathology community in surveillance, diagnostics, monitoring, eradication programmes and education in restricting disease spread in plants was emphasised.

The subsequent conference sessions covered a wide range of areas including: phytopathology of the Asia/Pacific region, the taxonomy and physiology of plant pathogens, disease management strategies, host-pathogen interactions and plant resistance and breeding. An interesting session on vascular pathogens looked at various aspects of such diseases caused by bacteria and fungi. A presentation by **Professor Tim Denny** profiled the colonisation of tomato by *Ralstonia solanacearum*, and discussed the role of different virulence determinants in promoting colonisation and tissue invasion. Another presentation by **Dr S De Boer** discussed the soft rot *Erwinias* and described how transgenic plants, able to produce bacterial quorum sensing molecules, disrupt virulence processes and show resistance to soft rot infection. Of particular interest were sessions on how plants recognise pathogens, which discussed the complex signalling mechanisms that activate resistance processes and allow the host to protect itself from attack.

The conference gave me a valuable opportunity to meet researchers from New Zealand, particularly those working on E*rwinia amylovora*, which represents a considerably greater plant health problem there than in the UK. Finaly, I would like to express my gratitude to the Society for Applied Microbiology for awarding me a President's Fund grant to help me to attend this important and most interesting meeting.

Julie Eastgate
University of Paisley

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Would you like to review a book and have your review published in **Microbiologist**? There are a number of books available, a selection of which is detailed below. Please email the Editor of **Microbiologist** at: **a.c.hilton@aston.ac.uk** stating which book you wish to review and in return for your efforts you can keep the book. More titles are being sent to the Society on a regular basis so if there is nothing that grabs your interest in the current selection, email the Editor.

Dictyostelium Evolution, Cell Biology, and the Development of Multicellularity
Richard H. Kessin

***E. coli*, Shiga Toxin Methods and Protocols** *Dana Philpott and Frank Ebel*

Essential Fungal Genetics
David Moore, LilyAnn Novak Frazer

Fungi in Bioremediation
G.M. Hadd.

How Scientists Explain Disease
Paul Thagard

Medical Microbiology, A Guide to Microbial Infections: Pathogenesis, Immunity, Laboratory Diagnosis and Control *David Greenwood, Richard C.B. Slack and John F. Peutherer*

Probiotics and prebiotics, where are we going?
G W Tannock
Caister Academic Press, 2002

RNA viruses *A J Cann.*
Oxford University Press, 2000

Viral Vectors for Gene Therapy, Methods and Protocols
Curtis A. Machida

PCR detection of microbial pathogens (2003)

Edited by K. Sachse and J Frey
Humana Press
$99.50. pp. 334 + xi
ISBN 1-58829-049-2
reviewed by Max Sussman

THE ORIGIN OF THE polymerase chain reaction (PCR), in 1985, was from its application to the diagnosis of sickle cell disease. The method has since then come a long way. Classical laboratory diagnostic tests for microbial pathogens take time - sometimes a long time. Now the dream of making the diagnosis of an infection in real time is becoming a reality and to this PCR is making an increasing contribution. This monograph, which belongs to the well-known series Methods in Molecular Biology has a strongly veterinary emphasis, but contains a wide ranging collection of methods for the application of PCR mainly to bacteria but also to the mycoplasmas, Coxiella and, amongst the parasites, Toxoplasma and Trichinella.

The first four chapters deal with basic aspects, including the specificity, performance and standardisation of PCR, the processing of test samples, and the special considerations when the technique is applied to zoonotic pathogens derived from foods. The value of these chapters is that they provide the necessary background information essential to understand PCR in depth, which is in turn the *sine qua non* of the correct use of the methods and interpretation of the results obtained.

The main body of the text consist of 18 chapters, described as protocols, that describe methods for the detection of the various kinds of pathogens. These are set out in the outstandingly didactic style that will be well known to users of other books in the series. Particularly helpful are the notes at the end of chapters that deal with essential matters that are not strictly part of the protocols themselves but are essential to their proper use.

Though the range of the included pathogens is rather limited, as is unavoidable in a book of manageable size, the protocols will also be a guide to those attempting to apply PCR to their own favourite microbe. In that way this book will find application to much more than is at first apparent. The editors and their authors are to be congratulated.

Microbial Life Perry, Staley & Lory

Hardback £35.99 811p
reviewed by Pauline Handley

MICROBIAL LIFE is the first edition of a new undergradaute microbiology textbook and it covers all the topics usually found in an introductory text on microbes. The majority of the text is about bacteria which is to be expected and there are sections on viruses and one chapter covers eukaryotic micro-organisms (algae, protozoa and fungi). The text is divided into eight parts to cover, (1)the scope of microbiology; (2)nutrition and growth; (3)metabolism; (4)genetics and basic virology; (5)microbial evolution and diversity; (6) microbial ecology; (7)immunology and medical microbiology; and (8), applied microbiology.

The book is very easy to understand and written in a student friendly style. The diagrams and models are particularly clear with excellent labelling and clear colours to attract the interest of the reader. Everything about the text encourages students to read, understand and learn the material presented. Every copy includes a student CD advertised as a 'valuable multimedia tool' and it includes interactive exercises and quizzes to further explain key concepts.

There are, of course, many other excellent microbiology textbooks on the market. So the competition for any new text book covering similar material is fierce. The quality of the diagrams in ***Microbial Life*** is one of its strengths and this undoubtedly increases the impact of the book. It is bang up to date and in every chapter there are boxes including 'Research highlights' which describe recent, high profile discoveries related to the material in each chapter.

In conclusion, this is a very good new microbiology text book which is certainly suitable for adoption as a course text for first year University courses and would also provide basic information for second year units as well.

E. coli gene xxpression protocols

Edited by Peter E. Vaillancourt
Humana Press (2003) pp. 347 + xi
ISBN 1-58829-008-5
reviewed by Max Sussman

RECENT ADVANCES IN GENETIC and molecular techniques and methodology have been astonishing in their variety and utility. To establish and prove the methods requires expertise and time. It is, therefore, extremely valuable to have proven methods easily available in the laboratory.

This book is just such a collection of methods. As the title states, it deals with methods directly applicable to that old laboratory workhorse, *Escherichia coli*, but with suitable modification the methods will also have far wider application. The central topic dealt with by the described methods is protein expression, beginning with cold-inducible promoters for heterologous protein expression and dual-expression vectors that permit expression of structural genes in *E. coli* and eukaryotic cells. Then come a series of chapters on various aspects of recombinant protein purification, affinity tagging, solubility enhancement and protein folding. Several chapters then deal with the investigation of protein libraries and related topics, and much else.

The presentation of the methods is clear and uniform, beginning with itemisation of the materials required. Then the methods themselves are described in a stepwise fashion with helpful cross-referencing in boldface. Finally, there are important explanatory notes that would otherwise obstruct the detailed setting out of the method.

The methods described are undoubtedly complicated and intended for experienced investigators, but beginners should be able to work through the stages of the methods and, with basic experience and reasonable effort, obtain the results they seek. Others will welcome the clear, though densely written, introductory sections of each chapter that describe the principles that underlie the methods. In conclusion, this is an excellent methodological text that will be widely used.

Salmonella, a practical approach to the organism and its control in foods"

Chris Bell and Alec Kyriakides,
Blackwell Science Ltd, 1st ed., 2002.
reviewed by Walid M El-Sharoud

DESPITE THE PASSING OF MORE THAN A CENTURY since the first recognition of *Salmonella*, microbiologists have never lost their interest in this pathogen. This has resulted in a wide, and growing body of knowledge that represents *Salmonella* beside its sister *Escherichia coli* as model microorganisms. Chris Bell and Alec Kyriakides have produced an interesting text on the pathogen in their fourth addition to the *Practical Food Microbiology Series*

The book is basically devoted to demonstrating *Salmonella* in food safety terms, but also gives useful information on its biology. Following the systematic way that was adopted for the other series texts, the authors start with a background on the pathogen's history, taxonomy and the illnesses it causes. Here, they smoothly compile various stages in the development of *Salmonella* taxonomy and wisely decide to use the most recent nomenclature concept to refer to the organism throughout the book. This is quite critical since this revolutionary concept considers the genus *Salmonella* to involve only two species: *enterica* and *bongori*. Typhimurium, Typhi, Dublin, etc., are no longer presumed to be species but serovars.

The second chapter highlights unforgettable food poisoning outbreaks caused by *Salmonella*. The authors comprehensively discuss the routes that could have led to such outbreaks accompanied by relevant mention of measures that could have prevented the pathogens spread. The same approach is even more thoroughly adopted in chapter 4 where an in-depth and practical analysis is employed to identify hazard-associated points through the whole food preparation chain. This chapter is extremely useful for food manufacturers seeking proper guidance on the application of the hazard analysis, critical control points (HACCP) system. I would consider these two chapters as a distinguished contribution to the literature of food safety.

But chapters 3 and 6 could have been better exploited. The first one knocks at responses of *Salmonella* to traditional food preservation regimes but does not mention "acid adaptation" in *Salmonella*. This phenomenon was pointed out in the 1970s and extensively studied during last decade.

Chapter 6 is describes analysis methods to detect the pathogen in foodstuffs. It is disappointing that the authors did not explain, even briefly, the principles behind the standard cultural detection methods. This necessary demonstration is highly relevant to food safety particularly in regard to the pre-enrichment step.

While the book lacks the use of attractive diagrams and amusing cartoons, tables are properly employed to complement the text. A helpful feature is the inclusion of a brief glossary to explain some of the technical terms scattered throughout different chapters. The authors generally succeed in presenting their material in a highly simplified, clear and readable style that does not require much effort or sound microbiological knowledge to understand. I highly recommend this book to those involved in the various food industry domains. It should alos be valuable to food safety students and researchers, but the publisher should reconsider the cover price to make the book more affordable.

Industrial microbiology: an introduction

Michael J Waites, Neil L Morgan, John S Rockey and Gary Higton
Blackwell Science 2001
ISBN 0-632-05307-0
reviewed by Louise Fielding

THE TEXT IS AIMED at both undergraduate and Masters students in the fields of microbiology, food science, biotechnology and biochemical engineering. Although the authors state that a basic knowledge of microbiology and biochemistry is assumed, it is equally accessible to readers who do not possess significant knowledge of these fields. This

makes the book valuable to a wide range of students of the biological sciences as different courses do not cover the fundamentals to the same extent.

The book is divided into three parts, each clearly segregated and the concepts are developed as the reader progresses through the text. The first part of the book explores the basic concepts of microbial physiology including sections on microbial structure and function, growth and nutrition and metabolism. This section of the book is invaluable to those students who do not have a strong grounding in the basics and also to returning professionals wishing to revise and update their knowledge. It clearly explains the underpinning concepts and relates them to the practice of industrial microbiology. The text is supported by clear illustrations and figures and the mathematical calculations of growth kinetics are covered. Specific examples are also given, for example types, structures and uses of antimicrobial agents. All the major biochemical pathways are outlined.

The second part of the book is concerned with the bioprocessing aspects of industrial microbiology. It looks at industrial microorganisms and a brief list is provided which identifies the type of product and the range of organisms that can be used. Culture collections and maintenance are also briefly explained and the factors which affect the choice of microorganisms are discussed. The theory of genetic techniques for strain improvement are also included in this section. Fermentation media are also explored and the different types of carbon and nitrogen sources are analysed. Information is also provided regarding the requirements for water, minerals, vitamins and growth factors, precursors, and many other aspects are discussed. The chapter on Fermentation systems deals with fermenter design and construction relating it to the requirements for heat and mass transfer within the system. Provision of services such as sterilization of air, media and the vessel as well as the need for process control are considered. Downstream processing is clearly explained with the aid of a flow diagram which separates upstream and downstream operations. Each unit operation is identified and discussed in terms of the techniques, the application and relevant calculations are included. The final chapter in this section concerns product development, regulation and safety. It brings together considerations of the scientific aspects of the product with the regulatory requirements. Quality assurance is briefly discussed and provides an overview only - it is not a comprehensive explanation of requirements.

The final section of the text looks in more detail at specific applications of industrial microbiology such as microbial enzymes, fuels and industrial chemicals, health care products, food and beverage fermentations, food additives and supplements, microbial biomass production, environmental biotechnology, microbial biodeterioration of materials and its control and animal and plant cell culture. This section comprises almost half of the book and each chapter introduces the product, outlines production methods and looks at specific applications. Where applicable information is provided in the form of flow diagrams outlining the processes involved and diagrams of relevant equipment are also included. Each chapter cannot provide a comprehensive resource for each of the applications but does give a very good outline of the types of process and product which are involved.

The information in this book is not novel - the majority of it can be found by reference to other existing texts. It is, however, very well written, accessible to a wide range of students and brings together a lot of information, which would otherwise take a lot of searching through numerous other resources. It is readable and supported by very clear illustrations, flow diagrams and tables. Each chapter is supplied with a list of references, both journal and book, which the reader can access. Overall, this book will be very good for undergraduate, postgraduate and professionals in the biological sciences.

Two books:

Microbiological risk assessment in food processing

Martyn Brown and Mike Stringer (eds.)
Woodhead Publishing, Cambridge
301pp ISBN 1855735857 £115.00
reviewed by Martin Adams

The microbiological risk assessment of food

Stephen J. Forsyth Blackwell Publishing
Oxford, 216pp. ISBN 0632059524
£29.95
reviewed by Martin Adams

APPEALS TO VANITY rarely fail and it is with this in mind that I can confidently predict that most food microbiologists will already be familiar with the essential concept of microbiological risk assessment (MRA). Rather like Monsieur Jourdain, the character in Moliere's play *le Bourgeois Gentilhomme*, who was extremely flattered to discover that he had been speaking prose all his life without realising it, microbiologists have been attempting MRA in some form or other for many years. Indeed a chapter on the evolution of MRA in the book edited by Brown and Stringer shows how risk assessment principles were used in defining processing standards for low acid canned foods in the 1920s and by Enright and coworkers in the 1950s to establish performance criteria for milk pasteurisation that would give an appropriate level of protection against *Coxiella burnetii*. The difference is that now the task of assessing the risk associated with a particular food, process and/or pathogen has been systematised into a number of generally agreed steps, each with a well defined function in the overall risk assessment process. Considerable impetus for this development has come from the need for an internationally agreed approach to help eliminate artificial barriers to world trade in foods based on laws protecting public health.

While the different stages in MRA may seem clear cut, their actual execution can be extraordinarily difficult, particularly when compared with chemical risk assessment. Difficulties stem from the considerable inherent variability arising from strain to strain differences in the ability to cause illness and the extent to which growth or inactivation may occur in different food systems, the uneven distribution of microorganisms in a foodstuff and the varying susceptibility to illness within a human population. These problems are then further compounded by uncertainty associated with the

available data describing "true" levels of an organism in particular foods, food consumption patterns and the relationship between pathogen numbers and clinical illness.

These two books both address the topic of MRA but take rather different approaches. One is by a single academic author while the other is edited by two leading microbiologists from the UK food industry. The single author approach has the advantage of uniformity of treatment, although in this case the editors have done a good job in ensuring the contributors to their book do not differ wildly in approach. The book by Forsythe assumes rather less prior knowledge and takes longer to build up to the actual topic. A third of the book is occupied by two introductory chapters on Foodborne microbial pathogens in world trade and Food safety, control and HACCP. It then goes on to describe Risk Analysis as it has emerged over recent years, focusing particularly on the RA process.

The book edited by Brown and Stringer is longer and contains considerably more in the way of scientific and technical detail. Following an introduction setting MRA in the context of international food safety standards and a chapter describing the evolution of MRA, the key steps in MRA are described in a series of individual chapters. Although strictly speaking it falls outside the book's remit, Risk Communication is also covered in this section. In the second part, aspects of the implementation of MRA in practice and are covered and there are chapters relating MRA to two other key tools in food safety management - the use of microbiological criteria and HACCP.

Both books have their merits and would be useful library acquisitions. Undergraduate students and non-specialists would probably find the Forsythe book easier going, but my own preference was for Brown and Stringer for its greater depth of coverage, albeit at a considerably higher price.

Principles and practice of clinical parasitology

Edited by S H Gillespie and R D Pearson. 2001 Wiley,
ISBN 0-471-97729-2. £145 Hardback
reviewed by S P Hardy

PARASITIC DISEASE OF MAN has such an impact on human activity in terms of morbidity, mortality, economics and national development that it was very surprising to find only two appropriate titles on an Internet book search using the words ''clinical'' and ''parasitology''. In medical settings it is conventional to use the term parasite to mean macroparasites such as protozoa, helminths (round worms) cestodes (tapeworms) and trematodes (flukes). Hence, bacteria and viruses are microparasites and do not fall within the remit of clinical parasitology.

The press release for *Principles and Practice of Clinical Parasitology* give two key features of the book. Firstly, it has *'strong emphasis placed on integrating new knowledge in a clinically relevant manner.'* And, secondly, that it contains *'comprehensive coverage of the latest diagnostic techniques and investigative methods'*. In 670 pages the editors have collated 28 chapters written by an international list of authors covering the common parasites of medical significance covering events up to the year 2000. Other than 2 chapters on the history of parasitology and parasite epidemiology they are titled according to the organisms in question (malaria, schistosomiasis, African trypanosomiasis etc.). In reviewing the book of multi-authored chapters one is conscious of the problems of heterogeneity in style and content. The best chapters provide a balance between the biology of the organism the pathophysiology, clinical picture and treatment (e.g. Malaria by Biggs and Brown). Fitting nicely with the press release the model chapter on toxoplasmosis by J D Schwartzman includes a clear perspective on the role of laboratory diagnostic tests. Some chapters include recent research findings of the cell biology of the parasite in question (e.g. the chapter on cryptoporidiosis by Sears and Kirkpatrick includes substantial information on the possible cellular mechanisms of diarrhoea). Other chapters however do not project much excitement, being more traditional in style.

The aesthetics of the book left this reviewer disappointed. It is printed on matt paper and this does not help the low resolution photographic images and results in some of the computer-generated graphs looking rather mottled. Some of the figures lacked any appropriate legends and others were very amateurish diagrammatic representations. All figures were black and white except for four colour plates. The book is clearly not an atlas or a diagnostic laboratory manual for diagnostic purposes, indeed there were no pictures of the organism itself (eggs larvae or worms) on the chapter on toxocariasis.

The clinical information can be found in the classic textbooks such as *Manson's Tropical Diseases* but P*rinciples of Clinical Parasitology* seeks to add data on pathology, immunology, drug treatment, laboratory diagnosis and prevention and control programmes. Such a tall order means that to cover all the topics the text has to be heavily distilled. A significant proportion of the terms are likely to be unfamiliar to bacteriologist or virologist and one would have liked to see a glossary to cover the specialist terms or better still an introductory chapter on parasite biology. The chapter on parasite epidemiology includes a discussion of mathematical modelling as tested on microparasites but does not explain how these contrast with vector borne disease models.

When given the opportunity to review this book I was hoping it would provide a text to illustrate the rewards of parasitology. Students are often surprised to hear how parasitic disease is not an old, tropical disease of restricted relevance, malaria and cryptosporidiosis have seen to that. The chapter on microsporidia shows how contemporary the discipline remains with a number of newly recognised genera /species involved in human diarrhoeal disease. The book is targeted at clinicians based in clinics and presumably in diagnostic and research laboratories. Postgraduate students will find things of interest and value if they work on any of the organisms. With precious few courses offered at undergraduate level, parasitology has an unjust image of limited intellectual interest and relevance. The better chapters in this book go someway in showing how the subject has great rewards but the poor images of organisms will convert no-one. The book is useful and necessary and the editors deserve congratulation for filling a hole in the market but I hope all those concerned have the energy to see through the revisions for a second edition.

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We hold two annual meetings. The January Meeting comprises discussion sessions with the opportunity to display posters on related work. The Summer Conference is held every July and comprises a main symposium, a poster session, the AGM and a lively social programme. We also hold occasional joint ventures with other organisations on topics of mutual interest.

Publications

The Society publishes two monthly journals: ***Journal of Applied Microbiology*** and ***Letters in Applied Microbiology.*** We also produce our own quarterly in-house colour magazine: ***Microbiologist***, which contains features, reports topical news stories and full details of our meetings. The Society is also a partner with Blackwell Publishing in the bi-monthly journal ***Environmental Microbiology.***

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Synergy is an online service provided by Blackwell Publishing that gives Full and Student Members **FREE** access to the online versions of the Society's three journals: ***Journal of Applied Microbiology***, ***Letters in Applied Microbiology*** and ***Environmental Microbiology***. Members can register for this service at http://www.blackwell-science.com. Members can also submit papers directly to our journals via an online submission service.

For more information about Synergy or online manuscript submission, please visit the website.

Grants & awards

Many 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 Lectures and the popular **Students into Work** Scheme.

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