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SRSVs

Hospital-acquired infections

The spread of plant pathogens

Foot-and-mouth disease

Q fever

UK culture collections

SGM visits ASM

Contents

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Above: Florence Nightingale checking on her patients and administering medicine at Scutari Hospital during the Crimean War. Florence Nightingale was one of the first epidemiologists to write about hospital-acquired infections. See article on p. 106.

Coloured lithograph by J.A. Benwell. Courtesy Wellcome Institute Library, London

This issue of *Microbiology Today* focuses on the spread of pathogens.

Is it healthy to be admitted to hospital? Your risk of contracting an infection is high, as Nick Brown reveals on p.106.

Small Round Structured Viruses are a significant cause of diarrhoeal illness. Barry Vipond and colleagues describe the latest research into the transmission of these organisms on p.110.

Plant diseases have an important economic effect. Jim Duncan looks at the spread of potato blight on p.114 and Mike Asher explains the dangers from rhizomania in sugar-beet on p.120.

Only ungulates can contract foot-and-mouth disease, as Alex Donaldson discusses on p.118, but *Coxiella burnetii* can pass from animal to man, causing Q fever according to Ulrich Desselberger (p.123).

Cultures are at the centre of microbiological research. David Smith describes recent developments in the UK National Culture Collections on p.124.

Finally, on p. 131 join the SGM staff on their trip to the ASM meeting in Chicago.

These articles appear in addition to all the regular features and reports of Society activities.

Articles

Regular Features

Other Items

Opportunist pathogens in hospitals – all change please

Nick Brown

"...the actual mortality in hospitals, especially in those of crowded cities, is much higher than any calculation founded on the mortality of the same class of diseases among patients treated out of hospital..."

Florence Nightingale, 1863

Florence Nightingale was one of the earliest epidemiologists to write about the calculation of mortality rates in hospitals, for infection acquired in hospital was a major problem at this time. In 1869, Lancefield Group A streptococcal infection probably accounted for the high mortality following leg amputation in Edinburgh described by James Simpson. He postulated that the infection was due to the "*accidental inoculation of the morbific secretions formed in the bodies of other patients affected*". Of course, nosocomial infection had been recognized for centuries before this and the spread of diseases such as smallpox and typhus within institutions was well described. None of these infections is a major cause of hospital-acquired infection in the UK today; a completely different range of organisms is seen. Indeed, even in the short-term, the continual evolution of opportunist infection has become one of the characteristics of communicable disease in hospital.

The term 'opportunist' in this setting is a very broad one, and is taken to refer to an organism that would not normally cause infection, but is able to do so because of some impairment in the defences of the individual. Often the organisms are considered to be of low pathogenicity, and infection only occurs in a particular clinical setting. An example is infection due to coagulase-negative staphylococci in patients with some sort of implanted prosthetic material, such as a central line, artificial heart valve or drain. Otherwise, the clinical presentation of the infection may be changed by increased susceptibility of the patient. For example, varicella zoster virus (VZV) generally causes a mild self-limiting infection in young children (chickenpox), but may present as a devastating life-threatening illness in immunocompromised adults or children in hospital. Environmental factors may be important, such as the selection of antibiotic-resistant organisms within a hospital encouraged by antibiotic use, the congregation of susceptible patients within the same ward, and the person-to-person spread of organisms from environmental reservoirs, e.g. fluids, drains, taps and shared equipment. A host of bacteria, viruses, fungi and protozoa have been associated with opportunist infection at some time. This article discusses features of some, but by no means all, opportunistic pathogens in hospitals today. Some specific immunocompromised patient groups where opportunist infections are important, for example those with AIDS, will not be discussed as these infections are generally acquired outside hospital.

Infections in cancer patients following chemotherapy

The evolution of opportunist infection in hospital is very well demonstrated by the changing organisms associated with bacteraemia in neutropenic patients over the years. Trials performed under the auspices of the European Organization for Research and Treatment of Cancer (EORTC) between 1973 and 1994 were designed to compare a different antibiotic regimen for the treatment of episodes of fever in neutropenic patients following cytotoxic chemotherapy. In the majority of patients no causative organism was isolated, but between 22 and 32% of patients were documented to have bacteraemia. In the first trial, carried out between 1973 and 1978, bacteraemia was most commonly due to Gram-negative organisms (71% of the total), notably *Escherichia coli* (32%) and *Pseudomonas aeruginosa* (12%). At this time Gram-negative sepsis, due to *P. aeruginosa* in particular, was recognized as a major cause of fulminant infection in neutropenic patients, with a rapid progression and very high mortality. The subsequent six EORTC trials performed between 1978 and 1994 showed a gradual fall in both the number and proportion of patients with Gram-negative bacteraemia and a rise in the number of patients with Gram-positive bacteraemia. Today the spectrum of organisms associated with bacteraemia is virtually unrecognizable from that of 20 years ago. The 1992–1994 EORTC trial showed that the proportion of patients with Gram-negative bacteraemia had fallen to 33%. Indeed, in many units treating neutropenic patients Gram-negative bacteraemia has now virtually disappeared. In addition, even the spectrum of organisms isolated from patients with Gram-positive bacteraemia has changed. Whereas in 1973–1978 *Staphylococcus aureus* (19%) and *Streptococcus pneumoniae* (3%) were most common, the most prominent Gram-positive organisms isolated between 1992 and 1994 were coagulase-negative staphylococci (33%) and α-haemolytic or non-haemolytic streptococci (25%). These were very uncommon in 1973.

Many factors have contributed to this change. Certainly cytotoxic chemotherapy for blood cancers (leukaemia and lymphoma) and the solid organ malignancies has changed in intensity such that patients are now more immunocompromised than they were, both in terms of degree and duration of neutropenia. Medical advances have meant that it is now possible to give very aggressive chemotherapy, and hence improve the outcome of treatment, while preventing the complications of these regimens or supporting the patients through them. In addition, bone marrow transplantation has now progressed to an almost routine procedure, such that it could be argued that the patients recruited into later EORTC trials were completely different from those seen in 1973. More intensive chemotherapy regimens have made mucositis of the gastro-intestinal tract more common, and this may explain the increase in bacteraemia due to streptococci which are commensals of the upper and lower gastro-intestinal tract. Coagulase-negative staphylococci are associated with infection of Broviac or Hickman indwelling vascular lines, which are now almost universally used for vascular access during treatment.

Also, quinolone antibiotics are often given throughout the period of neutropenia for selective decontamination of the gastro-intestinal tract to prevent Gram-negative bacteraemia. This has had a dramatic effect on the Gram-negative bacteraemia rate in some units, either by preventing it (which was the intention) or by suppressing bacterial growth in blood culture systems and therefore reducing the isolation rate. However, quinolones have only been widely available since 1987, and Gram-negative bacteraemia had started to fall long before this. Some units do not use quinolone prophylaxis, and they have also documented a fall in Gram-negative bacteraemia.

Effects of antibiotic therapy

The potential effect of antibiotic therapy on opportunist pathogens in hospitals is one of the most important areas to consider. This has been emphasized by the recent House of Lords Select Committee on Science and Technology Report *Resistance to Antibiotics and Other Antimicrobial Agents*, which described the hospital environment as '*an epidemiological pressure cooker for the emergence of resistance, combining high infective risks in immunologically compromised patients who are undergoing invasive procedures, frequent spread of infection, and high usage of antibiotics exerting strong selective pressure on the microbial population.*' It is important to consider the complex interaction between these factors, all of which influence the ability of a micro-organism to cause infection.

Two antibiotic-resistant organisms causing concern in hospitals worldwide at present include methicillin-resistant *S. aureus* (MRSA) and vancomycin-resistant enterococci (VRE).

MRSA. MRSA is clearly a pathogen in its own right, but recent evidence suggests that, as methicillin resistance in *S. aureus* becomes more common, MRSA is not simply replacing methicillin-sensitive strains (MSSA) as a cause of infection, but is an additional burden. This has been seen at Addenbrooke's Hospital, Cambridge, where the bacteraemia rate for MSSA has remained remarkably constant in the last 5 years, but bacteraemia due to MRSA has appeared and is increasing every year. In 1998 MRSA bacteraemia represented 52% of the total *S. aureus* bacteraemia identified. The majority of the MRSA bacteraemia (84%) was acquired in hospital, whereas 54% of the MSSA bacteraemia was community-acquired. Therefore, it appears that MRSA has become a major opportunist pathogen in the hospital in its own right. The spread of MRSA in the hospital from colonized patients and the presence of risk factors for infection, such as indwelling vascular lines or surgical procedures, is probably the cause of this.

VRE. The clinical impact of VRE is more difficult to assess, as enterococci are intrinsically less pathogenic than *S. aureus*. Nevertheless, many hospitals are beginning to isolate VRE from patients on wards where glycopeptide antibiotics are widely used, for example, haematology, transplant or intensive care units. Our own experience is that VRE are not uncommon isolates from clinical specimens, but we have had few patients in whom we have been convinced that it was a cause of infection. When we have felt that there is sufficient evidence of infection to treat the patient, there has usually been a persistent source of the organism, for example, a colonized indwelling vascular line (for patients with bacteraemia) or a colonized Tenckhoff catheter or intestinal perforation (in patients with peritoneal kidney dialysis-associated peritonitis).

Clostridium difficile. Another opportunist pathogen that emphasizes the interaction between antibiotic therapy, the environment and the susceptible patient is *C. difficile*. This organism is a major cause of antibiotic-associated diarrhoea in hospitals and has significant morbidity and mortality. However, patients must have a triad of risk factors before developing symptoms. First, they must be colonized with toxigenic strains of the organism. A small proportion of the population carries *C. difficile* as normal gut flora. Many more will acquire the organism from the environment soon after entering hospital, and we know that *C. difficile* spores may persist on surfaces for many months. Second, the patient must be susceptible to the action of the bacterial enterotoxins, and the elderly appear to be much more at risk than younger patients. Finally, the patient must usually be exposed to antibiotic therapy, particularly broad spectrum injectable cephalosporins, which kill many of the bacteria of the normal gut flora and allow overgrowth of *C. difficile*.

Glossary

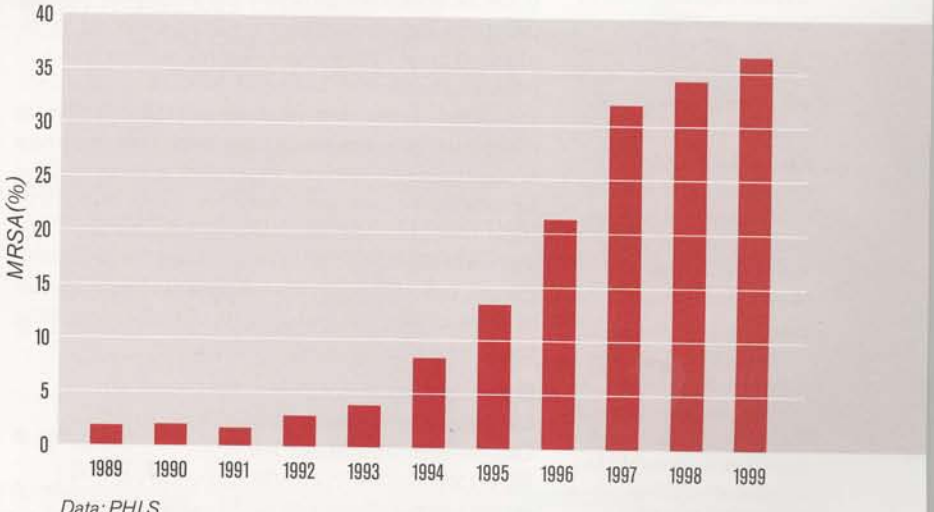
Bacteraemia
Presence of bacteria in the blood.

Indwelling vascular line
A line or drip inserted into a blood vessel to give fluids and/or drugs.

Mucositis
Inflammation of the mucosa of the gastrointestinal tract as a result of chemotherapy.

Neutropenia
A white cell count of $<1 \times 10^9$ per litre, usually as a result of chemotherapy.

MRSA from blood and cerebrospinal fluid (CSF)



Data: PHLS

Control strategies

For the opportunist organisms discussed above, control in hospital must take account of the pressure to select the organism, the care of the infected or colonized patient, and the prevention of spread of the organism to other patients. For prevention of transmission the most important factor remains handwashing, and this has been emphasized recently by a renewed national hand hygiene campaign to improve education among health-care workers. Perhaps one of the other most interesting areas is the role of antibiotic use in the selection of these organisms. It is well known, of course, that use of an antibiotic may encourage the emergence of resistance to that antibiotic or class of antibiotics. Alternatively, the use of an antibiotic may change the colonizing flora so that a different range of infecting organisms is seen. Sometimes, however, the connection is not so clear-cut. For example, the use of broad-spectrum injectable cephalosporins in hospitals has been linked to the emergence of *C. difficile* diarrhoea as a major concern. It has not been possible in individual studies to prove that cephalosporins are the primary cause, but several studies have now shown that it is possible to reduce the incidence of *C. difficile* diarrhoea dramatically by changing antibiotic prescribing practice to avoid these agents. Likewise, it has been suggested that the incidence of vancomycin-resistant enterococci may be reduced by avoiding the use of glycopeptide and cephalosporin antibiotics, the agents most likely to encourage the proliferation of these organisms. Looking to the future, control of vancomycin-resistant enterococci and the restricted use of glycopeptide antibiotics have been advocated as an essential prerequisite to the prevention of the emergence of vancomycin-resistance among staphylococci, and MRSA in particular.

Conclusions

It can be seen, therefore, that the pathogens causing infections in hospitals are constantly evolving to fill niches created by the ever-changing susceptibility of patients, the selective antibiotic pressure on organisms and spread of organisms from one patient to another in the hospital environment. In many respects the spectrum of opportunist infections we see now is a result of the treatments we have given patients. As we respond to these infections and medical treatment advances the spectrum of pathogens we encounter will continue to change. Infection control in hospitals is often described by those closely involved with it as fire-fighting. Who knows where the fire will break out next?

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Further reading

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Letters

Dear Editor

The new edition of the biennial publication *CRAC Degree Course Guide 1999/2000: Microbiology, Immunology & Biotechnology* was published in April. The purpose of the series in which this guide features is to help prospective undergraduates in their choice of degree course and institution. When I wrote about the guide in the August 1998 issue of *SGM Quarterly* (Vol. 25, part 3, p. 105), my main purpose was to alert members responsible for recruitment and admissions to be on the lookout for the request for revised information for this new edition.

In the normal course of events the guide would not come to the attention of members in this way for another two years. However, apart from its main intended readership, it may also be of interest to those of us involved in undergraduate teaching because it includes a table of information listing which of 20 topics are compulsory or optional components in the final year of some 100 degree courses. This information was introduced two editions ago. Although 20 topics does not provide the amount of detail that we might need because it was not drawn up with us in mind, it seems to be the only such summary available.

Copies are not always readily accessible within HE institutions. Therefore, as it is academic consultant on a strictly non-commission basis, I feel reasonably comfortable in mentioning that the 45-page guide (ISBN 1-8601-7619-4) is available through booksellers at £5.50 and by post (plus £1 p&p) from Client Services Department, Biblios Publishers Distribution Services Ltd, Star Road, Partridge Green, West Sussex RH13 8LD (Tel. 01403 710851; Fax 01403 711143).

Yours sincerely

■ *John Grainger, University of Reading*

Dear Sir/Madam

We are writing in recognition of the information on food preservation you sent us. It was very informative and we are grateful for your help. Our project in our Year Nine Science fair would not have ran smoothly without it. Many thanks.

We send a special thank you to you, for all the effort you put into selecting relevant information, sending things and also recommending other sources we could use. You were by far the most helpful company we wrote to, and our teacher was surprised at your efficiency in replying. We received the reams of information within three days of sending off for it.

Thank you again. We will be crediting you on our display board.

■ *Lucy Razzall, Gemma Gomersall & Alison Zander, The Blue Coat School. Egerton Street, Oldham, Lancashire*

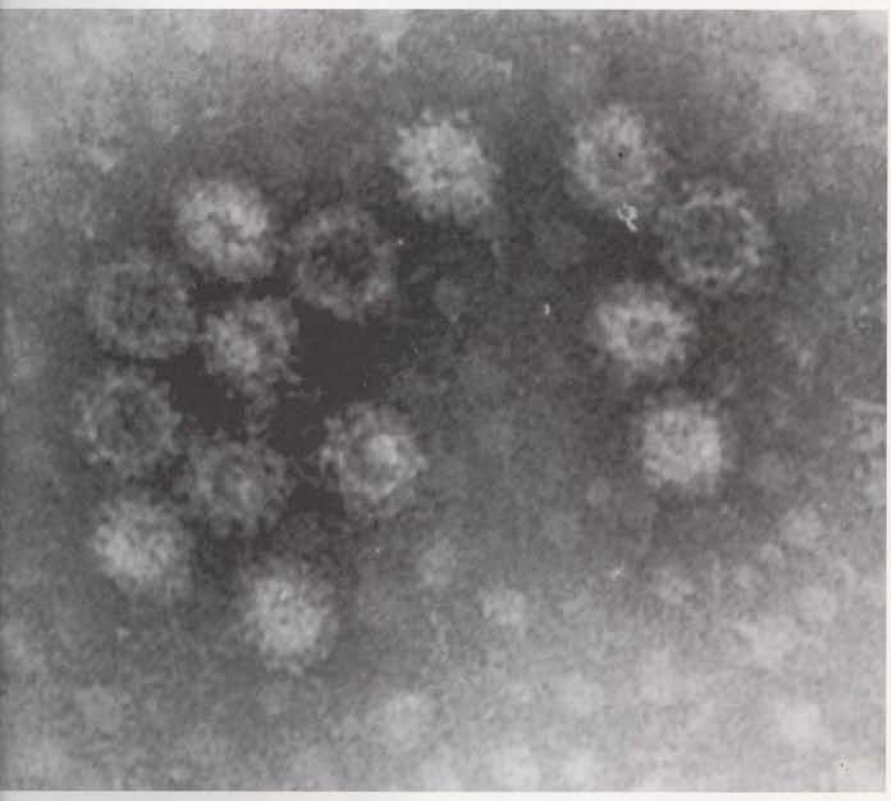
'Hyperemesis hiemis': new light on an old syndrome

I. Barry Vipond, E. Owen Caul, Paul R. Lambden & Ian N. Clarke

SRSVs are a significant cause of gastroenteritis which have only been identified in recent years. Now molecular methods are aiding the research into the transmission and diagnosis of these organisms.

Diarrhoeal illness in man is second only to respiratory disease in terms of morbidity and mortality. Despite original reports of a gastrointestinal illness termed 'hyperemesis hiemis' or 'winter vomiting disease' in 1929 by an American physician, it was not until almost 45 years later that a causative agent was identified for this syndrome. A further 25 years was to elapse before the full scale of the prevalence of the role of this agent in gastrointestinal infection was recognized.

This diarrhoeal disease was originally established in the USA as non-bacterial in origin with widespread outbreaks occurring primarily in families during the winter season. Numerous descriptive terms were subsequently coined by various workers, including 'non-bacterial gastroenteritis', 'epidemic vomiting disease' and 'acute infectious gastroenteritis'. A viral aetiology was suspected by the use of oral administration of faecal filtrates to human volunteers which reproduced the disease, fulfilling Koch's postulates. However, all attempts to isolate the viral agent in conventional cell and organ cultures failed. Despite comprehensive epidemiological studies allied to transmission of the agent to human volunteers, a specific aetiology (cause) for this gastrointestinal infection could not be established. This failure over many years hampered progress in identifying the agent causing worldwide epidemics.



BELOW:
Electron micrograph showing typical appearance of SRSVs. The virus particles are approximately 30 nm in diameter.
PHOTO: C. ASHLEY, PHLS

Identification of the infectious agent

However, in 1972, following an outbreak of gastroenteritis in a primary school in the USA, a small round 32 nm virus with a clearly resolved amorphous surface structure lacking geometric symmetry was eventually identified by electron microscopy. It was named Norwalk virus after the town in Ohio where the outbreak took place. Soon after, the widespread application of electron microscopy lead to the identification of a variety of other morphologically distinct small round viruses in stools. Some of these had no distinguishing structure visible in the electron microscope and were shown not to be associated with disease. Other small round viruses associated with gastroenteritis were identified and specifically named according to their definitive surface structure, including the astrovirus (five/six-pointed star) and the classic caliciviruses (cup-shaped indentations on the surface of the virus giving the appearance of the Star of David). Other viruses indistinguishable from Norwalk virus by electron microscopy were identified in stool samples from gastroenteritis outbreaks around the world and, as in the case of Norwalk virus, were named after the location of the outbreak, e.g. Hawaii, Montgomery County, Toronto, Bristol, Southampton and Desert Shield (Gulf War), to name but a few.

Classification of small round structured viruses (SRSVs)

Some order was brought to the recognition of the small round viruses with the introduction of a classification scheme in 1982. This lead to the use of the term small round structured viruses (SRSVs) to describe viruses structurally indistinguishable in the electron microscope from the original Norwalk virus, but clearly distinct from astroviruses and the 'classical' caliciviruses. In the UK, this scheme established the role of all the small round viruses as aetiological agents in non-bacterial gastroenteritis. As a result the SRSVs became identified as the most important cause of epidemic gastroenteritis in the UK and worldwide. The virus is known to affect all age groups in contrast to astroviruses and caliciviruses which are often the causal agents in sporadic cases of paediatric diarrhoea and uncommonly as causes of outbreaks.

Genome sequencing

Complete genome sequences are available for three human SRSVs: the prototype Norwalk virus and two from the UK, Southampton and Lordsdale viruses. Genome sequencing studies have revealed that SRSV genomes consist of approximately 7.5–7.7 kb single-stranded RNA, polyadenylated at the 3′ terminus. The genomes have three open reading frames (ORFs), including a large ORF encoding the non-structural proteins preceding a second ORF encoding a viral capsid

LEFT:
Aerosol spread by projectile vomiting!
COURTESY WILLIAM H.J. BUTTON

protein and a short 3′-terminal ORF that encodes a small basic protein of unknown function. SRSVs can be divided into two genogroups based upon comparisons of nucleotide sequences from various parts of the viral genome. All of these features have lead to the classification of the SRSVs within the *Caliciviridae*. However, on the basis of genome organization and sequence analyses, enteric caliciviruses with the classic morphology have been assigned to a separate genus within the *Caliciviridae*. The SRSVs remain clearly distinct from the classic human caliciviruses not only in terms of genomic characteristics and morphology but also in their epidemiology and immunobiology.

SRSVs have also been recognized by direct electron microscopy of faecal specimens from animal species. However, it was not until recently that the complete genome sequence for a bovine enteric calicivirus (Jena virus) was obtained. This clearly showed that this animal virus was closely related to the human viruses. Phylogenetic studies with Jena virus showed that it belongs to genogroup 1 (the same genogroup as the prototypical Norwalk virus). In contrast, a recent partial sequence analysis of cDNA obtained from the caecum contents of pigs detected the presence of viruses belonging to genogroup 2.

The recent characterization of SRSVs isolated from animal faeces demonstrates that these viruses are very similar to their human counterparts and raises intriguing questions about their zoonotic potential. It is likely that with improved methods of detection these enteric caliciviruses will be found widely distributed throughout the animal kingdom.

Transmission of SRSVs

SRSVs cause acute, explosive diarrhoea and/or vomiting and are highly infectious, with rapid secondary spread. Human volunteer studies established that the virus was spread through the faecal–oral route but this mode of transmission alone could not explain the explosive outbreaks documented. Subsequently, SRSVs were identified in vomit from affected patients. As vomiting (often projectile) is a common presenting feature of the illness, an additional mode of transmission became plausible because of the large numbers of virus particles present in vomit (>20 million ml^{-1}) and the aerosols generated in acute infection. The nature of sudden-onset diarrhoea and projectile vomiting means that environmental contamination occurs and this has been demonstrated recently. The infective dose is very low (10–100 particles) making transmission via aerosolized vomit a reality. Anecdotal support is provided by outbreaks where groups of people gathered together in enclosed spaces, e.g. on a bus, in a restaurant, on cruise ships and at wedding receptions, are ill following a vomiting incident, despite being distant from the event. Consequently, outbreaks have the potential to spread rapidly, and so semi-closed communities such as hospital wards, old people's homes, cruise ships and holiday centres are common sites of outbreaks. The consequences of outbreaks in health care have both financial and managerial implications. Ward closure often results from staff shortages due to illness and widespread infection.

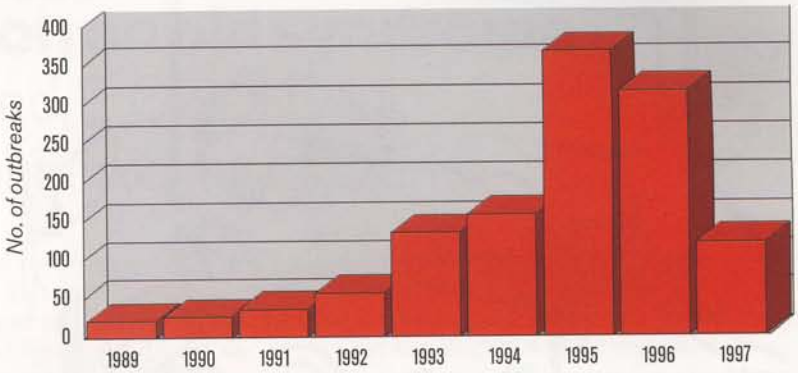
SRSVs in food

Another dimension of the impact of SRSVs is in the food industry. Point source outbreaks have been reported as a result of sewage-contaminated water used for bathing, drinking or preparation of food. Salads, sandwiches and other cold foods being prepared and contaminated by ill food handlers have been widely reported. Oysters, which are usually eaten uncooked, serve as a reservoir to concentrate SRSVs from contaminated estuaries or seawater where they grow. As a result the virus is delivered appropriately to the intestine of the unsuspecting diners. Consequently, amorous diners in search of the aphrodisiac properties of oysters on Valentine's Day are often left with a most unexpected moving experience some 24–48 hours later. With the increase in the scale of food production and ever-expanding distribution networks, the potential for large national and international outbreaks is inevitable.

Diagnosis – new methods

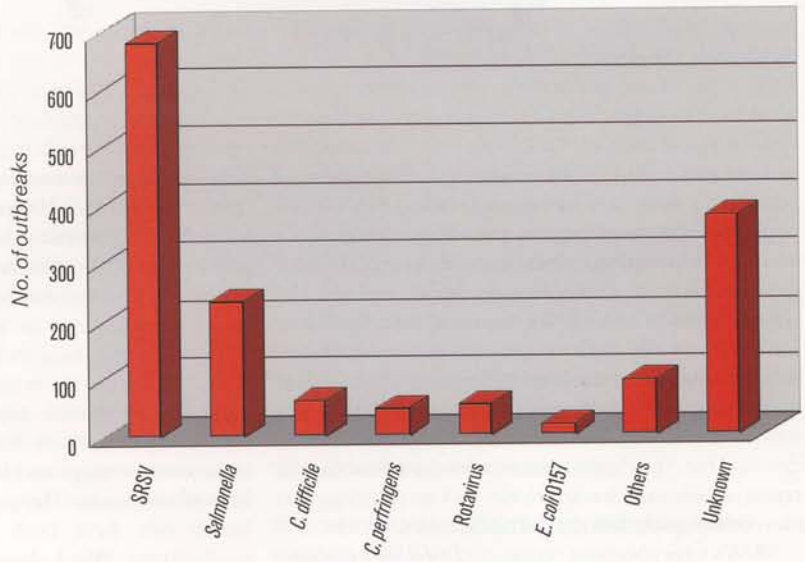
Although the role of SRSVs in gastroenteritis outbreaks is now well recognized, the scale of their involvement in the population has only recently been acknowledged in the UK. Routine diagnosis primarily relies on

SRSV positive outbreaks in England and Wales between 1989 and 1997



Data for 1996 and 1997 are provisional. Courtesy CDSC, CPHL Colindale

General outbreaks of infectious intestinal disease in England and Wales, 1995–1996



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electron microscopy since, in spite of intensive laboratory efforts, the virus cannot be cultured. Electron microscopy is relatively insensitive and is dependent on good timely sampling from acutely ill patients. More recently the advent of molecular techniques has allowed characterization of complete and partial genomes of several SRSVs. Methodologies based upon the polymerase chain reaction (PCR) have been applied to outbreak diagnosis. Although PCR has proved more sensitive than electron microscopy, the need to apply extensive 'clean-up' on patient specimens to obtain viral RNA of sufficient purity for analysis hampers its widespread use. Molecular assays are more technically demanding and are only suitable for relatively small numbers of samples and therefore cannot be applied in most laboratories. However, molecular epidemiology has revealed that the SRSVs can be divided into two broadly diverse genetic groups and that the diversity of strains has allowed characterization of large foodborne SRSV outbreaks affecting large geographical areas. The real benefit of molecular techniques, however, has only recently been realised. Cloned SRSV capsid genes can be expressed in cell culture systems leading to the formation of virus-like particles (VLPs) which are morphologically and antigenically representative of the real virus. In the absence of conventional virus culture these recombinant VLPs have allowed the generation of strain-specific immunological reagents which can be applied to simple diagnostic tests and sero-epidemiological surveys. Such epidemiological studies have been applied in many countries and reveal that most children have been exposed to SRSVs by 5 years of age. Although the disease symptoms can be distressing to the individual, they are relatively mild and clear quickly, and so probably go unreported in most cases. However, volunteer studies showed that immunity is strain-specific and short-lived, but the widespread occurrence of the disease in conjunction with the antigenic diversity of SRSVs and the low infectious dose means that numerous episodes of exposure and illness should be expected in the lifetime of an individual.

● *Dr Owen Caul is Consultant Virologist and Dr Vipond is a Clinical Scientist at Bristol Public Health Laboratory, the Regional Virus Laboratory for the South West Group of the Public Health Laboratory Service.*

● *Professor Clarke and Dr Lambden are in the Virology Group of the Division of Cell and Molecular Medicine at the University of Southampton School of Medicine.*

Phytophthora – an abiding threat to our crops

Jim Duncan

Late blight caused the Irish Potato Famine in the 1840s, but as Jim Duncan describes, the dangers from this plant pathogen to food crops today are still significant.

ABOVE:
Close-up of typical blighted leaves.
PHOTO COURTESY SCOTTISH CROP RESEARCH INSTITUTE

BELOW RIGHT:
Detachable sporangia of *P. infestans* viewed under microscope. Bar, 20 µm.
PHOTO COURTESY SCOTTISH CROP RESEARCH INSTITUTE

The Irish Potato Famine in the mid-1840s is still the most vivid example of the damage that can be wrought on plants and human society by the depredations of a plant pathogen. The almost complete destruction of the potato crop in a country that had come to depend on it as the chief staple, and inadequate responses to the subsequent food crisis by government at all levels, led directly to the deaths of over a million people and the emigration of many more. Between 1841 and 1861, the population of Ireland fell from 8.2 million to 5.8 million. The famine also occasioned fundamental shifts in Irish nationalism and politics that echo to this day.

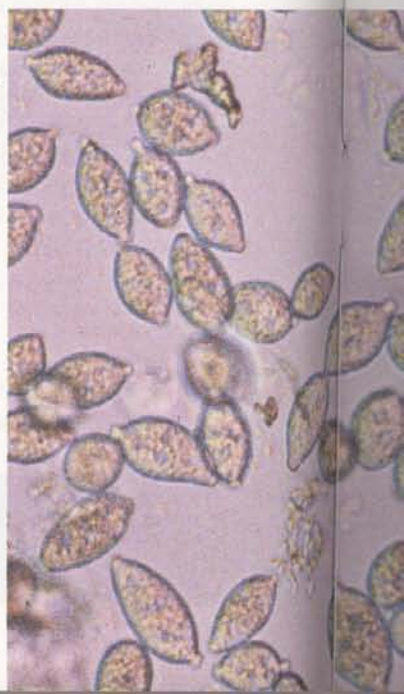
Late blight of potato, as the disease is known, has remained in Europe ever since. Moreover, just as import of infected potatoes probably brought the disease to Europe in the 1840s, exports of infected seed potatoes from Europe led to further spread to all other parts of the world, including the Andes of S. America, the original home of the 'Irish' potato. Ironically, the disease does not appear to have originated in the Andes but in the mountains of central Mexico, home to many wild potato species.

Late blight is caused by the 'fungus' *Phytophthora infestans*. Although in everyday parlance *Phytophthora* is a 'fungus', it does not actually belong to the Kingdom *Fungi*, to which the majority of fungi are consigned. Rather it belongs in the Kingdom *Straminipilia* along with various groups such as the brown and golden brown algae. There are around 60 *Phytophthora* species, most of which are of considerable economic or environmental importance. Fairly typical is black pod of cocoa caused by *P. palmivora*, *P. capsici* and *P. megakarya*, which together caused an estimated loss of US$300 million in 1982 and more recently have been behind scares about shortages of chocolate. Large areas of rare, world heritage forest ecosystems in Western Australia have been killed by *P. cinnamomi* (Jarrah dieback). The fungus attacks numerous species in the forest, killing many of the unique herbaceous understorey plants, shrubs such as the spectacular banksias, and the dominant eucalypt *Eucalyptus marginata*. Many more examples could be quoted for the range of plants attacked by *Phytophthora* is enormous. Some species have very broad host ranges, although others have very narrow ones.

Nevertheless, *P. infestans* is undoubtedly the best known and most investigated *Phytophthora* species and it deserves to be! Even today, with modern potato varieties having some resistance to the disease, and effective fungicides, the costs of losses to potato late blight and of controlling it are enormous. Estimates vary considerably but a common figure is US$3 billion per annum worldwide. In an average year, farmers in Europe will spray up to eight times to control blight at a cost of £150 per hectare; in the disease-favouring climate of the tropical highlands this can rise to as many as 30 sprays a year. And *P. infestans* is not confined to the potato: it can infect many relatives of the potato, including tomato and aubergine. On a recent trip to Ecuador I saw spectacular damage to plantations of the tree tomato, so severe that one grower had dug up and burned all his plants.

Late blight until 1980

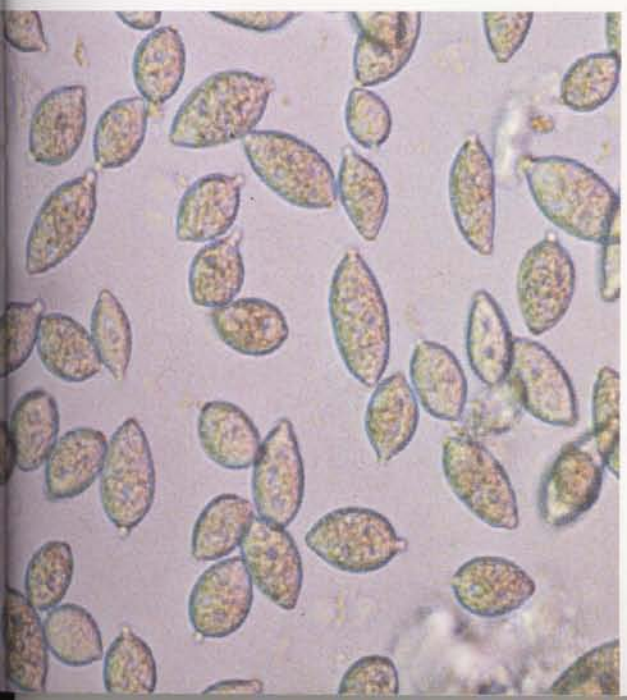
From the late 1840s until the early 1980s, farmers learned to live with late blight. The discovery of Bordeaux mixture by Millardet in France in the 1880s heralded a new era of control by chemicals, for although developed for the control of grape downy mildew, it was effective against late blight. In the 1930s, discovery of the dithiocarbamates gave the first effective organic fungicides. Later, plant pathologists were able to develop forecasting systems to tell farmers when to begin spraying with fungicides, from knowledge that successful infection was critically dependent on the presence of free water on the foliage, and on high humidity around the leaves and moderate temperatures for a period thereafter.



ABOVE:
Two views of a field of susceptible Bintje unprotected by fungicides. The upper photograph was taken in early August and some blight is visible. The lower photograph was taken 10 days later.
PHOTO COURTESY SCOTTISH CROP RESEARCH INSTITUTE

Some of the early potato varieties that survived the first onslaughts of disease in the 1840s proved to have some resistance and breeders used these to develop new, more resistant varieties. The protection offered by resistance was far from complete but it was useful. A dramatic breakthrough came when breeders turned to some wild species from Mexico as sources of resistance, which they were able to introgress into *Solanum tuberosum*. The results were spectacular: the resulting material was immune to late blight. Alas, it proved a false dawn. When new immune varieties were finally released to commercial cultivation, the fungus quickly adapted to overcome the resistance, and they became as susceptible as more conventional material. Later, scientists around the world, most notably Dr William Black of the Scottish Plant Breeding Station at Pentlandfield near Edinburgh (now part of SCRI in Dundee), worked out that the wild species from Mexico had 'race-specific' resistance. It transpired that the fungus exists as a series of races and the most common race in the early part of this century could not overcome the race-specific resistance introduced from Mexico. But when the breeders introduced a variety with a new race-specific resistance, a race emerged within a few years that could overcome it: a biological arms race. Eventually, breeders abandoned breeding for this form of resistance, partly because control by fungicide was by then very good and relatively cheap, and partly because they had decided to try to breed instead for durable field resistance. This is not based on a single gene but on many genes acting in concert. It is not race-specific and should not be overcome. On the other hand it is not usually as complete as race-specific resistance when the latter is effective, and developing it is a long haul for the breeder because of the number of genes involved.

While all this was going on, much more had been learned about the biology of the fungus. First, American and Mexican scientists had discovered that at its origins in central Mexico, the fungus is pathogenic to the same wild species used in early resistance breeding in Europe. In Mexico the fungus exists as two mating types, A1 and A2, both of which are needed for sexual reproduction. The ratio of A1 and A2 was about 50:50, strongly suggesting that sexual reproduction was important in the Mexican life cycle. The product of sex is a thick-walled spore, the oospore, which unlike all other structures formed by the fungus can survive well in soil, probably for many years. Thus in Mexico each year, the epidemic was begun from oospores in soil and not from dormant infections in seed tubers. The disease now had a soilborne dimension.



Late blight today

At this point in the story only the A1 strain had been found outside of Mexico: in other countries the fungus had no sex life, and no soilborne dimension. There the position would have remained till today but for the summer of 1976, which was was hot and dry across most of Europe. The largely unirrigated potato crop failed leading to shortages and high prices. Consequently, import restrictions were relaxed to allow imports of potatoes from other countries, including large tonnages from Mexico. With them came many new strains of late blight, including the other mating type A2. In retrospect, what existed before 1976 outside Mexico had been a unique situation. Genetic fingerprinting has shown that then, all non-Mexican isolates of the fungus had a single fingerprint: the fungus was to all intents and purposes a single 'clone' throughout the world but for Mexico. Apparently, the same clone had devastated the potato crop throughout Europe in 1845/46 and done so much damage since.

It took until 1984 for the world to become aware of the changed situation. Hans Hohl in Switzerland reported that while carrying out a routine laboratory teaching exercise with undergraduates, he had discovered that some isolates of *P. infestans* collected from his garden were A2 mating type. At more or less the same time, reports started circulating of earlier and more severe attacks of late blight, stimulating a period of intense research.

The new population turned out to have many different fingerprints, and various proportions of A2 strains,

depending on where the samples were collected. It also appeared to be more aggressive, causing larger lesions with more sporulation than the original population, although there is still some debate about this. What is not in dispute is that the new population displaced the old population throughout most of Eurasia, beginning in the Netherlands in the 1980s and gradually spreading eastwards through the 1990s to reach Korea and Japan. Similar changes in North American populations have occurred over roughly the same period of time, but with the added complication that there probably have been several introductions, some of them on tomato.

Dutch workers have shown that the new population is undergoing sex and producing oospores. This may lead to earlier and more intense epidemics as oospores infect shoots before they emerge from the soil. In addition, fields will remain infested between crops as oospores can survive for years in soil. It may be necessary, for example, to lengthen the period between crops in a rotation if oospore inoculum becomes a greater problem.

The changes in blight populations have not only led to increased research on the pathogen, they have renewed interest in breeding for resistance. Needless to say an increase in diversity has led to an increase in the number and complexity of races and breeding for race-specific resistance would be a waste of time. This is where the alternative strategy initiated by Bill Black back in the early 1960s has begun to pay off. Some of the varieties bred at the Scottish Crop Research Institute have high scores for resistance, i.e. scores of 7 or 8 on a scale of 1–9. There is no indication that this resistance is race-specific. Some have already been grown in organic systems and have performed very well without the protection afforded by fungicides.

The developing world and GILB

When the risk of new populations became widely apparent in the early 1990s, the International Potato Centre in Lima, Peru (CIP) took a keen interest. CIP has done a tremendous job promoting the potato throughout the tropical highlands of the world. From the early sixties until today, production of this popular, nutritious and relatively simple to grow crop in the developing world has expanded from about 6% to just over 30% of the world total.

Not unnaturally, CIP saw the emergence of new blight populations as a particular threat to farmers and peasants growing potatoes in the developing world, given the expense of fungicide control. CIP therefore led the formation in 1996 of the Global Initiative on Late Blight (GILB). This is a 10 year programme of research and development that aims to produce cultivars suitable for growing in the tropics, with high levels of durable blight resistance. One of the first results is a multi-site trial in 10 countries from the tropics to high latitudes. Fourteen varieties with varying levels of resistance, half tropical and half from developed countries, have been grown in each country and ranked for their resistance against a wide diversity of local strains. It is pleasing to report that the varieties ranked more or less the same for late blight resistance regardless of the blight population and the environment at each site, strongly suggesting that what appears durable in the laboratory may also be durable in the field. This is only the first step in attempts to introduce and popularize blight-resistant potatoes which do not require fungicide treatment, but it is a promising one.

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Airborne spread of foot-and-mouth disease

Alex Donaldson

Foot-and-mouth disease is one of the the most important diseases of farm animals in the world. Alex Donaldson describes how computer models can be used to predict and thus control its spread.

Foot-and-mouth disease (FMD) virus, a member of the Picornaviridae family and the first animal virus to be identified just over 100 years ago, infects a wide range of cloven-hoofed animals, both domesticated and wild. It causes an acute disease characterized by the development of vesicles on the feet and in and around the mouth. Affected animals become severely depressed and quickly lose condition. The milk yield of dairy animals drops precipitously and animals used for ploughing or transport are incapacitated through lameness. Mortality among adult animals is rare but in young animals it can be high, sometimes up to 100%, due to severe myocarditis leading to heart failure. During an epidemic in Tunisia in 1989–1990 more than 51,000 lambs succumbed.

Most animals recover quickly but an important epidemiological feature is that up to 50% of some ruminant species may remain infected for months or even years. These carrier animals can initiate new outbreaks so it is accepted practice when an outbreak occurs in a country normally free of the disease that all the cloven-hoofed animals in an affected herd are slaughtered to ensure that no carriers remain.

Financial implications

Internationally, FMD is the most important virus disease of farm animals. This is due to the constraint it causes to trade in livestock and animal products. Countries free of the disease enjoy access to the world's markets but those infected are treated as pariahs and the opportunities for them to export livestock and animal products are severely curtailed. As a result countries free from the virus go to great lengths to ensure that it is kept out.

Farmers greatly fear FMD because of the devastating losses which can be expected when an outbreak occurs and the draconian measures required to eradicate the causal virus. An epidemic which occurred in Taiwan, Province of China, in 1997 graphically illustrates what can happen when the virus enters a densely stocked livestock population. Taiwan, which had been free from FMD since 1929, reported three outbreaks of the disease to the World Organization for Animal Health on 20 March 1997. Disease spread very quickly and in just over three months more than 6,000 farms were affected. Both culling and vaccination were used to control the epidemic. Around 4 million pigs were either slaughtered or died and an estimated 13 million doses of vaccine were administered. In addition to the direct costs of control and compensation, Taiwan lost its lucrative export trade in pig meat to Japan. The cost of the epidemic has been estimated at US$400 million in direct and US$3,650 million in indirect losses, i.e. US$4,050 million total.

Spread of FMD

FMD is most commonly spread by the transmission of virus in droplets from infected to in-contact animals. The rate of spread within a herd depends on the stocking density. Next in frequency is the feeding to animals of infected products such as meat or milk. Mechanical spread may occur when the virus is transferred by vehicles such as milk tankers, or by milking machines, people, etc. More rarely, disease may spread between farms, even those far apart. This requires special climatic and other circumstances. Following is a brief history of the evidence for the windborne spread of FMD and the research which has led to the development of computer models to predict the risk of that type of spread.

Airborne transmission

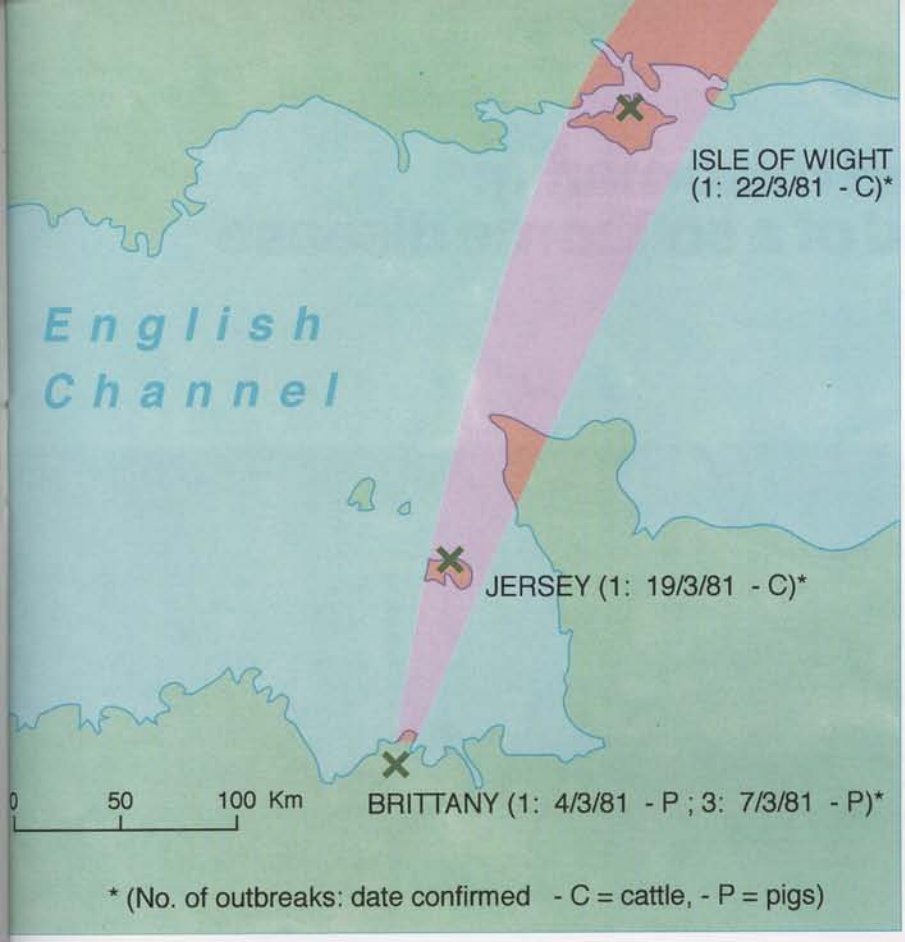
The potential for FMD to spread long distances has been recognized from early this century but the mechanism was not understood. In Denmark it was observed that outbreaks often followed the occurrence of those in northern Germany. It was proposed that spread was due to the carriage of virus by the wind. Similarly, outbreaks in the east and south-east of Britain frequently appeared soon after those in the Benelux countries. British authorities hypothesized that migrating birds were responsible. Work done in Britain during the last three decades resolved the argument and demonstrated that the long distance spread of FMD can occur simply by the transport of virus on the wind and without the involvement of birds.

Research findings from the 1967–1968 UK outbreak

Clarification of the mechanism of airborne spread of FMD came from epidemiological and meteorological investigations of epidemics in north-western Europe and from experimental investigations done primarily at the Institute for Animal Health (IAH), Pirbright. The devastating UK epidemic of 1967–1968, when over 2,300 farms were affected, with 300 being struck during the first three weeks, provided a fresh impetus for the investigations.

Studies at IAH, Pirbright, demonstrated that just before and during the acute stage of FMD infected livestock excrete airborne virus in their breath. All species of infected livestock excrete airborne virus for 4–5 days but pigs are notable for the vast quantities of virus they liberate. Ruminant species can excrete around $10^{5.1}$ $TCID_{50}$ of virus per animal per day when excreting maximally. By contrast a pig can release up to $10^{8.6}$ $TCID_{50}$ of virus during a 24 hour period. Even this is probably an underestimation since a certain amount of 'slippage' always occurs through air samplers.

The next finding of significance was that atmospheric relative humidity (RH) markedly influences the survival of airborne virus: in moist air virus is stable but in dry air it rapidly loses infectivity. The critical RH separating good from poor survival is 55%. Other atmospheric parameters have much less effect on virus viability.



LEFT:
Fig. 1. Location of outbreaks of FMD in France and the UK during March 1981 and the plume of airborne FMD virus from pig farms in Brittany simulated by the VPM–Rimpuff prediction model for the 24 hours before midnight on 8 March 1981.
COURTESY STEVEN ARCHIBALD, IAH, PIRBRIGHT

For example, sunlight causes little or no loss of virus infectivity in aerosols. Any effect of sunlight is probably indirect and through the generation of air currents which reduce the concentration of virus by physical dilution.

Computer-based models

Through collaboration between IAH, Pirbright, and the UK Meteorological Office, a computer-based model was developed during the 1970s for assessing the risk of airborne spread of FMD. It was created by bringing together data on the aerobiology of FMD with data on the physical behaviour of particles in the atmosphere under different climatic conditions. The model was shown to be capable of giving a prediction within a few of hours of the confirmation of an outbreak of FMD of whether there was a risk of spread and, if so, which farms were in jeopardy. The model could predict accurately up to a distance of 10 km from the source. Any farms considered to be at risk could be placed under intensive surveillance so that suspected cases could be quickly identified and eliminated. The model was used successfully under operational conditions during the outbreaks of FMD on Jersey and the Isle of Wight in March 1981.

Work continued to refine and improve the model. The next experimental objective was to determine the doses of airborne virus which can infect different species. Using natural aerosols of FMD virus produced by infected pigs the minimum doses capable of initiating infection were found to be remarkably low. Doses as low as $10^{1.0}$ and $10^{1.3}$ $TCID_{50}$ could infect a sheep and a steer, respectively. The minimum dose of natural aerosol to infect a pig has not been determined but some observations suggest that it is probably much higher than that for other species.

These experimental results, namely the high output of airborne virus by pigs and the extreme sensitivity of cattle to respiratory infection, provide an explanation for the findings of field studies where the pattern of spread of FMD over long distances has invariably been from infected pigs at source to cattle downwind.

The availability of a model called 'Rimpuff', developed at the Riso National Laboratory, Denmark, to simulate the spread of airborne radioactive particles and gases such as might occur following a nuclear accident, created the opportunity to improve the airborne prediction model for FMD. In a collaboration between IAH, Pirbright, and the Danish Meteorological Institute a virus production model (VPM) was developed and linked to Rimpuff. The VPM–Rimpuff system was validated using data from epidemics of FMD in France and the UK in 1981 as well as from the former East Germany and Denmark in 1982. A good fit was obtained between the spread predicted by the model and that which actually took place (Fig. 1).

The VPM-Rimpuff system is much more sophisticated than the earlier prediction model in that both short-range and meso-scale (up to 300 km) transmission can be modelled. It is also much faster, it can simulate simultaneous emission from several sources, as may occur during actual epidemics, and can be linked to geographical information systems and numerical weather prediction models.

In the event of an outbreak of FMD it would now be feasible for a veterinary service to operate the model and, if a risk of airborne spread was indicated, to deploy its manpower accordingly. It should then be in a good position to respond to any suspected cases at the earliest opportunity and prevent further spread of disease.

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Sugar-beet rhizomania: the spread of a soilborne disease

Mike Asher

Sugar-beet crops can be decimated by rhizomania, a disease caused by a virus, yet transmitted by a fungus in the soil. Although stringent control measures are in place in the UK to prevent its spread; severe economic losses are being experienced in other parts of the world.

Rhizomania disease of sugar-beet – so-called because of its 'mad root' symptoms – is caused by a virus (beet necrotic yellow vein virus) transmitted by a soilborne parasitic fungus, *Polymyxa betae*. *Polymyxa* species are members of a small group of zoosporic fungi that do not produce hyphae; indeed the debate continues as to whether they are truly fungi or more closely related to the protozoans. They infect by means of swimming spores which attach themselves to the rootlets and inject their contents (which may contain the virus) into the superficial cells. Here the fungus develops and differentiates to produce a further generation of zoospores which are released to infect neighbouring roots. Several such cycles of multiplication occur during the growing season. At some stage, however, usually in more mature plants, the fungus switches to producing thick-walled resting spores, which are released into the soil when the rootlets decay and can survive almost indefinitely, protecting the virus particles they contain. Virtually undiminished disease intensity has been recorded in fields in Italy where susceptible crop species had not been grown for 30 years. This longevity, unusual in soilborne fungal plant pathogens subject to the degradative activity of the general soil microflora, creates particular problems for disease management since eradication of the disease on a field scale is impossible.

The fungal vector

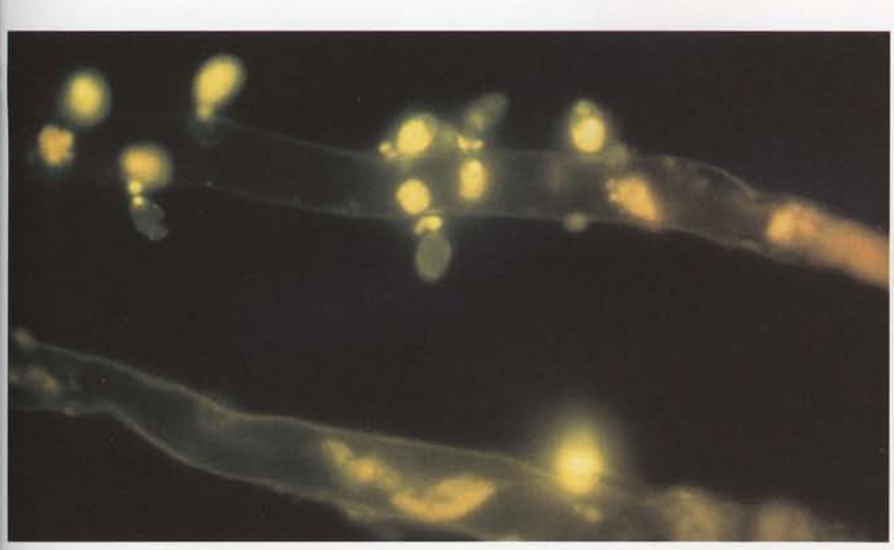
The fungus itself occurs in almost all fields worldwide where sugar-beet has been grown for any length of time. It is a relatively harmless root parasite. Only where the virus has been introduced does the growth of the plant root become severely damaged, with yield losses of up to 80%. However, the fungal vector plays the key role in the build-up and spread of the disease. Sugar beet is its only major arable crop host and there is effectively no multiplication in the soil in the absence of this crop. Experiments carried out in the Netherlands have shown an increase in soil inoculum (virus-containing spores per gram soil) under sugar-beet crops of 10^4-fold in a single growing season and 10^6-fold over two growing seasons. This is despite the fact that only about 10–15% of fungal spores contain detectable virus, even in the most severely diseased areas. In normal practice, sugar-beet is grown every third or fourth year in the crop rotation and experience has shown that it takes approximately two to three beet crops from the time a field is first contaminated to multiply up inoculum sufficiently to cause obvious symptoms in the plants depending, of course, on the initial level of contamination. This long 'latent period', of at least 5–10 years, during which agricultural activity proceeds unchecked, is a major factor in the spread of rhizomania.

Table 1. First records of rhizomania in different countries

1950s and 1960s		1970s		1980s and 1990s	
Italy	(1952)	Yugoslavia	(1971)	Hungary	(1982)
Japan	(1965)	Greece	(1972)	USA	(1983)
		France	(1973)	Switzerland	(1983)
		Germany	(1974)	Bulgaria	(1983)
		Czech. Rep.	(1978)	Netherlands	(1983)
		China	(1978)	Belgium	(1984)
		Austria	(1979)	UK	(1987)
		Romania	(1979)		
		USSR	(1979)	Sweden	(1997)

Spread and occurrence of the disease

Historically, the disease was first officially recorded in the Po valley in Northern Italy in 1952, though anecdotal evidence suggests that it had been present in this region at least since the second world war. Subsequently, the disease was recorded in Japan (1965) and, during the 1970s and early 80s, increasingly throughout Europe (Table 1). Though difficult to establish unequivocally so long after the event, much of this long-distance international spread is thought to have been due to seed being contaminated with infested soil. The Po valley was one of the world's major sugar-beet seed-producing areas during this period and many of these crops were unknowingly grown on rhizomania-infested fields. Unprocessed raw seed carries



OPPOSITE PAGE:
Fig. 1. The 'mad-root' symptoms of rhizomania disease.
IACR-BROOM'S BARN

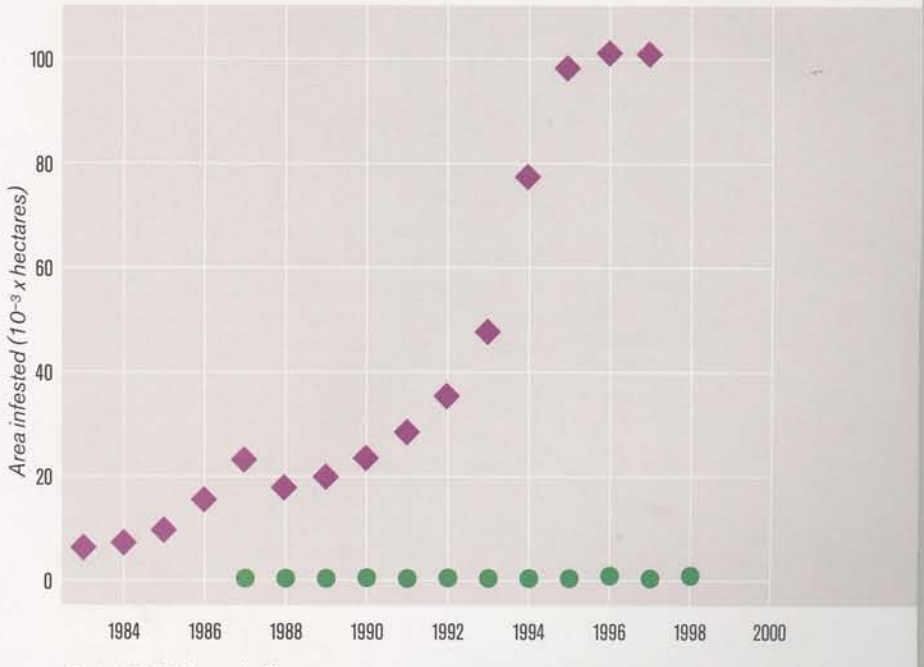
THIS PAGE:
Fig. 2. *Polymyxa betae* zoospores infecting sugar-beet rootlets.
IACR-BROOM'S BARN

much dust and soil and, although seed destined for the production of commercial root crops is cleaned, processed and treated with fungicides prior to use, the seed used by plant-breeding companies for performance and breeding trials often was not so treated. In the USA, rhizomania was first discovered in 1983 on a small breeder's trial plot in California and within 5 years had spread to 30,000 hectares! The virus has never been detected within clean seed and repeated efforts to transmit the virus by means of vectors other than *P. betae* (e.g. insects and nematodes) have failed.

What has been demonstrated, however, is that movement of even small amounts of contaminated soil by whatever means has the potential to spread the disease. Again, studies in the Netherlands have shown that as little as 5 kg of rhizomania-infested soil spread over a 1 hectare area of a field is sufficient to generate uniformly severe symptoms in a sugar-beet crop within two growing seasons. Clearly, therefore, even a few grams would be sufficient to initiate the small patches of disease that normally appear when rhizomania first shows up in a field. Throughout the world sugar-beet tends to be grown in intensive arable areas and large-scale machinery is often used in the cultivation and harvesting of the crop. Furthermore, the harvested roots have to be transported to a central factory for processing and sugar extraction. All of this results in considerable movement of soil from field to field and from farm to farm. Also, waste soil and water accumulated at factories, from washing the roots prior to processing, has to be disposed of. In most countries this not inconsiderable amount of waste (1 million tonnes of soil per annum in the UK alone) finds its way back on to agricultural land. In Japan, this practice is known to have played a major role in contaminating a large part of the sugar-beet-growing area in 1975. Irrigation also contributes to spreading the disease in many areas of the world by re-cycling contaminated drainage water, since the fungal resting spores are readily dispersed in this way.

In most countries where sugar-beet is grown, the disease has been established too long or has already spread too extensively for any measures aimed at limiting further spread to be worthwhile. Instead, reliance is being placed on growing recently introduced sugar-beet varieties that have partial genetic resistance to the virus. As a result the disease has spread very rapidly in many countries in recent years. The total infested area in Western Europe, for example, increased from 245,000 hectares in 1993 to 530,000 hectares in 1997. In France, where surveys have recorded the diseased area each year, rhizomania increased from 6000 hectares in 1983 to 101,000 hectares in 1996, where it has subsequently stabilized (see Fig. 3). By contrast, countries with a cooler, maritime climate, such as the UK and Sweden, exhibit a much slower rate of spread; indeed some of these, such as Denmark and Ireland, have yet to record the disease. This is because both fungus and virus are favoured by warm soil temperatures, the optimum being 25°C.

Fig. 3. Annual area affected by rhizomania in France (◆) and the UK (●)



Data: IACR-Broom's Barn

Control measures

In the UK, since the first recorded outbreak in 1987, strenuous efforts have been made to slow disease spread. Rhizomania is a notifiable plant disease under statutory control. As part of the policy of containment operated by MAFF, for example, imports of plant material that might carry soil (e.g. seed potatoes for planting) must come from certified rhizomania-free areas, and used agricultural machinery is required to be steam-cleaned at the port of entry. Soil limits are imposed on all vegetables, including potatoes, imported for consumption and controls placed on any waste material arising from their subsequent processing in this country. Import controls

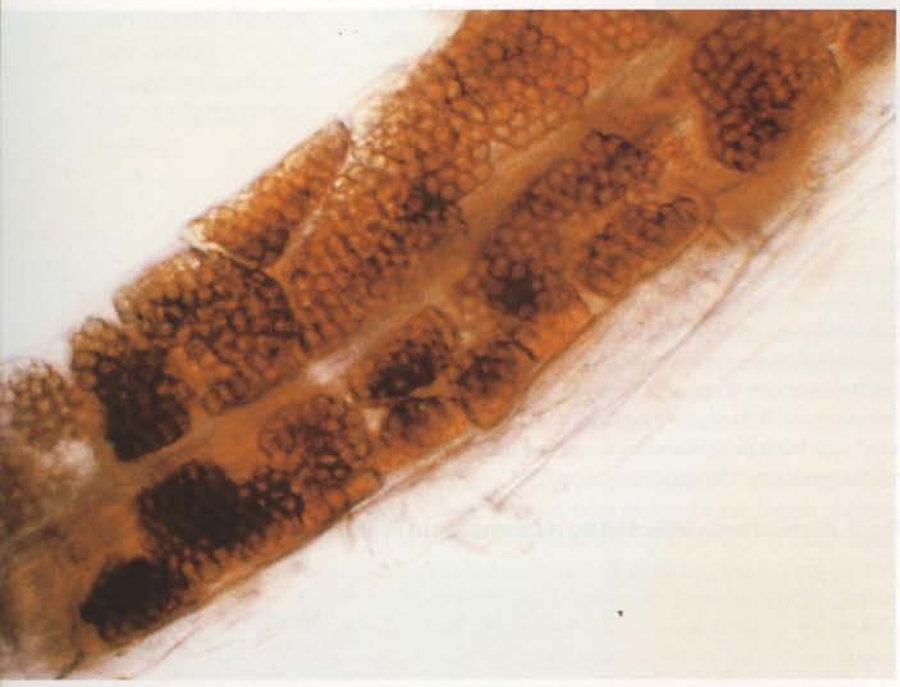


Fig. 4. Cystosori in sugar-beet root cells.
PHOTO COURTESY MIKE ASHER

are considered essential since evidence from studies of molecular variability within the virus genome suggests that the isolates present in this country are likely to have originated from at least two different areas in continental Europe. Within the UK, extensive surveys are carried out each year and any infected sugar-beet crops, or parts of crops, are destroyed *in situ*. Further sugar-beet cropping on affected fields is prohibited. These measures, along with the very limited use of irrigation on the crop and the disposal of factory waste soil only to non-arable land, have made a substantial contribution to reducing the rate of spread of the disease. Only 4000 hectares, less than 1 % of the total UK sugar-beet-growing area, have been affected since the disease was first recorded 12 years ago, and these are largely restricted to the East Anglia region.

The future

Rhizomania has become a major economic problem for the sugar-beet industries of most countries where the crop is grown in only the last 20 years. Increased intensity of cropping and the scaling-up of production methods have encouraged its multiplication and spread. The ease with which the agents are transmitted in soil, their almost indefinite persistence and the long incubation period before crops show symptoms of the disease, all contribute to its continued, inexorable spread. Ultimately, it is likely that almost all the world's sugar-beet-growing land will be contaminated with the virus, as it is already with the fungal vector. However, virus-resistant varieties have become very widely grown over the last few years, and are likely to provide the long-term solution to the problem. Indeed, rhizomania resistance will eventually become an essential prerequisite to successful sugar-beet production. Once again, plant breeders have risen to the challenge of a major disease threat with an economically and environmentally acceptable solution.

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Q for query

Ulrich Desselberger

Q Fever (Q for 'query') is an infection caused by *Coxiella burnetii*, an obligate intracellular parasite of the *Rickettsiaceae* family, first described in Australia in 1937. *Coxiella* develops in phagolysosomes and forms spores which are transmitted, after cellular lysis, by contaminated aerosols. There is phase variation, phase I being the natural form and phase II an avirulent form which emerges after serial passage in embryonated eggs. Plasmids are also associated with the micro-organism and to some extent correlate with disease. After inhalation, *C. burnetii* grows in the lung of humans, and rickettsemia follows, presenting various clinical symptoms.

The incubation period is 20 (14–39) days. Q fever is usually signified by an acute fever, severe headache and other influenza-like symptoms which may be self-limiting, although an atypical pneumonia often develops. More rarely, a chronic infection may arise leading mainly to endocarditis but also hepatitis. Central nervous system complications are not infrequent. For pneumonia tetracycline is the treatment of choice. In cases of chronic infection, long-term antibiotic combination therapy (doxycycline, trimethoprim-sulfamethoxazole or rifampin) is used.

Diagnosis

The diagnosis is initially by complement fixation tests (CFT) against phase I and phase II *C. burnetii* antigens, phase II antibody rising quickly after the acute infection and phase I antibodies developing when chronic infection is established. Testing of CFT-positive sera for immunoglobulin M (IgM) antibody by indirect immunofluorescence tests (IFT) using smears of formaldehyde-inactivated antigen (*C. burnetii* phase II), combined with the use of sequential serum specimens from patients with a known date of onset of illness, has shown that specific IgM titres persisted for more than 6 months in the majority of cases and are therefore not a sufficient criterion for the diagnosis of recent infection. However, it was shown that the antibody titre ratio (IgG/IgM) and the ratio of IgG antibodies with or without treatment with 8 M urea before testing, indicated that the relative avidity changed significantly after infection; the titre ratios can therefore be used to estimate the time point of infection. The IgG response is mainly of subclass IgG1 throughout the time, clearly showing affinity maturation in this subclass.

Transmission

C. burnetii is a zoonosis and endemic throughout the world. It is transmitted to man mainly from chronically infected animals (cattle, sheep, goats, rodents, cats, etc). Particularly high infectivity titres of *C. burnetii* (10^9–10^{10} infectious doses per gram of tissue) are found in foetuses and placentae. The ability of the micro-organism to form spore-like structures explains its resistance to drying and its ability to survive in these materials for many months. Infection of animals and humans is mainly by inhalation of contaminated aerosols, although transmission by contaminated milk or straw/manure has also been reported. The infectious dose for animals and humans is very small, one to five organisms being sufficient. Numerous Q fever outbreaks have been described, and the main sources of infection are soil contaminated by chronically infected sheep or cattle, and aerosols.

The exact sources of many outbreaks, including several large recent ones in the UK, have not, however, been clearly identified. Endemically infected animals are the main source, but direct contact with animals by infected humans often cannot always be established. Following the Birmingham outbreak of 1989, the largest in the UK, it has recently been suggested that a combination of outdoor lambing and calving and particular weather conditions can create and transport contaminated aerosols to infect large numbers of people in conurbations several miles distant from the likely point source of infection. Two other recent outbreaks in Germany and France have also been judged to be caused by windborne spread of *C. burnetii* spores.

Outbreaks of atypical pneumonia in whatever environment (rural or urban) should guide the physician's attention to the possibility of *C. burnetii* being the causative agent.

Dr Ulrich Desselberger of the Public Health Laboratories Cambridge and Oxford, is a member of SGM Council

Further reading

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The United Kingdom National Culture Collection (UKNCC): microbiological resources to meet your needs

David Smith

The UK culture collections have recently undergone a stringent review. David Smith describes the new system that is now in place and the services that are available from the UKNCC.

It is over 50 years since the network of UK national collections was first established, placing collections of organisms at centres of expertise and embedding them in research and development areas based on the use of the organisms they held. Over the years the collections have increased their holdings to more than 70,000 microbes and cell lines. These play an important role in preserving the results of microbiological research and providing the tools for biotechnology. During the late 1980s it became clear that the collections were not being used to their maximum potential. A UK Government-sponsored review was set up to assess the collections and identify ways of developing their activities to provide better support for user groups. The review recommended central co-ordination of the collections by establishing a federal UK National Culture Collection (UKNCC) under the aegis of the Biotechnology and Biological Sciences Research Council (BBSRC). The CABI Bioscience Genetic Resource Collection has been playing a key role in the implementation of the UK Government's strategy for UK microbial collections over the past three years. This initiative co-ordinates some of the activities of nine National Collections (one on two sites) under the UKNCC. However, the collections still retain their own identity and their existing relationship to their current funding bodies. Three specific initiatives are under way:

- to improve the profile and marketing of the collections;
- to fund a molecular characterization programme;
- to establish an animal virus collection.

The collections are co-ordinated through a Memorandum of Understanding, which commits collection staff to continuing collaborative research, co-ordinated marketing and cataloguing and joint development of new products and activities. This aims to support the continued survival of this vast and unique resource that underpins scientific development not only in the UK but worldwide. The project came to fruition during the first quarter of 1999. The web site was launched in the first week of January and the microbiological community contacted through brochures and flyers produced to publicize the holdings, source, property and uses data and supporting services available. A public launch of the UKNCC was held at the SGM Meeting in Edinburgh on 15 April 1999.

Key activities of the initiative

- Establishment of a distributed electronic database
- A unified marketing strategy
- Collaborative research
- Implementation of a UKNCC Quality Management System
- A single point of contact: The UKNCC website (http://www.ukncc.co.uk)

These key activities have led to improved access to the catalogues and strain data of the UK public service collections by establishing a mechanism for the user to search collection databases on the UKNCC website. Mechanisms are in place to update the catalogues as data are added and new strains become available from the collections. Internet access to strains and information is backed up by brochures giving details of other services provided by the collections. These publications are distributed through mailings with journals and at key scientific meetings worldwide. Raising the profile of the UK collections enables microbiologists to discover how these long established biological resource centres can help to support research and development. By operating to uniform standards and providing quality products, the UKNCC is striving to improve the service the member collections provide and to make it easier for microbiologists to use these services. In turn, the long-term sustainability of the collections themselves depends upon the microbiologist using the expertise and resources within the collections. Visiting the UKNCC website provides not only a catalogue but also a huge resource of information on growing, preserving and the safe handling and distribution of organisms.

The UKNCC organisms and services

The collections hold strains of algae, bacteria, bacteriophages, filamentous fungi, mycoplasmas, plasmids, protozoa, animal and plant cell lines and yeasts. They are supplied as reference strains, starter cultures and production strains, and some have specific uses in microbial resistance test strains. In addition to the supply of pure authenticated organisms, the collections accept deposit of published, safe confidential and patent strains, and offer preservation, identification and training services.

The UKNCC member collections

- CABI Bioscience UK Centre (Egham), formerly the International Mycological Institute
- Culture Collection of Algae and Protozoa (freshwater)
- Culture Collection of Algae and Protozoa (marine algae)
- European Collection of Cell Cultures
- National Collection of Pathogenic Viruses
- National Collection of Industrial, Food and Marine Bacteria
- National Collection of Pathogenic Fungi
- National Collection of Plant Pathogenic Bacteria
- National Collection of Type Cultures
- National Collection of Yeast Cultures

The role of public service collections

The public service culture collection is charged with several tasks:

- the *ex situ* conservation of organisms;
- custody of a national resource;
- provision of a living resource to underpin the science base;
- receipt of deposits subject to publication;
- safe, confidential and patent deposit services.

Collections are in a unique position as custodians of *ex situ* genetic resources and therefore have a key role to play in the conservation of genetic resources. Biologists who collect organisms for their research and publish information on them should make their most important strains available for confirmation of results and future use. Collections add value to received and collected biological material. This is done through purification, expert preparation, authoritative identification, description, determination of biochemical and other characteristics, comparison with related material, safe and effective storage/preservation, evaluation of value for biological control uses, and indication of importance of beneficial and detrimental attributes. They often provide samples of deposited organisms free of charge to the depositor and participate in capacity-building projects to help establish facilities and expertise in-country to maintain *ex situ* collections. Operating within the spirit of the Convention on Biological Diversity, UKNCC seeks to protect the rights of the country of origin of organisms in its collections. Depositors of strains benefit from the added value, secure storage of their isolates and, in particular, relief from the burden of distribution and ensuring the continued availability of the strain.

Provision of strains and expertise underpins science

Collections have been the source of many technical and systematic publications and provided organisms that have underpinned several new scientific hypotheses and discoveries. For example, a 'new' cucumber disease caused by an *Agrobacterium* sp. causing root proliferation has recently come from nowhere to be regarded as the most serious disease in UK crops. The National Collection of Plant Pathogenic Bacteria (NCPPB) showed that the pathogen was identical to NCPPB strains isolated sporadically over the last 25 years, proving that it is not new, merely adapted to the current ways of growing cucumbers in rockwool. This fact has enabled NCPPB to suggest control means perhaps much more quickly than if there had been no previous record.

The UKNCC member collections cover a wide range of micro-organisms and their activities often lead the way in many fields. Most people are only aware of the yeasts used in brewing and baking. In fact, over 800 different biological species have been described and thousands of different varieties are known to exist in all kinds of natural and artificial habitats. The National Collection of Yeast Cultures (NCYC) maintains a vital research and reference collection. Recent examples of the value of this collection include the identification of a new species of food spoilage yeast and the molecular characterization of emerging pathogenic yeasts of the genus *Saccharomyces*.

This spoilage yeast, isolated from wine and orange juice, has exceptional resistance to food preservatives and represents a significant economic threat. The organism, and the risks associated with it, are being investigated in a collaboration between NCYC and Unilever Research, Colworth. Virulent *Saccharomyces* yeasts are being analysed as part of a BBSRC-funded collaborative programme in comparative genomics with UMIST and the University of Oxford. Fundamental information concerning their evolution is having wide scientific impact, extending from the characterization of emerging microbial threats into biotechnological applications of yeasts and functional genomics. The NCYC collection and associated expertise in taxonomy and phylogenetic analysis are proving extremely valuable to such studies.

The UKNCC also supports medical research, particularly in the UK. The *Escherichia coli* O157 outbreak in Scotland gained wide media coverage and the organism was re-classified in ACDP Hazard Category 3. The National Collection of Type Cultures (NCTC) responded by making a non-cytotoxin-producing strain, NCTC 12900, available, which could be handled safely under Category 2 conditions for those requiring a strain of this organism for quality control purposes.

It is evident that the UKNCC has provided vital information and research tools in the past and will continue to do so. The struggle for survival of collections continues but together the UKNCC members will meet the challenges the future brings with relish. Why not visit the website and learn more about what the collections have to offer?

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SocietyNews

April Council Meeting

Council Officers

● The President reported that the Search Committee for a replacement for Charles Penn as General Secretary had recommended Alan Vivian, of the University of the West of England, and this was accepted unanimously by Council. Alan will take over at the end of Charles' term of office, at the Society AGM on 7 September. A profile appears on this page. Council also supported suggestions that the term of office of the Scientific Meetings Officer should be reduced to 4 years, and that for the Publications Officer to 3 years, and that the latter post should be renamed as Editor, Microbiology Today. Special resolutions to alter the Society's Articles of Association will be put to the membership at the AGM. The reason for the changes is to reduce the burden on individuals occupying these onerous positions, and to ensure a flow of fresh ideas for articles in *Microbiology Today*.

Student membership

● Council approved suggestions that postgraduate student membership of the Society should be made available worldwide, instead of being restricted to the European Union as at present. It was decided that grants would continue to be restricted to qualifying students from EU countries. Council also supported creation of a new class of student membership, for undergraduates at higher education institutions in the United Kingdom and Ireland. Special resolutions to change the Society Bye-Laws accordingly will be put to the membership at the AGM.

Antibiotic resistance

● It was noted that the special symposium on this topic at the Edinburgh meeting, and the related public event at the Edinburgh International Science Festival organized by staff of the External Relations Office at Marlborough House, had been very successful and well attended.

Finance

● The Treasurer presented the audited accounts for 1998, which showed a healthy state of affairs. The transfer of management of the Society's investment portfolio from Dresdner RCM Global Investors to Mercury Asset Management, referred to in the February issue of *Microbiology Today*, had been successfully completed.

IJSB

● Erko Stackebrandt, the Editor of the *International Journal of Systematic Bacteriology*, was welcomed to his annual visit to Council. He reported that the first year of the journal's publication by SGM had been a great success, and that after an initial delay, issues were appearing on schedule. For publication in the year 2000, it would be necessary to appear bimonthly rather than quarterly, because of the increase in numbers of papers. The title would also change, to the *International Journal of Systematic and Evolutionary Microbiology*, to reflect the increased coverage of eukaryotic micro-organisms.

● *Ron Fraser, Executive Secretary*

SGM Journals *on-line at last!*

Microbiology, *Journal of General Virology* and the *International Journal of Systematic Bacteriology* are now available on-line through HighWire Press of Stanford University, California. The sites (see box for the URLs) went live at 7 pm on Thursday 27 May, after a great deal of preparatory work. Do have a look.

At present, the sites have searchable article headers in HTML and full text article PDFs from January 1998 up to the current issues. PDFs for 1997 will be added next. The sites also contain header and table of contents information for many (but not all) papers from a number of earlier years, downloaded from PubMed. Work is progressing on provision of full article HTML, which will bring useful additional functionalities. Our printers and electronic text suppliers, Cambridge University Press, are currently tackling some problems in how tables are handled. These can be produced as HTML for present and future issues, but for older material will have to be converted to graphic images.

After a 'free trial' period until September or a bit later, access to headers will continue to be free for all, but full text will be limited to locations with subscriptions at the institutional rate. The next big task will be to set up the systems to enable this.

URLs for the SGM journals

● *the home page for all three:* http://www.sgmjournals.org

● *Microbiology:* http://mic.sgmjournals.org

● *JGV:* http://vir.sgmjournals.org

● *IJSB:* http://ijs.sgmjournals.org

● *Ron Fraser*
Executive Secretary

New General Secretary
Alan Vivian

Born in Wellington Somerset, Alan read Zoology at Reading University before an interest in bacterial genetics led him to undertake a PhD with H.P. Charles on CO_2-requiring mutants. During this time he visited Glasgow to learn about *Streptomyces coelicolor* and following his PhD returned there in 1967 to work with David Hopwood. He moved with David's group to the John Innes Institute a year later and by then was working on the newly discovered fertility system in *Streptomyces*.

Appointed to a lectureship in Microbiology at Thames Polytechnic (now the University of Greenwich) in 1972, Alan developed genetic systems in *Acinetobacter calcoaceticus* and the cherry pathogen, *Pseudomonas morsprunorum*, before moving to his present post as Reader in Biotechnology at UWE-Bristol. Here he continues to work on host-specificity and pathogenicity in phytopathogenic pseudomonads and their plasmids.

Married to May, whom he met in Glasgow, Alan enjoys walking, collecting and reading interesting books (which May says they haven't enough room for!).

New Convener
Clinical Virology Group
Tim Wreghitt

I am delighted to have been elected as Convener of the SGM Clinical Virology Group. I am a clinical virologist in Cambridge; previously I worked at Wellcome on hepatitis viruses. I have been a member of the Group since it was inaugurated by Professor Tony Waterson in the early 1970s. Since that time, the Clinical Virology Group has been the main clinical virology forum in the UK.

It is most important that we continue to organize high quality clinical virology meetings which will attract a good proportion of the clinical virologists in the UK, to act as a forum for discussion of current issues.

For contact information see p. 149.

Grants

Education Development Fund

Members may apply for grants to support projects intended to lead to an improvement in the teaching of any aspect of microbiology relevant to education in the UK. Examples of work which might be funded include the provision of teaching materials (e.g. videos, slides, posters), the development of reliable, novel practical exercises, new approaches to teaching/learning familiar concepts (e.g. computer simulations or tutorials) or any other appropriate aspect. Grants are also now available to fund small projects to promote the public understanding of microbiology. These might include workshops, talks, demonstrations, posters, leaflets, broadcasts, activities at science festivals and AV or computer packages. The full rules of the scheme were published on p. 81 of the May issue of *Microbiology Today*. Application forms are available on the SGM website. The closing date for applications is **4 October 1999**.

International Development Fund

Members are reminded that Council has established an International Development Fund for competition this year. The purpose of the Fund is to make small grants available to help microbiologists in developing countries and Eastern Europe. Members may apply for funding to run training courses in laboratories in developing countries appropriate to the needs of those countries, or for any other small project to assist in technology transfer from Western Europe. Full details of the scheme were published on p. 82 of the May issue of *Microbiology Today*. The closing date for applications is **1 October 1999**.

Vacation Studentships 1999

In 1995 Council instituted a scheme to enable undergraduates to work on microbiological projects during the summer vacation before their final year. The studentships are intended to provide undergraduates with experience of research and to encourage them to consider a career in laboratory-based science. Support is provided at the rate of £120 per week, for a maximum period of 8 weeks. A small sum of up to £400 may also be awarded towards the cost of consumables. Students are required to submit a brief report of their research on the completion of the studentship, which in itself is a useful exercise for them. The scheme has proved to be very successful and popular. This year 36 applications were received. After careful scrutiny by referees and the Award Panel, studentships were offered to 23 applicants. The number of applications was less than in 1998, probably due to the earlier closing date for the scheme that was instituted on request this year to enable successful applicants to plan their summer work more effectively. A list of awardees is available from the SGM Grants Office on request.

Council has set aside a further sum to fund vacation studentships next year. Full details of the 2000 scheme will be announced in the next issue of *Microbiology Today*.

Details of all Society grant schemes are now available on the SGM website at **http://www.socgenmicrobiol.org.uk**

Most application forms can be downloaded. Requests for paper copies or any inquiries should be made to the Grants Office at SGM Headquarters (Tel. 0118 988 1821; Fax 0118 988 5656; e-mail grants@socgenmicrobiol.org.uk).

UK Telephone area code changes

The following changes to the telephone area code numbers for Cardiff, Coventry, London, Portsmouth, Southampton and Northern Ireland took effect from **1 June 1999**.

- **Cardiff** **(01222) xxx xxx** *becomes* **(029) 20xx xxxx**
- **Coventry** **(01203) xxx xxx** *becomes* **(024) 76xx xxxx**
- **London** **(0171) xxx xxxx** *becomes* **(020) 7xxx xxxx**
- **London** **(0181) xxx xxxx** *becomes* **(020) 8xxx xxxx**
- **Portsmouth** **(01705) xxx xxx** *becomes* **(023) 92xx xxxx**
- **Southampton** **(01703) xxx xxx** *becomes* **(023) 80xx xxxx**
- The new **Northern Ireland** area code is **(028)** followed by new **xxxx xxxx** numbers

As usual the two numbering systems will run in parallel, until 22 April 2000. For more detailed information, see the BT website: http://www.numberchange.bt.com

UNESCO–IUMS–MIRCEN–SGM Short Term Fellowships 1999

SGM is a co-sponsor of these fellowships which provide an opportunity for a young microbiologist from a developing country to pursue, or complete, a part of an on-going research programme in a laboratory in a developed country. Applicants should be a permanent employee in the country of residence, be aged under 45, must have completed at least 5 years of postdoctoral experience in any of the microbiological sciences and must provide specific evidence in the form of a proposal about the work which is to be performed at the host laboratory. Up to US$4,000 may be awarded for travel and subsistence for a maximum period of 3 months. Full details of the scheme and how to apply are available on the SGM website or from the Grants Office.

Seminar Speakers Fund

The purpose of the Seminar Speakers Fund is to promote talks on microbiological topics in departmental seminar programmes. Applications are invited from Higher Education Institutions where microbiology is taught for grants of up to £200 towards the travel, and if necessary, accommodation, expenses of an invited speaker. Applications will be dealt with on a first-come, first-served basis during the academic year, which is defined as running from September 1999 to June 2000. Written submissions should be sent to the Grants Office for consideration. Details of the scheme were published on p. 82 of the May issue of *Microbiology Today*.

The Watanabe Book Fund

Members who are permanently resident in a developing country are reminded that they may apply for funding to acquire for their libraries books, or possibly journals, relating to microbiology. These annual awards are available as a result of a generous donation from Professor T. Watanabe of Japan. Full details of the scheme were published on p. 24 of the February issue of *Microbiology Today*. The closing date for the receipt of applications, which should be made to the Grants Office at SGM Headquarters, is **29 October 1999**.

News of Members

● **Professor Jangu E. Banatvala**, Professor of Clinical Virology, United Medical and Dental Schools of Guy's & St Thomas', has been awarded a CBE for services to the prevention of viral hepatitis.

● **Professor Fred Brown**, FRS, has been awarded an OBE for services to the Spongiform Encephalopathy Advisory Committee.

● At the Institute of Biology AGM in April, **Bernard Dixon** was presented with with the IOB 1999 Charter Award for contributions to the biological community.

● **Dr R.A. Dixon**, Nitrogen Fixation Laboratory, John Innes Centre, Norwich, and **Professor L.A. Casselton**, Department of Plant Sciences, University of Oxford, have been elected Fellows of the Royal Society.

● **Dr H.M. Lappin-Scott**, Department of Biological Sciences, University of Exeter and Convener of the SGM Environmental Microbiology Group, has been appointed to a Personal Chair in Environmental Microbiology.

● **Dr Paul Nurse**, Director General and Head of the Cell Cycle Laboratory of the Imperial Cancer Research Fund, has been made a Knight Bachelor for services to cell biology and to cancer research. Dr Nurse has also been awarded an honorary Doctor of Science degree by the University of Edinburgh.

● **Professor Sir John Pattison** has been made Director of Research and Development at the Department of Health.

● **Dr Charles W. Penn**, School of Biological Sciences, University of Birmingham and SGM General Secretary, has been awarded a Personal Chair in Molecular Microbiology.

● The Society notes with regret the death of **Professor H. Wege** (member since 1981).

SGM Prize Lectures and Awards

Fleming Lecturer 1999

David Richardson

Bacterial respiration: a flexible process for a changing environment

David studied Biochemistry at the University of Keele, where John Mills introduced him to the joys of bioenergetics. David graduated in 1995 and moved to the University of Birmingham to undertake doctoral research under the joint supervision of Baz Jackson and Stuart Ferguson. He studied the biochemistry of anaerobic respiratory electron transport in the photosynthetic bacterium *Rhodobacter capsulatus* and established a role for the process in the maintenance of cellular redox balance during photoheterotrophic metabolism. On completion of his PhD in 1988, David moved to Stuart Ferguson's lab at the University of Oxford and worked on nitrate respiration in the denitrifying bacterium *Paracoccus denitrificans*. A feature of this work was the identification of two distinct nitrate reductase systems that were involved in energy conservation during anaerobic denitrifying growth and energy dissipation during aerobic growth. In 1991 David took up a lectureship in the School of Biological Sciences at the University of East Anglia and is studying the genetics, biochemistry and physiological role of a range of bacterial respiratory systems, including those involved in aerobic denitrification, heterotrophic nitrification, nitric oxide respiration and Fe(III) respiration. He was promoted to Reader in 1998.

Dr Richardson will deliver his lecture at the SGM meeting at Leeds on 8 September.

Awards 2000

Nominations are now sought for the prize lectures due to be awarded in the year 2000.

Fleming Award – *for outstanding research in any branch of microbiology by a young microbiologist in the early stages of his/her career. The award is £1,000 and the recipient is expected to deliver a lecture at a Society meeting and to publish it in a Society journal.*

Marjory Stephenson Prize Lecture – *for an outstanding contribution of current importance in microbiology. The award is £1,000 and the recipient is expected to deliver a lecture at a spring meeting of the SGM and to publish it in a Society journal.*

Kathleen Barton-Wright Memorial Lecture – *for an outstanding contribution to research in a more applied area of microbiology, or in any area where the microbiology impinges on other areas of biology, and where the topic would be attractive to a wider audience. The prize is £500 and the recipient is expected to deliver a lecture at a Society meeting.*

The rules of these awards were published on p. 83 of the May issue of *Microbiology Today*. Nomination forms are available on the SGM web site or from the Executive Secretary at Society HQ. Completed forms should be sent to Prof. Charles Penn, School of Biological Sciences, University of Birmingham, Birmingham B15 2TT. Prof. Penn will also be pleased to discuss the criteria for nominations.

The closing date for nominations is **31 August 1999**.

Undergraduate Microbiology Prizes

Council is pleased to announce a new scheme to encourage excellence in the study of microbiology by undergraduate students and to promote scholarship in, and awareness of, microbiology in universities. A prize will be awarded annually to the undergraduate student in each qualifying institution who performs best in microbiology in their penultimate year of study for a Bachelor's degree. Each winning student will be awarded £50, a certificate and a free year's student membership of the SGM.

One prize will be available to each university in the UK and Republic of Ireland offering an appropriate microbiology course. The university will be asked to choose the assessed microbiological work for which the prize is awarded. Examples of appropriate work include: best written dissertation on a microbiological topic; best microbiology presentation; best examined microbiology module. The submission should be supported by formal marks, not an informal assessment. Winning students should have attained at least 2(i) overall in their degree examinations at the stage at which the award is made.

Eligible students may be registered for any degree with a significant microbiology content (e.g. Biotechnology, Applied Biology, etc.) not just a BSc Microbiology. The university must decide which student group studying which microbiological activity is eligible for consideration. Usually this should remain the same from year to year, although a permanent change to the selection may be made if new courses develop.

Universities are now invited to nominate a student for a 1999 SGM Undergraduate Microbiology Prize. Submissions can only be accepted on the form which has been sent to all institutions. Further copies may be downloaded from the SGM website or obtained from the Grants Office. The closing date for nominations is **31 July 1999**.

Staff News

Millennium Award

Congratulations to **Jane Westwell** of the External Relations Office on her successful application for a personal Millennium Award. Jane will receive nearly £5,000 to run hands-on workshops on microbiology this summer at Reading Borough Council playschemes for children aged 5–12 years, the first science-based activity to be introduced. Jane will supervise two teams of science undergraduates who will deliver two workshops: *Fun with Fungi* and the *Microbial Model Shop*. With 18 playschemes and clubs in the area, many children will have the opportunity to learn about micro-organisms and how they affect our lives. Receipt of this award entitles Jane to be a Millennium Fellow. This project is funded through the Royal Society and British Association for the Advancement of Science Millennium Awards Scheme, financed by the Millennium Commission, to encourage people's understanding of science, engineering and technology in the community.

Wedding bells for JGV

Wedding bells have been ringing at the SGM. **Sue Westgate**, a staff editor on JGV, married Steve Andrews on 17 July and a pre-nuptial staff barbecue was held in the garden to wish the happy couple on their way. Sue was presented with a gift to mark the occasion.

Notices

Annual General Meeting 1999

The Annual General Meeting of the Society will be held on Tuesday, 7 September 1999, at the Society Meeting at the University of Leeds. Agenda papers, including reports from Officers and Group Conveners, and the accounts of the Society for 1998 are in the separate Annual Report booklet distributed to all members with this issue of *Microbiology Today*.

Questionnaire

There has been an excellent response from members to the recent questionnaire which sought views on society meetings and other activities. A preliminary report on the findings was made to July Council and full details will be published in the next issue of *Microbiology Today*.

IUMS Congresses

Sydney, 9–20 August 1999

SGM is having a stand in the trade exhibition at both congresses. If you are attending either of these events, please come along and say 'hello' and have a look at our displays. Janet Hurst and Ron Fraser will be manning the stand for both weeks and Aidan Parte, Managing Editor of IJSB, will be attending during ICBAM.

Print size in *Microbiology Today*

In response to requests from readers, we have increased the point size of some of the fonts used in the magazine. Please let the editorial team have your opinions of this change.

Chicago! Chicago! SGM meets ASM

Ron Fraser & Janet Hurst

Have stand will travel

The early hours of 29 May saw Ron Fraser and Janet Hurst from SGM HQ standing by the side of the road in Reading waiting for the RailAir Bus to Heathrow Airport. At their side was a large blue container resembling a dustbin on wheels. Inside was the Society's display stand and a range of promotional literature. We were off to Chicago, to the ASM's 99th meeting, held to celebrate their 100th anniversary as a society.

At Heathrow the 'wheelie-bin' provoked much interest at the American Airlines security check, but it was allowed through and we were soon on the plane to Chicago. In the States, much to our surprise, we got through customs with no problems; the difficulty there was to find a taxi to take the monster on board! Finally, an Oriental driver with a large trunk (boot) took pity on us and learning that Ron was a Scot, entertained us with a conversation about the history of Scotland based on his viewing of the film *Braveheart*. With a shout of "*William Wallace*" ringing in our ears, we checked in at the hotel and then set off on foot to find McCormick Place, the exhibition centre, to make sure that our 'booth' was OK and to register as exhibitors.

Threading our way through the crowds celebrating the Bank Holiday weekend, we eventually arrived at the enormous, black, aircraft-hangar-like complex. There are two parts to McCormick – East and West – separated by an eight-lane motorway. The scale of the complex is hard to comprehend. Just moving around involved walking down endless corridors and through vast concourses.

Eventually we located the exhibition hall, collected our exhibitors' badges and found our booth in the 'publishers' park' area. Thankfully, our large consignment of journals and literature was there. Footsore from all the hiking we caught the shuttle bus back to the hotel.

Next day, we trundled the wheelie to McCormick Place and set up the stand. There was then time for a brief sightseeing foray downtown and a boat trip on the Chicago River to view the fantastic architecture of the skyscrapers.

Showing off

The conference opened on Monday 31 May, Memorial Day in the States. Our booth was one of 780 in the ASM trade exhibition and nearly 10,000 people registered for the conference over the three days. The exhibition was in a vast hall with the poster boards at the far end, so all of the delegates had to pass the stands to view the posters. As these were displayed according to a timetable, with two slots each day, this meant that new people were constantly in the hall and ensured a steady stream of delegates to the stand.

Apart from display panels giving information about SGM activities, we offered leaflets about the journals and gave away copies of recent issues, membership packs, *Microbiology Today*, meetings information and our educational poster sets. Pride of place was given to the laptop computer connected to the internet which enabled us to demonstrate our newly available on-line journals and the SGM website.

We were delighted by the interest in our services. Everyone was highly complimentary about our journals, with many favourable remarks about the improvements made to IJSB since SGM took it over from the ASM. Delegates who said they had always been meaning to join the Society were persuaded to sign up on the spot and to subscribe to a journal. Visitors were impressed by the on-line journals and the wealth of information available on the website. Copies of our publications and free pens (printed with the on-line journals URL) disappeared at an alarming rate. Excited scientists leafed through the pages of IJSB to find papers that they had written and were thrilled to be able to take away copies for their family and friends.

Stand in line

What were our impressions of the meeting? There were queues everywhere – to register, to buy refreshments, to get on the shuttle buses – but the site was so big that it rarely seemed crowded. With parallel sessions in the two McCormick buildings, there were long walks between the venues; some of the lecture theatres were huge. ASM had desks for every area of their activities, a shop selling centennial souvenir products, a bank of computers for on-line messages for delegates and a bookshop. The atmosphere was nothing like an SGM meeting – with everyone staying in hotels all over Chicago, the vast venue and over 9,000 delegates, it was friendly yet impersonal. That said, we managed to bump into most of our UK-based members, although there seemed to be relatively few delegates from Europe at all.

Party-time

Wednesday marked the end of the trade exhibition, so we speedily packed up the stand and took our trusty wheelie and its contents back to the hotel before getting ready to join the crowds at the Centenary party at Chicago Science Museum. This involved yet more standing in line – to catch a shuttle bus, to get a drink, to collect some food and finally for champagne to help ASM President Stuart Levy toast the Society and sing happy birthday! It was an enjoyable occasion and we were able to look around the museum.

Homeward bound

At 6 am the next morning we were in a taxi in the rush hour traffic (it starts early in Chicago) heading for the airport. After a tussle to get the wheelie on the plane ("you flew it in, so why won't you take it back?") we embarked for home, landing in the UK late at night. It had been an exhausting trip but well worth the effort. We received a very warm welcome, enjoyed the American experience and felt that we had been successful in promoting SGM and its publications 'over the pond'. Next year's big ASM meeting is in Los Angeles and SGM will probably be there.

Exhibiting at the ASM 99th Annual Meeting was a completely new venture for the SGM. Intrepid Marlborough House staff found that attending this huge American conference was certainly an experience.

BELOW:
Janet Hurst demonstrates the SGM website and on-line journals on the laptop at the SGM stand in Chicago.

Meetings

Meetings on the web

Up-to-date information on future Society meetings is available on the website http://www.socgenmicrobiol.org.uk

Meetings organization

The programmes of the Society's meetings are organized by the committees of the special interest groups, co-ordinated by the Scientific Meetings Officer, Dr Pat Goodwin. Suggestions for topics for future symposia are always welcome. See p. 149 for contact details of Group Conveners. Administration of meetings is carried out by Mrs Josiane Dunn of the Meetings Office at SGM Headquarters, Marlborough House, Basingstoke Road, Spencers Wood, Reading RG7 1AE
Tel. 0118 988 1805
Fax 0118 988 5656
e-mail meetings@socgenmicrobiol.org.uk

Autumn 1999

144th Ordinary Meeting
University of Leeds
7–10 September

- Main Symposium (7–8 September) Transport of Molecules Across Microbial Membranes

Further information about the Main Symposium topic was given in an article on p.74 of the May issue of *Microbiology Today*.

● PROGRAMME BOOKLET

A booklet giving full details of the programme and a booking form is enclosed with this issue of *Microbiology Today*. Any changes will be posted on the SGM website.

● SYMPOSIUM VOLUME 58

The book of the Main Symposium will be on sale at the meeting. An order form will be published in the November issue of *Microbiology Today*.

● OFFERED POSTER PRESENTATIONS

Will delegates whose offered posters have been accepted please note that an area of 1 m x 1 m only is available on the poster boards for their display.

● MICROSCENE NOTICEBOARD

At the September meeting of the Society at the University of Leeds, a board will be set up with notices of jobs, postdoctoral positions, studentships, courses, conferences, etc. Contributions are welcome and may either be brought to the meeting or sent beforehand to Janet Hurst at Marlborough House.

New Rules

New Rules for Offered Posters

The Meetings Officer and Group Conveners have decided that after the Leeds meeting, all submissions of offered posters should be associated with a Group. General Offered Posters will therefore no longer be accepted. Titles should be sent to the appropriate Convener, preferably by e-mail. The subject content should be relevant to the remit of the Group (see website for details); it does not have to relate to the topic of the Group Symposium taking place at the particular meeting. It will also be necessary for the abstract to be sent at the same time as the title in the required standard format:

- 200 words maximum [excluding title, author(s) and address(es)]
- single spacing, 12-pitch type
- 1st line: title in capital letters
- 2nd line: authors in upper/lower case (presenting author's name to be underlined)
- 3rd line: full address of institution(s)
- blank line before abstract text
- no references to be included

The Irish Branch will continue to call for offered papers/posters as usual.

Promega Prize

- Are you a member of the SGM?
- under 28 years of age?
- a postgraduate or first postdoc?
- thinking of presenting an offered paper or poster at an SGM meeting?

Why not enter for the Promega Prize Competition? You could win £200 in the SGM section of the competition and go on to compete for a further £2000 in the *Young Life Scientist of the Year* event. Contact the Meetings Office or see website for details.

Future Meetings

WINTER 1999/2000
145th Ordinary Meeting
5–7 January 2000 University of Surrey, Guildford

- Virus Infection – Life or Death for a Cell

Virus and Clinical Virology Groups

There will be 14 plenary talks (40 minutes plus 5 for questions) spread over three mornings and the early afternoon of the first two days. These will be followed on the first two days by afternoon open paper sessions and evening workshops. The invited speakers will review the process of programmed cell death (apoptosis) and the mechanisms by which a variety of viruses subvert this normal cellular pathway. The mechanisms by which viruses transform cells and induce cancer, and establish latent or persistent infections will also be addressed. This programme should appeal to all virologists with clinical or basic research interests, as well as cell biologists with interests in apoptosis, cell transformation and cancer.

● SYMPOSIUM

5 January
A. WYLLIE (Cambridge)
D. McCANCE (Rochester, USA)
D. ROCK (Plum Island, USA)
H. THOMAS (St Mary's London)
A. GREENBERG (Manitoba, Canada)
Offered oral papers

6 January
P. GALLIMORE (Birmingham)
W. WOLD (St Louis, USA)
L. YOUNG (Birmingham)
C. BOSHOFF (Chester Beatty London)
H. FICKENSCHER (Erlangen, Germany)
Offered oral papers

7 January (am)
P. FREISEN (Madison, USA)
C. BANGHAM (St Mary's London)
J. FAZACKERLEY (Edinburgh)
H.-J. THIEL (Giessen)

● OFFERED PAPERS

The open papers sessions (short talks of 10 minutes plus 5 for questions) will be mainly from graduate students or postdoctoral fellows. These talks may cover any aspect of virology, or aspects of cell biology relevant to the theme of the meeting. Titles and abstracts for offered papers or posters should be sent to the organizer **by 21 September 1999**. Submissions should contain the names of all authors, their affiliations, the title of the paper and the name of the author who will make the presentation together with an abstract (maximum 150 words).
Organizer: Geoff Smith (glsmith@molbiol.ox.ac.uk)

● EVENING WORKSHOPS

5 January – *Influenza Virus*
Organizer: John McCauley
(john.mccauley@bbsrc.ac.uk)

6 January – *Exotic Viruses*
Organizer: Susan Jacobs
(jacobs_susan@hotmail.com)

The evening workshops are usually a collection of short talks (5–10 minutes) on a specific theme. Anyone wishing to participate in the workshops should contact the appropriate organizer **no later than 30 November 1999**.

● BOOKINGS

A booking form for this meeting can be downloaded from the SGM website where any changes to the programme will be posted as they occur.

SPRING 2000
Millennium Meeting
10–14 April 2000 University of Warwick (jointly with Society for Applied Microbiology)

● Main Symposium Fighting Infection in the 21st Century

Organizers: P. Goodwin, P. Andrew, G. Smith, D. Stewart-Tull, M. Easter and P. Oyston
Experts from around the world, including a UK government representative and spokesmen from WHO, have been invited to speak on aspects of this theme.

To be published

● OTHER SYMPOSIA

● 11–12 April – Potable water treatment

Fermentation & Bioprocessing Group and SfAM
Contact: Reg England (r.england@uclan.ac.uk)

● 12 April – Ecology of food-poisoning micro-organisms

Environmental Microbiology Group and SfAM
Organizers: Linda Lawton (l.lawton@rgu.ac.uk) for SGM and Andy Davies, Convener of SfAM Food Group.
The programme includes 6 invited speakers. Potential topics are: Factors influencing growth and toxin production / Distribution and survival of *Salmonella* in farms, hatcheries and animal feed mills / El Paso: case history of a botulism outbreak associated with potatoes / Medical waste as a source of contamination / Controlling growth of food poisoning organisms / Microbiological quality of ready-to-use vegetables / Farms as reservoirs of infection.
We are keen to include offered papers and if you would like to present one, please contact the organizers **by 1 October 1999**. The deadline for poster submission is **1 November 1999**. We would especially like to encourage young scientists to participate and enter for a Promega Prize (see p. 132 or website for details).

● 12 April – Transcriptional control circuits in fungi

Physiology, Biochemistry & Molecular Genetics Group
Organizer: A. Brown (al.brown@abdn.ac.uk)

● 12 April – Vaccine delivery

Microbial Infection Group
Organizer: P. Oyston (poyston@hotmail.com)
The programme includes 6 invited speakers: Fundamental issues in vaccine delivery / Balancing the immune system / The trials and tribulations of clinical trials / Phage displayed peptides / Microencapsulation of vaccine antigens, including DNA / Cochleate delivery vehicles for the induction of mucosal and systemic immune responses.
If you would like to submit an offered paper or poster, please contact the organizer as soon as possible.

● 12 April – Public education in safe water and food

Education Group and SfAM
Organizers: Peter Wyn-Jones (peter.wyn-jones@sunderland.ac.uk) for SGM and R. Bishop (rh.bishop@ulst.ac.uk) for SfAM

● 12–14 April – Virus entry and exit

Virus Group
Organizer: Geoff Smith (glsmith@molbiol.ox.ac.uk)

● 13–14 April – Molecular epidemiology: infrasub-specific classification and identification

Systematics & Evolution and Clinical Virology Groups
Organizers: Gerry Saddler (g.saddler@cabi.org) and Tim Wreghitt (tim.wreghitt@msexc.addenbrookes.anglox.nhs.uk)

● 13–14 April – Proteases, proteolysis and control

Physiology, Biochemistry & Molecular Genetics and Cells & Cell Surfaces Groups
Organizers: C. Stirling (colin.stirling@man.ac.uk) and D. Hodgson (dm@dna.bio.warwick. ac.uk)

Also: Evening workshops, social events, trade exhibition.

OFFERED POSTERS: Deadline for receipt of titles/abstracts **3 December 1999**. New rules for submissions apply – see notice on p. 132.

AUTUMN 2000
147th Ordinary Meeting
12–15 September 2000 University of Exeter

● Main Symposium Community Structure and Co-operation in Biofilms

Contact: Hilary Lappin-Scott (h.m.lappin-scott@exeter.ac.uk)

To be published

● OTHER SYMPOSIA

● Applications of recombinant technology to industrial fermentations

Fermentation & Bioprocessing Group
Organizer: Reg England (r.england@uclan.ac.uk)

● Biofilms in infection and disease

Cells & Cell Surfaces and Microbial Infection Groups
The symposium will consist of three sessions: Biofilms in implant-associated infections / Oral biofilms / Biofilms on non-shedding surfaces.
Organizers: D. Devine (ORL6DD@oralbio.novrll.leeds.ac.uk) and M. Wilson (mwilson@eastman.ucl.ac.uk)

● Control of biofilms

Environmental Microbiology Group
At this one day session Bill Keevil will give the opening address, covering current perspectives and new developments in the field. We hope that most of the other talks will be short, offered papers from the many postgrads and first postdocs working on this topic. Anyone interested in presenting a paper or poster should contact the organizers a.s.a.p. as they would like to gauge the response to this approach. The invited talks are likely to focus on environmental and industrial biofilms as the medical aspects will be covered in other sessions. However offered papers on all aspects of biofilm control are welcome.
Organizers: Hilary Lappin-Scott (H.M.Lappin-Scott@exeter.ac.uk) and Bill Keevil (bill.keevil@camr.org.uk)

● Mathematical skills and microbiologists

Education Group
This half day session will include talks, case studies and demonstrations.
Organizer: Ron Bishop (rh.bishop@ulst.ac.uk)

SPRING 2001
148th Ordinary Meeting
24–30 March 2001 Heriot-Watt University

● Main Symposium New Challenges to Health: the Threat of Virus Infection

To be published

Organizer: Geoff Smith (glsmith@molbiol.ox.ac.uk)

Other symposia: Wall-less organisms / New enzyme targets for anti-microbials / Microbiology of nitrous oxide / Post-transcriptional control of gene expression / Microbe–pollutant interactions: biodegradation and bioremediation.

Irish Branch

Commercialization of Microbial Biotechnology
16–17 September 1999 University of Ulster at Coleraine
For further information and to offer papers and posters contact Nigel Ternan (ng.ternan@ulst.ac.uk). See also the SGM website.

Recent Advances in Molecular Microbial Ecology
7–8 April 2000 University College, Galway

Title t.b.a.
Autumn 2000 National University of Ireland, Maynooth

Title t.b.a.
January 2001 Waterford Institute of Technology

For details of Irish Branch activities contact the Convener, Martin Collins (m.collins@qub.ac.uk)

Other News

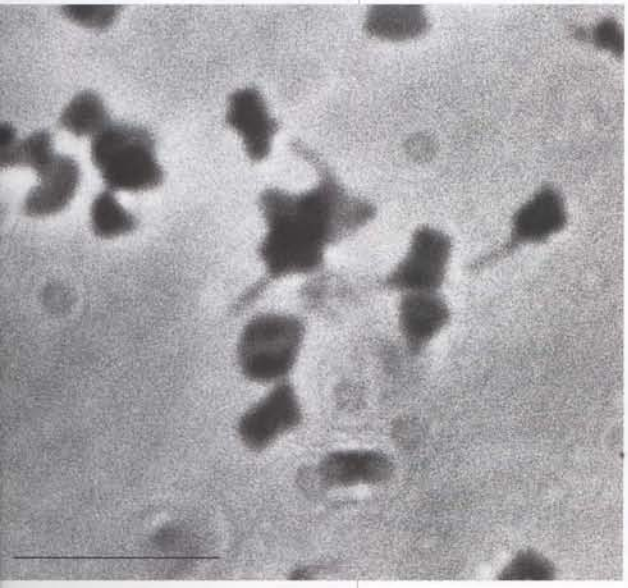
EUROPEAN VIROLOGY 2000
17–22 September 2000 Royal Concert Hall, Glasgow
Many European virology organizations are involved in this meeting which aims to provide a forum for both basic researchers and clinical virologists. Further details are available from Bill Carman (Tel.+44 141 330 4017; e-mail w.carman@vir.gla.ac.uk) or In Conference Ltd, Edinburgh (Tel. +44 131 556 9245; e-mail inconference@cableinet.co.uk).

Hot off the Press

Science journalist Meriel Jones takes a look at some papers in current issues of the Society's journals which highlight new and exciting developments in microbiological research.

Hip to be square

Bacteria come in all shapes and small sizes and even include square ones living in salt-saturated water. Outdoor ponds are used in countries like Israel, Egypt and Spain to produce domestic table salt, sodium chloride. As a first step, seawater is evaporated in the hot sun. Some bacteria can live only in these salt-saturated brines, where the salt concentration is above 250 g per litre. These conditions are similar to those used for preserving food and the bacteria are known to have a series of specialized features that allow them to thrive where most die. In addition, although square bacteria can be seen swimming in extremely saline ponds, most have so far defied attempts by microbiologists to grow them in the laboratory. One was isolated from an Egyptian brine pool about 20 years ago and has been an intriguing oddity ever since. An international collaboration, led by Aharon Oren from the Hebrew University of Jerusalem, has now reported a critical look at its identity.



ABOVE:
Phase-contrast micrograph of a culture of the square bacterium *Haloarcula quadrata* in standard growth medium. Bar, 10 µm.
COURTESY A. OREN

This involved a battery of tests to see if the bacteria could grow in particular growth media, complicated by the need to add large amounts of salt to them all. In addition, the researchers analysed the bacterial cells for fats since some are confined to particular taxonomic groups. Their final step was to analyse several characteristics of the DNA of the bacteria. The picture from the results was revealing. The cells contained a group of complex lipids that have only been found together in the genus *Haloarcula*. The fact that the bacteria grew best at temperatures around 55 °C and could live on a diet of sugars such as glucose and maltose also fitted with this group. However, when the strain was compared with representatives of the six species in this genus, it was not particularly like any of them. Apart from its unique shape, the most telling differences were in its DNA characteristics, indicating a new species within the genus. The name *Haloarcula quadrata* was coined to emphasize its square shape.

■ **A. Oren *et al.*** *Haloarcula quadrata* sp. nov., a square, motile archaeon isolated from a brine pool in Sinai (Egypt). *Int J Syst Bacteriol* **49**, 1149–1155.

The mystery of TTV

About 2 years ago a group of Japanese researchers reported a new virus from a patient with unexplained liver disease. Although it was reminiscent of a parvovirus, there were significant differences. One of the first things to do with a new virus is to sequence its entire genome. The first three isolates were 97 % identical along their 3852 base genome sequences but were completely unlike any known viruses. That immediately meant that it was the first member of a new viral family, as well as a new species. They called it TT virus (TTV), after the name of a patient, or the possibility that it might be 'transfusion-transmitted'. Recently in JGV, reports have been published on two interlinked aspects of this newcomer. As always, as information accumulates, the story becomes much more confused and interesting. There is a real question mark over the place of TTV in disease and a big debate over how to detect it.

The first studies on TTV concentrated on patients suffering from liver disease and people who were likely to have had contact with blood. Eckart Schreier and co-workers in Berlin picked out the DNA signature of the virus in 22 out of 118 German patients suffering from a range of liver diseases. A study of patients being treated with interferon for hepatitis C virus infection at the Toranomon Hospital in Tokyo showed that 16 of them were infected with TTV before their treatment started. The interferon removed both viral infections from just over half the patients. The remainder included those who had been cured of their hepatitis C infection but not of TTV, people who had been cured of TTV but not hepatitis C and a third group who still had both viruses. Those who harboured TTV only appeared to have recovered their health while most of the patients who still had the hepatitis C virus had symptoms of liver disease. When a group from Chicago used their most sensitive test on samples from healthy blood donors, about a third of them were found to be infected with TTV. With a disease connection looking less likely, they searched for a source for the virus and tested farm animals. Significant numbers of chickens, pigs, cows and sheep all contained the virus.

Of course, a key aspect of these clinical studies is to have a good way of detecting TTV.

Viruses are small and often have few distinguishing physical characteristics. TTV is a small, dense particle, about 40 nm across. The DNA itself is single-stranded. Isa Mushahwar and the Virus Discovery Group at the Abbott Laboratories in Chicago, have been adding to the number of complete TTV genomes. They have now reported a further nine. The sequences differ by up to 30 % overall, with some small regions being 90 % identical in all isolates, while others were as much as 40 % different. This is a very substantial, and unexpected, amount of variation and provides evidence that there are at least three types of the virus, with two sub-types. Further sequencing may reveal even more.

Variation within a viral genome poses an immediate problem for detection of the virus. The current way of finding TTV uses the polymerase chain reaction. This relies on pairing up two short pieces of DNA against the target DNA and then running off masses of copies of the sequence between them. Obviously, if the short pieces do not match the target, it may

be impossible to produce any copies and the virus will not be detected. On the other hand, if they match very common sequences, the method will over-report the presence of TTV. The trick is to find a region that is unique to TTV, and found in all its variants, but nothing else. Isa Mushahwar and colleagues reported a comparison between the detection powers of several regions of the genome which shows very clearly that some of them do not detect all TTV variants.

The source of this large amount of variation is intriguing. One possibility is errors during propagation of the virus. This is a deliberate strategy used by some viruses to evade destruction by the immune system. An alternative is that variants are a consequence of the antiquity of TTV. Variation acquired over thousands or millions of years by occasional mistakes would be handed on from one generation of human host to another. These possibilities can be resolved by seeing if the genome of the virus stays the same during an infection. A survey by Xavier de Lamballerie and colleagues in Marseille of French in-patients detected several with TTV. One patient kept the same two strains for 15 months and another patient had the same strain for almost 3 years. In contrast, Jonathan Ball and colleagues from the University of Nottingham followed the virus in serum samples from three British people suffering from chronic hepatitis C infection. Although one patient had a stable level of one form of the TTV for 3 years, another had fluctuating levels of at least seven distinct forms of the virus over 5 years. The strange fact was that there was no obvious way for this person to acquire such a collection of viruses. For example, she had not had blood transfusions, did not have tattoos and had a single lifetime sexual partner. Thus, although it looks as if the virus maintains a constant identity within one host, the opposite is occasionally true as well.

The worldwide distribution of the virus, along with its variability, has been brought home by a study led by Peter Simmonds of the University of Edinburgh with collaborators in England, Gambia, Pakistan and Saudi Arabia. They have reported TTV infection in over 70% of healthy people in countries like the Gambia and Ecuador. Some TTV variants had a worldwide distribution. For example, one appeared in undisturbed indigenous people of Ecuador, rural people from Gambia and blood donors in Saudi Arabia. Another was unique to Papua New Guinea.

Thus, after only a few years study, knowledge about the natural history of TTV has expanded, and provides a confusing but very interesting picture of its life.

■ **M. Höhne *et al.*** Detection of sequences of TT virus, a novel DNA virus, in German patients. *J Gen Virol* **79**, 2761–2764.

■ **P. Biagini *et al.*** Determination and phylogenetic analysis of partial sequences from TT virus isolates. *J Gen Virol* **80**, 419–424.

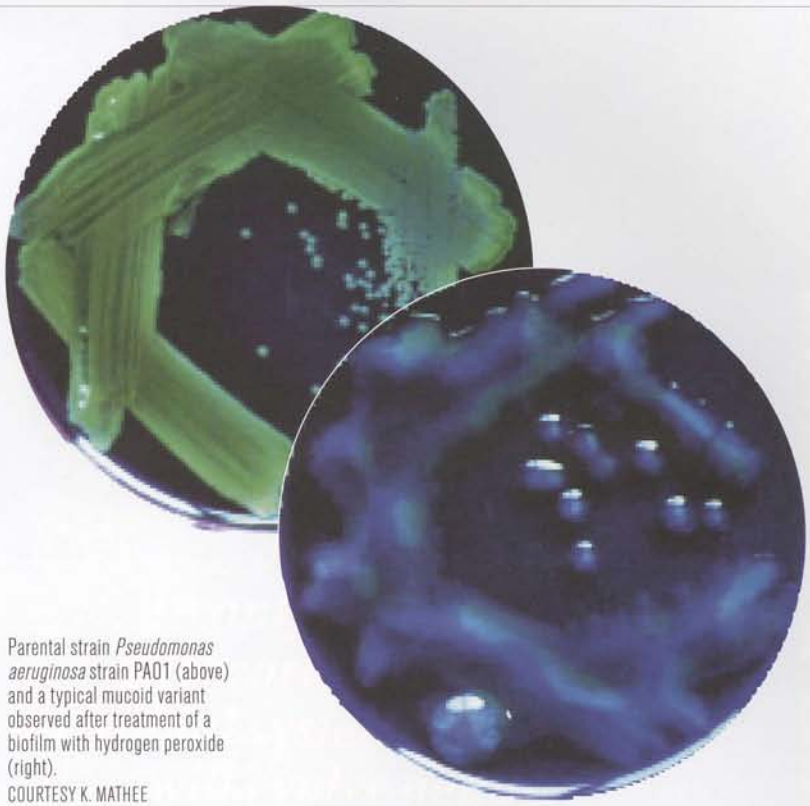
■ **K. Chayama *et al.*** Susceptibility of TT virus to interferon therapy. *J Gen Virol* **80**, 631–634.

■ **L.E. Prescott *et al.*** Sequence diversity of TT virus in geographically dispersed human populations. *J Gen Virol* **80**, 1751–1758.

■ **J.C. Erker *et al.*** Analyses of TT virus full-length genomic sequences. *J Gen Virol* **80**, 1743–1750.

■ **J.K. Ball *et al.*** TT virus sequence heterogeneity *in vivo*: evidence for co-infection with multiple genetic types. *J Gen Virol* **80**, 1759–1768.

■ **T.P. Leary *et al.*** Improved detection systems for TT virus reveal high prevalence in humans, non-human primates and farm animals. *J Gen Virol* **80**, 2115–2120.



Parental strain *Pseudomonas aeruginosa* strain PA01 (above) and a typical mucoid variant observed after treatment of a biofilm with hydrogen peroxide (right).
COURTESY K. MATHEE

Revealing the secrets within the cystic fibrosis lung

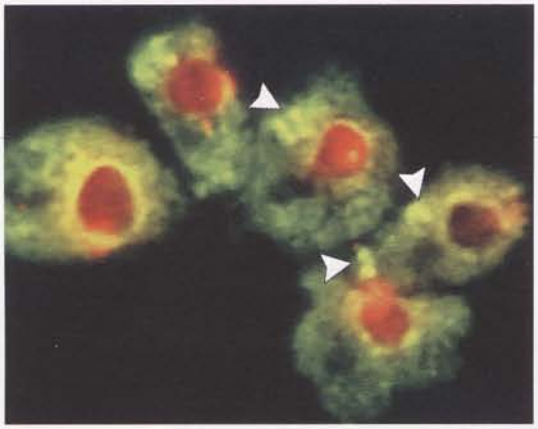
Cystic fibrosis is a common inherited disease in white European populations. Although understanding its genetic basis may eventually provide a cure, careful regimes of physiotherapy and monitoring are the way to a good quality of life for people with this condition at present. One aspect of the disease is frequent lung infections, particularly with *Pseudomonas aeruginosa*. This causes damage which can eventually be fatal. Current treatment uses antibiotics to eradicate the bacteria as soon as possible. The situation becomes particularly serious if the *P. aeruginosa* converts to its mucoid form. The bacterial cells manage to coat themselves with a sugary layer called alginate, along with acquiring other new characteristics. These interfere with the lethal bursts of energized oxygen directed by immune cells at the bacteria. Obviously, anything that can be done to prevent or remove mucoid strains will be helpful to patients.

A group in Denmark, led by Arsalan Kharazmi, has been studying how mucoid variants arise, since they might be a response to attack by the immune system. To test this hypothesis, a normal *P. aeruginosa* strain was grown within a flat container with the growth medium flowing gently past the attached cells to mimic an infected lung. Additions of hydrogen peroxide simulated the reaction of the immune system. The intriguing result was that the *P. aeruginosa* remained normal until the hydrogen peroxide treatment when a few mucoid variants always appeared. Exactly the same result was observed when white blood cells were added to the growth medium as a more realistic test.

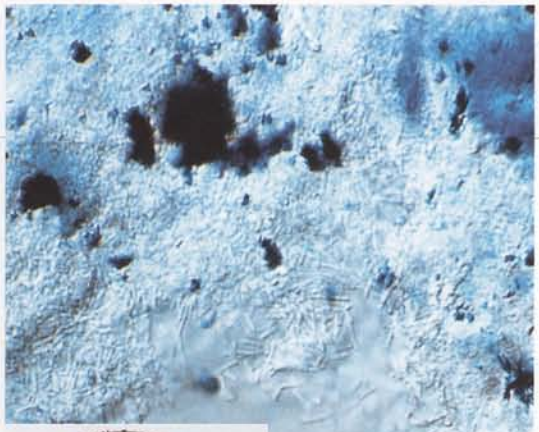
The big question was whether these experimental mucoid strains were the same as ones found in cystic fibrosis patients. All the mucoid strains had a mutation in one gene, *mucA*, and changes in a number of physical characteristics. When the researchers deliberately created a mutation in only this gene, the mutant had a set of new characteristics. The strains from cystic fibrosis patients had this set, plus a variable collection of other characters. The reason why a mutation in one gene can cause many changes lies in the normal role of MucA. It controls several other genes, so any changes to it immediately affect them all and they are probably the most important ones for damaging lungs.

This experiment suggested that the immune system encourages precisely the type of *P. aeruginosa* that resists it best. Scientists know that plant and animal cells can switch on sets of genes to protect themselves against toxic oxygen molecules. This research indicates that bacteria can do this as well, and at just the wrong moment for us.

■ **K. Mathee *et al.*** Mucoid conversion of *Pseudomonas aeruginosa* by hydrogen peroxide: a mechanism for virulence activation in the cystic fibrosis lung. *Microbiology* **145**, 1349–1357.



ABOVE:
Acanthamoeba polyphaga carrying intracellular *Burkholderia cepacia* (arrowheads) 24 h after phagocytosis. Samples were stained with the fluorescent DEAD/LIVE BacLight kit to determine the viability of intracellular bacteria. Dead bacteria stain red and live bacteria stain green.
PREPARATION PERFORMED BY H. SHANNON & C.L. MAROLDA



RIGHT:
Clostridium isatidis reducing indigo.
INSET:
Fresh woad ball containing indigo prior to processing.
PHOTOS COURTESY NIKKI PADDEN & PHILIP JOHN

The enemy within

The bacterium *Burkholderia cepacia* was first detected in the late 1940s, causing a soft-rot disease in onions. However, it appears in many other situations, including life-threatening lung infections in people who are already suffering from lung problems, such as cystic fibrosis. These are very difficult to deal with because this species is intrinsically resistant to many antibiotics. Clinical isolates can survive for a long time in the environment and can spread from patient to patient.

To add to the problem, it now appears that *B. cepacia* can survive within amoebae. This is not just an esoteric laboratory experiment; several types of amoebae can be found in the noses of patients with respiratory problems, and amoebae containing *Burkholderia* cells have been found on the tiles inside a hospital. This group report that the bacteria really can survive, and even multiply within an amoeba. They used several varieties of *B. cepacia* and of the amoeba *Acanthamoeba* in their experiments. When they mixed amoebae that had been grown in sterile conditions with live *B. cepacia* cells, the amoebae developed spacious vacuoles. The researchers could see bacteria swimming about within them, and the number of both bacteria and vacuoles increased over about a week. These vacuoles looked completely different from the sort formed around bacteria like *Escherichia coli* which are often given to these amoebae as food. The *B. cepacia* strains could set up persistent infections in most strains of *Acanthamoeba*.

Interestingly, the temperature of the cells affected the outcome of the experiments. At 37 °C, the amoeba remained uninfected and went into a resting stage called a cyst, or became infected with bacteria and disintegrated. The long-term infections with *B. cepacia* were only set up at lower temperatures, between 20 and 30 °C. This is of clinical importance, since the tip of the nose, where the amoebae lurk, is typically at about 30 °C. If infected amoebae set up home here, they are in a good spot to release bacteria-laden droplets out into the air, or down into the lungs.

■ C.L. Marolda *et al.* Intracellular survival and saprophytic growth of isolates from the *Burkholderia cepacia* complex in free-living amoebae. *Microbiology* 145 (in press).

Ancient and modern

Bacteria are hardly the first thing that springs to mind when you think about medieval industrial processes. However, it turns out that they have an important role in both the production of dyes and in the destruction of ancient paintings. Up until the 17th century, the only source of blue dye in Europe was the woad plant. Its leaves were processed to extract the blue dye indigo by a lengthy procedure of crushing, drying, re-wetting and fermenting. The final stage involved soaking the fermented mass in a hot alkaline vat along with the cloth to be dyed. The insoluble pigment was released from the decayed leaves, but bleached colourless in the process. However, once the cloth was hauled out into the air the indigo was oxidized back to its intense blue colour. The start of the synthetic dye industry in the late 19th century signalled the end of natural dyes. However, the need to clean up wastewater from modern dye factories has made scientists look again at biological methods of dye production.

The Chiltern Open Air Museum near Chalfont St Giles in Britain has been demonstrating all stages of the woad dye industry. Their collaboration with Nikki Padden and colleagues from Reading University has uncovered a new species of bacteria from the depths of the dye vats. *Clostridium isatidis* enjoys the 50 °C temperature and air-less conditions, but more importantly has the ability to decolourize indigo. A first look at its cells and colonies indicated that it was a member of the well known genus *Clostridium*: it grew in anaerobic conditions and had characteristic rod-shaped cells which stained positive with the Gram stain and could produce endospores. This genus contains a large number of species and the researchers had to go through many tests to satisfy themselves that they really had a new species, rather than a variant of a less well known one. An analysis of one region of its DNA pinned the new *Clostridium* down to Cluster I of the genus. A detailed comparison between it and genuine members of the cluster showed that although the new isolate was similar, there were enough detailed differences to warrant its own specific name.

The new species *Agrococcus citreus* was recently isolated by researchers in a much less useful situation. Hans-Jürgen Busse and his colleagues are studying decaying medieval murals in the chapel of Castle Herberstein in Austria. The cool damp atmosphere unfortunately provides ideal growth conditions for some bacteria, including a yellow-coloured one that belongs to the coryneform group. This group poses a number of taxonomic problems, centred around the fact that their similar physical appearance conceals dramatic differences in cell biochemistry and genetics. The composition of their cell wall and lipids can be revealing. When the researchers analysed their new isolate it contained the very unusual diaminobutyric acid. This immediately narrowed down its identity and the sequence of part of its DNA indicated the genus *Agrococcus*. Although it had many features in common with the other species in this genus, significant differences such as its resistance to an antibiotic and inability to grow on particular organic acids suggested that it was a new species.

■ A.N. Padden *et al.* An indigo-reducing moderate thermophile from a woad vat, *Clostridium isatidis* sp. nov. *Int J Syst Bacteriol* 49, 1025–1031.

■ M. Wieser *et al.* *Agrococcus citreus* sp. nov., isolated from a medieval wall painting of the chapel of Castle Herberstein (Austria). *Int J Syst Bacteriol* 49, 1165–1170.

UK Life Sciences Committee (UKLSC) Careers Conferences 1999

University of Sheffield	**Saturday 30 October**
University of Cardiff	**Saturday 13 November**
Queen Mary Westfield, London	**Saturday 27 November**

These one day conferences give undergraduate and postgraduate students an overview of the many career options open to life scientists. Speakers cover such topics as careers in industry, clinical careers, careers in publishing, patenting, science administration, etc. A split session in the afternoon gives undergraduate students a chance to hear about options for further study while postgrads hear about postdoctoral research.

During the lunch and coffee breaks students have ample opportunity to talk to exhibitors from industry and HE institutions. In addition, those who send in their CVs in advance will have an opportunity to talk through how it can be improved in a one-to-one session.

There will be a charge of £6 per delegate to cover lunch, tea and coffee.

Further details will be sent to university departments nearer the time, but if you would like to ensure that you receive registration details, please contact Jane Westwell (j.westwell@socgenmicrobiol.org.uk / 0118 988 1821).

The 1999 UKLSC Careers Conferences are supported by Next Wave, the career development website for young scientists.

Next Wave
uk.nextwave.org

Next Wave is a career development website for young scientists, maintained by the journal *Science* and the American Association for the Advancement of Science (AAAS). It includes regular features and information on jobs, education, personal stories, news summaries and data sources. Access to the site is free to universities and most of their affiliated sites in the UK. Most universities subscribe to the scheme. For further information e-mail nextwave@science-int.co.uk

SGM meeting, University of Leeds, 7–10 September 1999
Don't miss the following events!

Promega Prize meeting

1400 Tuesday 7 September

Lecture Theatre 15 Roger Stevens Building

Promega UK have set up a prize scheme to encourage both communication skills and technical excellence in young scientists. The two best presentations in this session will win £200 each. Please come along and support your fellow students.

- **Olivia McAuliffe**
  University College Cork

  Lacticin 3147: a bacteriocin with applications in food and medicine

- **Susan Lynch**
  University College Dublin

  The genetic analysis of amphotericin B biosynthesis

- **Jyoti Velayudhan**
  University of Sheffield

  The crucial role of a ferrous iron uptake system in iron acquisition and virulence in the human gastric pathogen, Helicobacter pylori

- **Catriona Kydd**
  University of Bath

  A novel aldolase from the hyperthermophilic archaeon Sulfolobus solfataricus

- **Helen Slater**
  John Innes Centre, Norwich

  A specialized two-component system links cell–cell signalling to pathogenicity gene expression in Xanthomonas campestris

- **Gina Manning**
  Central Veterinary Laboratory, Surrey

  Identification and characterization of Campylobacter jejuni genes involved in host cell invasion

- **Karen Isherwood**
  CBD Porton Down

  Quorum sensing in Yersinia pestis

- **Gulnur Coskuner**
  University of Newcastle

  Distribution of ammonia oxidizing bacteria in activated sludge flocs characterized by FISH (Fluorescence in situ hybridization) technique

- **Ian G. Goodfellow**
  University of Glasgow

  Inhibition of echovirus entry into rhabdomyosarcoma cells by antiserum to cd59: a common cell-specific entry mechanism for echoviruses?

To be chaired by **Pat Goodwin** (The Wellcome Trust).

The winners from this session will go forward to compete against winning colleagues from other UK learned societies for the title of *Promega Young Life Scientist of the Year*, with a prize of £2,000.

Workshop & reception for young members

1830 Tuesday 7 September

Senior Common Room

Workshop

CVs and interviews

Looking for a job or a postdoctoral position? How do you secure that vital interview and, having got on the shortlist, how do you present yourself to best advantage? Success depends on the quality of your application form, letter and CV, and applying the right interview techniques. Nalayini Thambar, of the Leeds University Careers Service, who specializes in advising biological scientists, will give a short talk on these key factors. Nalayini will then be joined by a panel representing different careers areas to answer your questions.

CV review

If you would like personal advice on your own CV, please send a copy to Jane Westwell, SGM External Relations Office, Marlborough House, Basingstoke Road, Spencers Wood, Reading RG7 1AE to arrive **no later than 2 September 1999**. We will talk to you at the event.

Reception

A reception will be held after the workshop. You will be able to chat to representatives from Promega, the careers panel and your fellow SGM members over a drink of wine and fortified by a substantial buffet. The winners of the Promega Prize competition held earlier in the day will be announced. There will also be a display of careers material.

Please note

Entry is free but will be by **ticket only** and restricted to young SGM members (defined as postgraduate students and first postdocs). Please tick the appropriate box on the booking form if you wish to attend.

"Good and bad micro-organisms"

■ Sarah Field

I have always been interested in the teaching of science and wondered if sparking an interest in young children could pre-empt the perception of science held by the non-scientific community of being difficult and therefore dull. I had an opportunity to do just this when I received a BBSRC award to run a SET week activity for 90 five- to seven-year-olds. The subject was microbiology. I was lucky to be introduced to the school through my supervisor whose daughter is a pupil; initial introductions can often be a problem especially with the tight security now operating in most schools.

My first ideas were rather ambitious but I soon realised that an open day catering for hundreds of children and their parents with a circus of experiments was a little beyond me. I decided that simple investigations were probably best. I wanted the children to leave the project knowing that although some micro-organisms were 'germs' and could make us ill, the majority were harmless and some would even help us in food preparation. I organized two types of session, one dealing with hand hygiene, the second with the use of yeast in bread making. Both sessions consisted of simple experiments with lots of time for talking, writing and drawing. The children made agar plates with before and after hand-washing fingerprints. The hand washing was helped by a video made in a local school showing six steps to clean hands! The children took these very seriously, and when we looked at the grown plates it seemed that dirty hands were best as far as they were concerned!

We exploited the carbon dioxide made by yeast during sugar fermentation to expand balloons. This was great fun, carried out scientifically with controls! I took some microscopes from UEA with slides of baker's yeast and the children were thrilled to see the yeast 'swimming' before their eyes.

Fortunately, I was able to recruit some fellow PhD students for a nominal fee so the children could work in groups of five, each with a 'scientist' helper. I was amazed at how quickly such young children picked up the ideas presented to them, emphasized when a 5-year-old boy commented about his agar plate, "*Are these bad micro-organisms? We put some good micro-organisms in our bread this morning*". And he used the proper word!

The week was thoroughly enjoyable and emphasized to me the need for connections between the teaching of science in schools and 'real scientists'. This has prompted me to further my link with the school by becoming involved in the Norfolk Teacher Scientist Network, a charity-run organization aiming to increase these links. I am currently waiting for my first meeting with the teacher. The ball is now in their court and my next day in school could involve anything from digging a pond to the science of pasta cooking.

I can't wait!

● *Sarah Field is a PhD student researching microbial dissimilatory iron (III) reduction at the School of Biological Sciences, University of East Anglia, Norwich*
Fax 01603 592250

ABOVE:
Seven-year-olds looking at baker's yeast through microscopes.

LOWER LEFT:
A class of 5-year-olds showing the photographs of their fingerprinting plates.

Safe practice

Anyone considering organizing microbiological investigations in schools should carry out a risk assessment first. The SGM External Relations Office is always pleased to give advice and has produced a fact sheet on safety and GLP in schools.

e-mail info@socgenmicrobiol.org.uk or see the Society website for details http://www.socgenmicrobiol.org.uk

● Contributions for Gradline from young SGM members are welcome.

edinburgh international science festival

For the 6th year running SGM took part in this well established science promotion event, where over 250 different activities were attended by tens of thousands of people. SGM contributed hands-on workshops for children and a public symposium.

Edinburgh International Science Festival 1999

Jane Westwell

Antibiotics: Use or Abuse?

An audience of about 200 people (ranging from students to senior citizens) gathered in the lecture theatre of the Royal Museum of Scotland to learn about the problems posed by antibiotic resistance and how we can take steps to overcome them. Dr Bernard Dixon, SGM member and well known science writer, chaired the symposium.

Professor Richard Wise, President of the British Society for Antimicrobial Chemotherapy, began by warning against making dangerous assumptions such as that of the US Surgeon General 30 years ago who predicted that infection would become a thing of the past. In practice, antibiotic resistance has been a growing problem and subject to a great deal of attention in recent years. Prof. Wise was an adviser to the House of Lords Select Committee on Science and Technology during their 9 month inquiry into antibiotic resistance which concluded that the problem posed a major threat to human health. Since the report's publication many organizations have produced documents in response.

He then went on to summarize the overall use of antibiotics which is spread evenly between agriculture and humans. In humans 80% of use takes place in the community where about 50% is considered to be clinically unnecessary. Figures from the USA suggest that 20% of antibiotic use in agriculture is therapeutic and the remaining 80% is for prophylaxis and growth promotion and in this case 75% of use is questionable. Anti-fungal and anti-viral drug resistance are emerging problems.

Antibiotic resistance is due to the pressure of use and over-prescription must play a part in this. There is also some pressure from the use of the drugs in agriculture. Prof. Wise believes that use of antibiotics for growth promotion should be curtailed and, in fact, the EU has banned the use of four growth promoters. However, measures should be taken on both sides, including enhancement of infection control procedures in establishments such as nursing homes and children's day nurseries. Patients should be educated to accept reduced use of antibiotics and doctors should be regulated more carefully. These measures will only bring about a gradual effect since practices are slow to change. Other suggested actions include improved surveillance of resistance, research into the mechanism of gene transfer and a limit on the use of disinfectant-impregnated household products since disinfectant resistance is a growing problem. Prof. Wise concluded that there is a difficult task ahead and it will take time to control drug resistance.

Dr David Livermore from the PHLS Central Public Health Laboratory reflected that, compared to other European countries, the UK uses relatively few antibiotics and in 1997 the average Briton had only one course of antibiotics. He indicated that of the antibiotics prescribed in the community about 50% are for respiratory tract infections, 25% for urinary tract infections, the remainder being used against a variety of other problems. Use of antibiotics favours resistant bacteria and introduction of new drugs leads to acquisition of resistance. Where antibiotics are used heavily, resistance is higher and sometimes resistant organisms are selected in individual patients. This perfectly illustrates Darwin's theory of evolution. Resistance can spread from one individual to another and from species to species.

Dr Livermore outlined the ways that resistance spreads among the bacterial community and commented that individual drug resistance is less of a problem than multi-drug resistance. Some bacteria that are resistant to penicillin tend to be resistant to other drugs; this reduces the options for treatment. In addition, cross-infection of multi-drug-resistant bacteria between patients can be a big problem. Changing lifestyles, such as childcare practices and increased foreign travel, have contributed to the spread of resistance. Resistant bacteria can be selected in animals and passed to humans in a minority of cases. Dr Livermore concluded that we cannot stop evolution or the use of antibiotics but careful use will reduce the problem. The pharmaceutical industry is working hard to develop new drugs but this is a slow process.

Dr Kornelia Smalla from the Federal Biological Research Centre, Braunschweig, Germany, discussed antibiotics in the environment. She pointed out that environmental fungi and bacteria themselves produce antibiotics, possibly as a means of communication. However, these antibiotics are produced in tiny quantities and are different from those introduced into the environment by human activities. Genes conferring antibiotic resistance are disseminated by different practices, for example growth promotion antibiotics enter soil and surface water via animal manure. Rhizosphere and soil bacteria contain resistance genes which can be transferred to humans via the food chain. Transfer of antibiotic resistance (to drugs not used in man) from animals to humans is rising every year. Dr Smalla concluded that antibiotic use has altered the composition of microbial communities due to man-made selective pressure. Further studies are needed to find reservoirs of resistance and the development of new technologies will allow us to follow the evolution of antibiotic-resistant genes.

Neil Cutler from the National Farmers' Union explained that farmers need to use antibiotics to treat and prevent disease. Farmed animals generally exist in large populations and are susceptible to infections. Reasons why these should be treated include animal welfare, food safety, food quality and prevention of economic losses. All antibiotics used to treat disease are prescription medicines and growth promotion antibiotics are available only from qualified merchants. Mr Cutler gave an overview of the use of therapeutic, prophylactic and growth promotion antibiotics in sheep, pig, beef, dairy and chicken farming. He pointed out that growth promoters

British Association Annual Festival of Science

University of Leeds, 13–17 September 1999

Prospering Through Science

In 1999 nearly one hundred sessions throughout the week will focus on different strands of the overall theme. The strands are:

- creating economic prosperity
- promoting health and quality of life
- building scientific awareness and understanding
- working towards a sustainable environment
- enriching culture
- learning from the past
- exploring new frontiers

The programme is delivered through talks and discussions with leading scientists, a fun-packed hands-on programme for families and young people, exhibitions showing the application of science and technology in industry and the world around us, a series of lunchtime and evening public lectures, visits and field trips to local areas of scientific interest and debates on a broad range of ethical and social issues.

Residential accommodation is available. Further information about the meeting may be found on the Web (www.britassoc.org.uk) or by contacting the British Association Major Events Department, 23 Savile Row, London W1X 2NB (Tel. 0171 973 3075; Fax 0171 973 3051).

are only allowed in chicken and pork production and in growing beef cattle. In all three cases a prophylactic effect is observed. If farmers reduce antibiotic use then other factors in disease control should be considered. There will be a need to control further the animals' environment but this would result in a less natural system which would be perceived poorly by the public. Vaccination, reduction of stress and use of probiotics could also play a part in disease control. The organization RUMA (Responsible Use of Medicines in Agriculture) is looking at how to manage antibiotic use. However, on welfare grounds alone, we must retain the use of antibiotics since animals will always suffer from diseases.

The last speaker, Professor Peter Hawkey (University of Leeds), discussed the lessons to be learned for patients and doctors. He commented that antibiotic resistance is as old as antibiotics themselves. The first clinical use of penicillin was reported in the same month as the first case of resistance in staphylococci. The main factors that drive antibiotic resistance are use, rate of development, and movement of resistance and the mobility and prevalence of disease-causing bacteria (brought about by increased foreign travel). He pointed out that sometimes it is better to use older drugs than driving resistance by the use of newer products.

Prof. Hawkey concluded with a reiteration of points made by previous speakers. Bacteria are surprisingly adaptable and resistance cannot be predicted. To combat resistance, immunization and infection control programmes should be improved and GPs should be equipped with better diagnostic tools to identify patients with a real need for antibiotic therapy. The search should continue for new antibiotics and we should bear in mind that both individual bacteria and their genes can spread.

After the talks, the speakers were joined by Dr Robin Bywater from FEDESA and Dr William Strohl from Merck and Co, USA. The audience responded with great enthusiasm and a lively discussion took place. Questions were diverse, including bacteriophage treatments, unregulated drug sales and the effect of stringent regulations on drug development. A retired GP from the audience emphasized the need for improved hygiene practices by health care workers and in the home; at 75 years old he was an excellent example to follow!

● *Jane Westwell, SGM External Relations Office*

SGM Workshops

Jane Westwell from the External Relations Office joined forces with the National Centre for Biotechnology Education (NCBE) during the Edinburgh International Science Festival in April. Several hands-on workshops, catering for all age groups, brought microbiology and biotechnology to children and their parents.

Primary school children enjoyed getting into a sticky mess making edible sweet models of microbes. The children discovered that almost every aspect of their lives is affected by these tiny organisms and learned about the diversity of shape and size in the microbial world. They went on to make models, which included features such as cell walls, DNA and cytoplasm. Modelling materials included chocolate, fondant icing and other delicious ingredients. At the end of the workshop children (and parents) left clutching their 'microbes' in boxes that they had decorated themselves. However, several creations were gobbled up before the chocolate had set!

Other young children had fun with fungi and spent an interesting hour having dough races and setting up oyster cap mushroom cultures on toilet rolls. All participants left the workshop with a mushroom culture and clear instructions on its care ringing in their ears!

Twenty-six individuals spent a morning trying out the techniques of genetic fingerprinting to solve a murder mystery. They digested DNA samples from 'suspects', separated the fragments by electrophoresis and made them visible with a blue dye to work out 'whodunit'.

Another group of visitors became DNA detectives and joined 'Superintendent' John Schollar in the laboratory. Using techniques similar to the genetic fingerprinting workshop they traced the inheritance of the mystery ESF gene through three generations of a fictitious family.

The Edinburgh Science Festival workshops are part of an ongoing programme of events that the SGM commissions from the NCBE. These events are always expertly prepared and delivered and never fail to generate a great deal of enthusiasm among participants. Thanks are also due to SGM member Dr Bob Rastall from the University of Reading who gave up some of his Easter break to take part in the festival workshops.

LEFT:
Participants in the SGM workshops at the Edinburgh International Science Festival earlier this year.

Going Public?

■ Advice, information & funding for SGM members who wish to explain microbiology to the public

- Will your employer be putting on Millennium open days, SET2000 events and lectures where you will be expected to explain your work?
- Do you struggle to complete forms sent to you by research councils asking how you disseminate your results to the 'wider public'?
- Do you get invited to speak to schools or adult groups about the research that you do?
- Are you not quite sure what is safe or appropriate to present to schools?
- Would you like some help from the SGM?

This summer SGM education staff will be preparing factsheets to help you devise effective means to communicate your science to the public safely. If you would like to get this information when it becomes available send a brief e-mail entitled 'Public info' to Dariel Burdass at the SGM (d.burdass@socgenmicrobiol.org.uk).

If you are already accomplished at 'Going Public' then don't forget that the SGM now funds grants of up to £1,000 for Public Understanding of Microbiology activities. See p. 81 of the May 1999 issue of *Microbiology Today* for details. If you'd like to offer an article on your activities for the 'Going Public' section of *Microbiology Today* contact Janet Hurst (j.hurst@socgenmicrobiol.org.uk).

Reviews

A classified compendium of book reviews from 1996 to the present is available on the SGM website.

Immunology of Infection. Methods in Microbiology, Vol. 25

Edited by S.H.E. Kaufmann & D. Kabelitz
Published by Academic Press Inc. (1998)
US$59.95, pp. 705
ISBN: 0-12-402305-3

This is a useful compendium of methods and techniques for those wishing to examine the immune responses to infections *in vitro* and *in vivo*. The major part of the book is devoted to investigations in mice, with both generally applicable methods and specific examples (models of tuberculosis and leishmaniasis) being cited in detail. The second major component is directed towards the human system, including isolation and propagation of human dendritic cells, T cells and macrophages, and measurement of the cytokine response. Also described is measurement of the immune response by immunohistology and *in situ* hybridization, and there is a chapter on DNA vaccines. The primary emphasis is on cell-mediated immunity rather than humoral immunity.
The book is clearly presented, packed with protocols, and well illustrated. A useful feature for those beginning in this area are the lists of suppliers as appendices to most chapters.

■ ***Ruth Matthews***
Manchester Royal Infirmary

Immune Modulating Agents

Edited by T.F. Kresina
Published by Marcel Dekker, Inc. (1998)
US$195.00, pp. 557
ISBN: 0-8247-0103-8

Fine tuning immune function is central to its normal physiology, as well as its dysregulation in specific disease states. While many books focus on either the basic or clinical science, this book succeeds in occupying the growing territory of 'translational' science, i.e. the transfer of basic knowledge into clinical applications.
The three main parts of the book,
I – Immunomodulation,
II – Immunomodulating agents in disease, and
III – Immunomodulating agents in therapy, succeed in bridging the gap from the bench to the bedside. Basic physiological aspects of immune system regulation are found in the 8 chapters of part I, disease-induced immune dysregulation is covered in the 10 chapters in part II, while 8 chapters in part III cover the therapeutic use made of clinical manipulations of the immune system. Thus, this is a balanced, state-of-the-art account, of 'translational immunology', written by high quality contributors.

■ ***Pedro Lowenstein***
University of Manchester

The Insect Viruses. The Viruses

Edited by L.K. Miller & L.A. Ball
Published by Plenum Press (1998)
US$125.00, pp. 413
ISBN: 0-306-45881-0

Insect viruses have hit the headlines in recent years by virtue of the use of baculoviruses as expression vectors and genetically modified biopesticides. Less attention has been paid to other insect-specific virus pathogens, although excellent research is being done in a number of laboratories around the world. The fruits of these labours are reviewed in this collection of well written articles from some of the leaders in the field. The book serves to emphasize how many virus families, usually noted for vertebrate pathogens, have their counterparts in insect species. Some insect viruses are unique, however, as demonstrated by the chapter on polydnaviruses. These pathogens have a complex but poorly understood life cycle involving wasps that parasitize butterfly and moth larva. I suspect that this book will attract a specialist audience, but I recommend university librarians to add it to their collection as a valuable, up-to-date teaching aid.

■ ***Bob Possee***
Institute of Virology and Environmental Microbiology, Oxford

Mycobacteria Protocols. Methods in Molecular Biology, Vol. 101

Edited by T. Parish & N.G. Stoker
Published by Humana Press (1998)
US$68.00, pp.480
ISBN: 0-89603-471-2

Mycobacteria are tough-skinned and reluctant to grow, properties which have delayed investigation of mycobacterial molecular biology despite the social and economic importance of the pathogens and the intriguing biological properties of the whole genus. Determined research effort is changing this situation, and this book presents current possibilities in 30 chapters and an introduction. Each chapter has a brief review of a method or group of methods, followed by detailed recipes. These are supplemented, in turn, by notes explaining variations, problems and safety hazards – all the useful things that there is no room to include under Methods in published papers. The microbiological safety information is a slightly confusing mixture of US and British nomenclature, the title is ungrammatical and the review copy is already showing signs of losing its binding, but I think this book is an essential purchase for any laboratory dealing with mycobacteria and good value for individual researchers.

■ ***Philip Draper***
NIMR, Mill Hill, London

Tumor Marker Protocols. Methods in Molecular Medicine, Vol. 14

Published by Humana Press (1998)
Edited by M. Hanausek & Z. Walaszek
US$99.50, pp. 512
ISBN: 0-89603-380-5

There is a continual need for works offering a perspective of multidisciplinary techniques and summaries of protocols. The mixture of technical and clinical contributions here has a very variable scope and its organization detracts from its utility. The opening chapters launch into statistical analysis, whereas an overview of the way in which different approaches in molecular and cell biology, biochemistry and histopathological analysis may complement each other would have been extremely useful. My preference would have been for a large section on general protocols (e.g. immunohistochemistry, differential display, FISH, ELISA, PCR, etc.) followed by comprehensive reviews of the current relevant or potentially useful 'tumour markers' and the analytic approaches used for some selected examples by way of illustration. A model for this approach is encapsulated in the excellent chapter on microdissection technique.
In summary, this book contains some very useful contributions but I doubt it will become a standard bench book in its current format.

■ ***Gordon Stamp***
Imperial College of Science, Technology and Medicine, Hammersmith Hospital

Molecular Biotechnology. Principles and Applications of Recombinant DNA, 2nd Edition

By B.R. Glick & J.J. Pasternak
Published by ASM Press (1998)
£29.50, pp. 683
ISBN: 1-55581-136-1

This book is ideal for undergraduates and provides an excellent source for information on the technologies and applications of recombinant DNA. The second edition of this book is a valuable expansion of an already high quality textbook. As with the first edition, the writing style is lucid and the diagrams have been increased in number and are clear and informative. No textbook such as this is ever complete in its coverage of a subject and there are some omissions, e.g. the application of biosensors in biotechnology, the advent of biochip technology and the application of antibody fragment technology in diagnostics. Also, more recent papers are required in the reference section to bring readers right up-to-date with the subjects. However, all the basic material is covered well. I enjoyed this book a great deal and would be happy to recommend it. I enjoyed the 'milestone' sections, found in many chapters, that indicate key pieces of research leading to significant advances in biotechnology.

■ ***Anne Glover***
University of Aberdeen

At the Bench: A Laboratory Navigator

By K. Barker
Published by Cold Spring Harbor Laboratory Press (1998)
US$45.00, pp. 460
ISBN: 0-87969-523-4

At the Bench is a lab manual with a difference. It aims to introduce the recently appointed PhD student to life in a life-science laboratory. The book is divided into two sections. First a laboratory navigator guides the reader through the inter-relationships between people to be found in a typical lab and introduces good practice in areas such as experimental planning, record keeping, presentations and writing papers. This is well presented and would probably be useful to new PhD students. The book is, however, written from a US point of view, and there are some differences in structure between US and UK labs. The second section is a collection of basic protocols used in biological research (microbial and cell culture, protein assays, DNA extraction, etc.). All in all, the book would be a useful addition to any academic lab to form part of the induction process for new researchers.

■ ***Bob Rastall***
University of Reading

Cytokine Knockouts. Contemporary Immunology, Vol. 1

Edited by S.K. Durum & K. Muegge
Published by Humana Press (1998)
US$125.00, pp. 482
ISBN: 0-89603-368-6

Cytokine function had been established through classical biochemical, physiological and pharmacological approaches until the advent of 'knockouts'. Life in the lab will never be the same! Cytokines thought to be essential, were shown not to be, and vice versa, and the cytokine's role moved from the field of speculation to that of (almost) irrefutable proof. *Cytokine Knockouts* is a fascinating *tour de force* through 24 cytokine-knockout installments. Particular strengths of this book are that some cytokines, i.e. TNF, IL-1 and TGFβ, are reviewed in several chapters. Not all knockouts are covered, but it would be difficult to expect this from a single volume. While knockouts have indicated the direction of much research, a remaining limitation is that proteins are eliminated from the earliest stages of development, and thus allow for compensatory changes to occur. Therefore, we will look forward to part 2, *Conditional Cytokine Knockouts*, in the near future.

■ ***Pedro Lowenstein***
University of Manchester

Probiotics. A Critical Review

Edited by G.W. Tannock
Published by Horizon Scientific Press (1999)
£59.99/US$119.99, pp. 164
ISBN: 1-898486-15-8

This book overviews a topical area of nutritional microbiology, namely the use of so-called probiotics. The Editor and authors are to be congratulated for assembling this highly proficient look at a rapidly moving field. The use of molecular approaches towards gut microbiological procedures are predominant in the book and serve to set the scene for progressing this important field of research further. Whilst the science of probiotics has, in the past, attracted some negative commentary, the authors are clear that much merit lies in their use, and a strong rationale for this is presented. The text will be of major interest to many varied scientific disciplines such as microbiology, gastroenterology, nutrition and general medicine. My only negative comment is that it could have been longer.

■ ***Glenn R. Gibson***
Institute of Food Research, Reading

Prions. Molecular and Cellular Biology

Edited by D.A. Harris
Published by Horizon Scientific Press (1999)
£74.99/US$129.99, pp. 218
ISBN: 1-898486-07-7

David Harris has drawn together a cosmopolitan band of experts to cover a broad area of work on prion diseases and succeeded in producing a monograph which is both readable and erudite. This book is a must for those of us working in the field or for harassed tertiary-grade teachers looking for a primer to prepare a set of up-to-date lectures on prions. I read it cover-to-cover in a weekend and it will remain a well-thumbed text in our lab for several years to come; the quality of the writing and its scientific accuracy probably justifies the price. I've one minor, xenophobic quibble – no Brits! However, the demands of the BSE Inquiry rather than editorial oversight may have prevented British researchers from adding their inside knowledge of BSE and vCJD to this text and these hot topics are dealt with authoritatively by D. Dormont. All the other authors have reviewed their own contribution to the field and so, apart from a necessarily repetitive introduction in each chapter, their personal enthusiasm, perspective and feel for the subject are powerfully communicated. The chapters on the 3D-structure of PrP and yeast prions were especially good.

■ ***Jim Hope***
Institute for Animal Health, Compton

In the Company of Mushrooms: A Biologist's Tale

By E. Schaechter
Published by Harvard University Press (1998)
£9.95, pp. 280
ISBN: 0-674-44555-4

Elio Schaechter retired recently after a distinguished career as a molecular biologist, studying DNA replication in bacteria. When in his forties, and needing a hobby, he came across the pursuit of wild mushrooms. This book is the account of his obsession with them. It is not a field guide to identification, and it does not contain recipes, although eating the edible species and avoiding the toxic has clearly been part of the attraction. It is an eclectic and arcane account of mushrooms in history and folklore, of their biology and importance in the environment, and of the characters who hunt and study them. From the use of mushrooms in the political murder of Roman Emperor Tiberius Claudius, to species nicknamed Laughing Jim and the Train Wrecker, the book fascinates from cover to cover, and will be as accessible to the lay reader as to the professional microbiologist.

■ ***Ron Fraser***
SGM Marlborough House

Recent Advances in Microbiology, Vol. 6, 1998

Edited by V. Asche
Published by The Australian Society for Microbiology (1998)
A$65.00 (incl. postage), pp. 229
ISBN: 0646-35697-6

Published by the Australian Society for Microbiology but not particularly focused on Australian research, this little book contains useful reviews of some topical areas of microbiology. The subjects covered are broad-ranging with chapters on Biological weapons, *Chlamydia pneumoniae* and heart disease, Food safety, Analysis of genome structure in bacteria, Recent developments in the epidemiology and laboratory diagnosis of tuberculosis and a look at bioethics in the section on Animals in microbiology. Undergraduates in particular will find the summaries of recent research in each field, presented in the context of the background to the subject, a useful study aid.

■ ***Janet Hurst***
SGM Marlborough House

Introduction to Light Microscopy

By S. Bradbury & B. Bracegirdle
Published by BIOS Scientific Publishers (1998)
£16.95, pp. 136
ISBN: 1-85996-121-5

This is a re-write of the first of the excellent RMS handbook series, covering the fundamentals of light microscope operation. It is not a book for the complete novice: optics is a complicated subject and the information here is presented in a concise form which makes it hard going for those not conversant with terms like 'the objective back-focal plane'. It is not a complete introduction either. Its criterion for judging a microscope is simple resolution, that is the ability to say whether two closely placed objects are in fact separate. In the biological sciences an equally important property is the ability of the microscope to generate contrast, most commonly in living cells by phase or interference contrast; both are covered in another volume (*Contrast Techniques In Light Microscopy*).

The bottom line is this is an excellent book, good value for money and strongly recommended to those developing their microscope skills.

■ ***Dave Roberts***
Natural History Museum

Tyrosine Phosphoprotein Phosphatases. Second Edition

By B.J. Goldstein
Published by Oxford University Press (1998)
£25.00, pp. 272
ISBN: 0-19-850247-8

To lecturers, senior undergraduates and researchers not truly blooded in the field, the subject of tyrosine phosphoprotein phosphatases (PTPases) has presented quite a daunting, confusing scenario and had long been requiring a useful compendium to pull such an enormous array of information together. This task has been admirably achieved by Barry J. Goldstein in this 2nd, greatly expanded, edition of an original volume in the *Protein Profile* series. Clearly these enzymes influence cellular signal transduction as they have been considered to balance the steady-state phosphorylation of a variety of cellular tyrosine kinase substrates, including autophosphorylated receptors. This text presents a clear classification of the non-receptor and receptor-linked PTPases, and addresses the structural and evolutionary relationships between them. The direct basic information is very well supported by extensive tables which are complemented by an extensive bibliography. This text is to be recommended to anybody with an interest in cellular signal transduction.

■ ***John Donlon***
National University of Ireland, Galway

PCR 3. PCR *In Situ* Hybridization. A Practical Approach. The Practical Approach Series No. 186

Edited by C.S. Herrington & J.J. O'Leary
Published by IRL Press at Oxford University Press
£27.95, pp. 224
ISBN: 0-19-963632-X

The application of PCR to the detection of target nucleic acids *in situ* is viewed as being very difficult, but the strengths offered to analyses by the conjugation of two powerful techniques are sufficient to encourage development of the technique. Unfortunately, this member of the extremely successful *Practical Approach* series may be one of the less successful. It is not until chapter four that a consideration of PCR *in situ* hybridization is given. Prior to this the chapters focus on either PCR or *in situ* hybridization. Having arrived at the technique the focus is, on occasion, lost in later chapters. Despite these deficiencies, the reader can, by selecting the relevant chapters, gain much information about the practical aspects of PCR *in situ* hybridization, with suggestions of necessary controls. As expected from books in this series, the methods are well laid out with a very good level of detail which should make initial attempts at the technique easier for the novice.

■ ***Andrew Easton***
University of Warwick

Applications and Engineering of Monoclonal Antibodies

By D.J. King
Published by Taylor and Francis (1998)
£49.95, pp. 249
ISBN: 0-7484-0422-8

This is an excellent book which successfully targets two kinds of reader at the same time. First, for those with a basic grounding in biology it is a very good introductory text to the field of antibody engineering, including the production of antibodies and their applications in research, in industry, and clinical diagnosis and therapy. It gives an overview of the subject, including some essential background concepts of immunology and immunochemistry by use of a collection of easy-to-read texts and simple diagrams. However, at the same time, this is also an excellent reference for those like myself engineering antibodies. David King has succinctly summarized a collection of some of the most useful facts and observations from the research literature in the text and in a series of concise tables. Full source references to the literature are given and there is a useful index. This book will definitely have a prominent position on my bookshelf.

■ ***Mike Clark***
University of Cambridge

Comprehensive Reports on Technical Items Presented to the International Committee or to Regional Commissions 1997

By Office International des Epizooties (1997)
FrF150.00/US$25.00, pp. 179
ISBN: 92-9044-452-5

The book contains selected papers presented to the general session or regional conferences of OIE during 1997, covering a wide range of diverse animal disease topics. Papers in the general session are produced in more than one language but all are also printed in English. The regional papers are mainly in English. For the non-specialist, each is a useful review of the subject. Inevitably in diseases of international importance, reports of meetings two years ago will not contain completely up-to-date information, a point well illustrated by the article on BSE. Other papers provide a fascinating insight into the state of expertise, considered importance and attitude of countries to specific infections or general methods to survey or control veterinary disease problems. The volume is not overpriced and will provide useful background knowledge to those concerned with animal disease or wishing to know the regional variation in ability to control animal, zoonotic and food-borne disease.

■ ***Tony Andrews***
Welwyn

Penicillin: A Paradigm for Biotechnology

Edited by R.I. Mateles
Published by Candida Corporation (1998)
US$25.00 + postage (USA US$2.00/ROW US$8.00), pp. 114
ISBN: 1-891-545-01-9

Richard Mateles has done microbiology a great service by resurrecting the out-of-print text *The History of Penicillin* and adding to it. The original 1970 publication by the American Institute of Chemical Engineers assembled the first-hand accounts of many of those who played key roles in the development of the penicillin commercial process. These fascinating papers are retained and two further chapters included bringing the penicillin story up-to-date. This text should be essential reading for both students and established scientists with an interest in industrial microbiology.

■ ***Peter Stanbury***
University of Hertfordshire

Biotechnology from A to Z. Second Edition

By W. Bains
Published by Oxford University Press (1998)
£14.95, pp. 420
ISBN: 0-19-963693-1

Biotechnology has an enormous impact on every aspect of our lives and the comprehensive coverage of the subject in the book reflects this fact. Entries cover biotechnological applications in the food and pharmaceutical industries and the environment. Attention is given to techniques and tools used in molecular biology. New terms, added to the second edition, reflect recent innovations in this fast moving area of science. The publication is not a textbook nor does it claim to be; it is an extended glossary of terms which the reader can dip into or just browse for pleasure. The author assumes a good basic understanding of modern biological terms; for instance DNA is not defined but entries are found under DNA amplification, probing, fingerprinting and sequencing. Entries are well written and cross-referencing ensures that material is not needlessly repeated. This book is an excellent addition to the bookshelves of students, educators, science writers or anyone interested in the far reaching field of biotechnology.

■ ***Jane Westwell***
SGM Marlborough House

Nitrogen Fixation. Third Edition

By J. Postgate
Published by Cambridge University Press (1998)
£11.95/US$19.95, pp. 196
ISBN: 0-521-64853-X

An opportunity to review a book by John Postgate is not to be missed. This edition retains the highly successful format, length and even chapter headings of earlier editions, but has been completely updated to include, for example, new research on the structure of nitrogenase, newly discovered nitrogenases, and updated suggestions for further reading. The book can be wholeheartedly recommended to the intended audience, namely 'sixth formers and first-year undergraduates' although the readership deserves to be, and probably will be, much wider. My only reservation is that successive editors and publishers have done little to 'jazz up' the style and presentation, so that even the new black-and-white photographs, line drawings and page layouts are not immediately appealing, particularly to the novice, and do not do full justice to the highly readable text. Nevertheless, this is an excellent little book that deserves a place on every microbiologist's bookshelf.

■ ***Robert Poole***
Krebs Institute for Biomolecular Research, University of Sheffield

Citric Acid Biotechnology

By B. Kristiansen, M. Mattey & J. Linden
Published by Taylor and Francis (1999)
£45.00, pp. 189
ISBN: 0-7484-0514-3

Citric acid is an established 'high-volume low-value' fermentation product and this excellent little book seeks to reflect the balance between the practical science, fundamental understanding and economics of the citric acid process. Practical science and fundamentals have been brought together especially well in the chapters on the biochemistry and modelling of the process and the interaction between chemical engineering and microbiology is reinforced throughout the text. Whilst the influence of economics on the practicalities of process development are emphasized, a chapter devoted to the economics of citric acid production would have been a welcome inclusion. Although the reader (and authors) are frequently frustrated by the understandable secrecy masking current commercial processes, the authors have succeeded in providing an excellent case study for student use and an authoritative source for specialists.

■ ***Peter Stanbury***
University of Hertfordshire

Nitric Oxide and the Cell. Proliferation, Differentiation and Death

Edited by S. Moncada, G. Nisticò, G. Bagetta & E.A. Higgs
Published by Portland Press Ltd (1998)
£80.00, pp. 320
ISBN: 1-85578-120-4

NO more NO jokes!
Two years is a long time in nitric oxide research. Unfortunately, this book, which comprises the proceedings of an international symposium held in September 1996, was published only last year. There is little of direct relevance to microbiologists here and the most useful chapter in this respect (by Hausladen & Stamler on bacterial resistance mechanisms) is very brief and has been superseded by several important papers on the bacterial flavohaemoglobin Hmp in the original research literature. It is therefore hard to recommend this book to the microbial community, although there are many interesting papers on NO-induced apoptosis, NO connections with cancer and mitochondrial metabolism, and mechanisms of cytotoxicity. Although the book is billed as a 'summary of discussions that took place', there are no transcripts of the question and answer discussion sections that make some symposium books (like those from Novartis Foundation Symposia) such compulsive reading.

■ ***Robert Poole***
Krebs Institute for Biomolecular Research, University of Sheffield

Persistent Viral Infections

Edited by R. Ahmed & I.S.Y. Chen
Published by John Wiley & Sons Ltd (1999)
£175.00, pp. 725
ISBN: 0-471-98083-8

This book covers a lot of different virus systems in separate chapters which are really pretty well done. If there is a difficulty with it, it is illustrated by the way it is all brought together; there is a section on persistent viral infections of humans, a second on selected animal models of viral persistence, a third on new approaches, which means a chapter on synthetic peptides to characterize CTL responses in acute and chronic infections, and another on anti-sense approaches to control of infection. It is a bit of an unblended mixture, in other words, and this is reflected in the topics covered. There is a lot on retroviruses, which persist in part by integration, hepatitis C virus, which persists by unknown mechanisms, papillomaviruses and adenoviruses, which persist in part by transforming the infected cell, which only requires part of the viral genome and is therefore only partial persistence, herpes viruses, which lie doggo from choice, and other viruses which subvert immune presentation in ways which are fascinating and I would bet present in all serious viruses in some form. The question raised then is what is meant by viral persistence? This book might start you thinking about it. It is certainly a useful addition to the library and education of those working on acute smash-and-grab type viruses such as myself.

■ ***Philip Minor, NIBSC, South Mimms***

Environmental Monitoring of Bacteria. Methods in Biotechnology, Vol. 12

Edited by C. Edwards
Published by Humana Press (1999)
US$89.50, pp. 300
ISBN: 0-89603-566-2

The realization that only a small proportion of micro-organisms present in most environments are culturable has led to the development of a range of new techniques for their sampling, isolation, detection and analysis. This book sets out to provide the reader with sufficient information to facilitate access to a number of these techniques. Each chapter follows a similar pattern, outlining the principles of each technique, giving examples of applications, and detailing the experimental protocols, the latter supplemented by a list of useful practical notes. This provides an excellent balance of the theoretical and practical and, because each chapter follows a clear and consistent layout, the relevant information is easy to locate. Although all of the contributors are based in the UK, this should not detract from the wide appeal of this book which is aimed at any environmental microbiologist from undergraduate level upwards; a broad target but one which I believe has been hit.

■ ***Alan Warren, Natural History Museum, London***

Herpesviruses and Immunity. Infectious Agents and Pathogenesis

Edited by P.G. Medveczky, H. Friedman & M. Bendinelli
Published by Plenum Publishing Corporation (1998)
US$115.00, pp. 317
ISBN: 0-306-45890-X

This publication brings together an impressive array of authors who superbly either review specific topics or overview general areas of herpesviruses and immunity. Not all reviews are immunological, despite the Editors' comments that, "at present, the most productive herpes virologists are expert immunologists".
The topic is a broad one and whilst this is not meant to be a comprehensive work on herpesviruses, I am left wondering how the Editors arrived at the mix of topics – i.e. why a specific review on EBV vaccines and not a general overview of herpesvirus vaccines? Given the nature of the book there is an element of repetition as authors introduce the reader to a topic previously discussed by others. However, that said, this publication contains some excellent reviews which will be a valuable institutional buy for postgraduates, postdoctoral workers and other researchers and teachers in the field of herpesviruses and immunity.

■ ***Dick Killington, University of Leeds***

Medical Microbiology Illustrated

By S.H. Gillespie
Published by Butterworth-Heinemann (1999)
£15.99, pp. 304
ISBN: 0-7506-4415-X

This book concisely describes the diversity of traditional approaches to diagnostic medical microbiology (excluding virology). To achieve the breadth of coverage at the level of detail presumably intended, it is of necessity selective and at times pragmatic in approach. Mechanism is treated minimally. Most of the illustrations are of good quality; some would have benefited from expanded legends/annotation and the inclusion of some EMs would have been useful.
Mycology and parasitology are included and serological aspects are well covered. The contribution of molecular approaches in general and bacterial typing overall is given little attention. Nomenclature is dated and inconsistent with respect to generic abbreviations (*S.* = *Staphylococcus*, *Streptococcus* and *Salmonella*). There are a number of unfortunate typographical errors – Mycoaerophilic streptococci, *N. lactima*, *A. barmanii*.
The target audience is not obvious to this reviewer. For those embarking on diagnostic laboratory work; an introductory text? Perhaps of greater value for those not directly involved in the day-to-day activity of the laboratory for whom it could clearly provide a valuable perspective.

■ ***David Platt, Glasgow Royal Infirmary***

Coronaviruses and Arteriviruses. Advances in Experimental Medicine and Biology, Vol. 440

Edited by L. Enjuanes, S.G. Siddell & W. Spaan
Published by Plenum Publishing Corporation (1998)
US$185.00, pp. 826
ISBN: 0-306-45910-8

I have some misgivings about 'Proceedings' (this book being the proceedings of the VIIth International Symposium on Coronaviruses and Arteriviruses, May 1997) in general. They are additional work for authors, most of the work being published at some time, in full, in peer-reviewed journals. Notwithstanding, this book is very good of its type. The 106 papers, including seven authoritative reviews, cover every aspect of coronavirus replication, from entry to egress, plus immunological, pathological and vaccinological aspects. The brevity of each paper makes the book a useful introduction to researchers new to the field, though purchase would probably be at library or research group level. The work represents output of virtually every laboratory engaged on these viruses. As such it is a veritable time capsule describing, among other notable achievements, targeted recombinants for relating genetic differences to pathogenesis.

■ ***Dave Cavanagh, Institute for Animal Health, Compton***

Biopesticides: Use and Delivery. Methods in Biotechnology, Vol. 5

Edited by F.R. Hall & J.J. Menn
Published by Humana Press (1998)
US$119.50, pp. 640
ISBN: 0-89603-515-8

This excellent book gives a comprehensive update on the current technology of biopesticide research and development.
Chapters cover the whole range of biopesticide applications, including their use as fungicides, insecticides and herbicides. Attention is given to both microbial agents and naturally derived products. The Editors have made efforts to give the book a worldwide perspective, but the majority of the chapter authors are from North America, which inevitably results in a bias towards views held on that side of the Atlantic. The current use of biopesticides in developing countries is particularly poorly represented.
The book will be of value to scientists in the field of biopesticide R&D and those working in the related areas of insect and plant pathology. It is likely that it will become one of the most commonly cited references in this subject area, much as Burges' book *Microbial Control of Pests and Plant Diseases 1970–1980* has been over the last decade.

■ ***Nina Jenkins, CABI Bioscience***

Books Received

Cytochrome P450 Protocols. Methods in Molecular Biology, Vol. 107
Edited by I.R. Phillips & E.A. Shephard
Published by Humana Press (1998)
US$69.50, pp. 496
ISBN: 0-89603-519-0

Lipase and Phospholipase Protocols. Methods in Molecular Biology, Vol. 109
Edited by M. Doolittle & K. Reue
Published by Humana Press (1998)
US$79.50, pp. 384
ISBN: 0-89603-546-8

Lipoprotein Protocols. Methods in Molecular Biology, Vol. 110
Edited by J.M. Ordovas
Published by Humana Press (1998)
US$ 69.50, pp. 304
ISBN: 0-89603-420-8

Calcium Signaling Protocols. Methods in Molecular Biology, Vol. 114
Edited by D.G. Lambert
Published by Humana Press (1999)
US$79.50, pp. 376
ISBN: 0-89603-597-2

Immunocytochemical Methods and Protocols. Second Edition. Methods in Molecular Biology, Vol. 115
Edited by L.C. Javois
Published by Humana Press (1999)
US$79.50, pp. 480
ISBN: 0-89603-570-0

Pharmaceutical Microbiology. Sixth Edition
Edited by W.B. Hugo & A.D. Russell
Published by Blackwell Science Ltd (1998)
£39.50, pp. 510
ISBN: 0-632-04196-X

Molecular Biology of the Toxic Response
Edited by A. Puga & K.B. Wallace
Published by Taylor & Francis (1999)
£84.95, pp. 581
ISBN: 1-56032-592-5

Comprehensive Reports on Technical Items Presented to the International Committee or to Regional Commissions 1998
Published by Office International des Epizooties (1999)
25 Euros, pp. 315
ISBN: 92-9044-482-7

2-D Proteome Analysis Protocols
Edited by A.J. Link
Published by Humana Press (1998)
US$79.50, pp. 601
ISBN: 0-89603-524-7

Diary

Scottish Microbiology Society

1999 is an exciting time in Scotland with the re-opening of the Scottish Parliament in July, Glasgow holding title to 'UK City of Architecture and Design' and Edinburgh hosting the world's largest Hogmanay party to greet the new millennium. It is also an exciting time for Scottish microbiology, and bioscience in general, with advances being made on science stories that have gripped the public's imagination (or stalked their nightmares) ranging from *E. coli* O157 to new variant CJD/BSE; from genetically modified foods to 'Dolly' the sheep! Bioscience in Scotland is certainly to the fore on both the national and international stage.

1999 is also especially exciting for microbiology in Scotland as it is the first full year of the Scottish Microbiology Society. The Society started as the Scottish Microbiology Club in 1993 following the demise of the SGM Scottish Branch. The Club, and later Society, were founded as "*the forum for microbiology in Scotland*" with a mission to "*promote a scientific and social forum for microbiologists based in Scotland and through it promote and foster the exchange of ideas and knowledge from all sections of the scientific community involved in microbiology in Scotland*"

The Society's activities centre on 1- or 2-day symposia (latterly with support from SGM) on a variety of themes in venues throughout Scotland and the North of England. These are well attended both by the 200-strong membership and visitors from wider afield. The Society also organizes industrial study tours within Scotland. Previous SMS symposia have been held at the universities of Abertay, Aberdeen, Newcastle, Heriot-Watt, Robert Gordon, Strathclyde and St Andrews, covering topics ranging from antibiotics to zoospores! These symposia comprise talks from research students with distinguished invited speakers from the wider microbiological community. This combination of youth and experience has allowed the symposia to evolve into an important forum for young Scottish microbiologists.

The future programme for 1999 and 2000 includes a joint meeting with the Scottish Microbiology Association on medical microbiology, a joint meeting with the Biofilm Club and as part of the Edinburgh Science Festival in Spring 2000 the SMS will be hosting an event entitled *Microbes in the Millennium*. This is the most exciting and ambitious event yet undertaken by the SMS – it provides the opportunity to excite, educate and inform the public about the role of microbiologists in society – past, present and future – and to banish some of the myths that have been built up in the public's minds over the negative aspects of microbiology and science in general.

Details of these events and the other activities of the Society can be found on the Society's website created and maintained by the SMS secretary, Simon Burton.

The Scottish Microbiology Society is currently looking for new members from Scotland and the North of England. Membership fees are modest (per annum: £6 full membership; £3 student membership) and the benefits of membership include priority booking for meetings, free entrance to social activities and a quarterly newsletter.

If you are interested in their activities or want to join, then contact either SMS Convener Graeme Walker (g.walker@mail1.tay.ac.uk) or Simon Burton (s.a.q.burton@strath.ac.uk) or visit the website at www.strath.ac.uk/Departments/BioSci/Sms1.htm

september 99

FUNDAMENTAL ASPECTS OF SURFACE SCIENCE: STRUCTURE AND DYNAMICS OF ORGANIC AND BIOLOGICAL MOLECULES AT INTERFACES

Castelvecchio Pascoli, Italy
3–8 September 1999

CONTACT: J. Hendekovic, European Science Foundation, Office of European Research Conferences (EURESCO), 1 quai Lezay-Marnésia, 67080 Strasbourg Cedex, France (Fax +33 3 88 36 69 87; e-mail euresco@esf.org; http://www.esf.org/euresco)

THE BIOCHEMICAL SOCIETY MEETING

University College Cork
7–9 September 1999

CONTACT: The Meetings Office, Biochemical Society, 59 Portland Place, London W1N 3AJ (Tel. 0171 580 3481; Fax 0171 637 7626; e-mail meetings@biochemsoc.org.uk; http://www.biochemsoc.org.ukmeetings/cork99/default.htm)

MOLECULAR BIOLOGY OF RNA: PROCESSING OF EUKARYOTIC PRE-mRNA AND NUCLEO-CYTOPLASMIC TRANSPORT

Castelvecchio Pascoli, Italy
11–16 September 1999

CONTACT: J. Hendekovic, European Science Foundation, Office of European Research Conferences (EURESCO), 1 quai Lezay-Marnésia, 67080 Strasbourg Cedex, France (Fax +33 3 88 36 69 87; e-mail euresco@esf.org; http://www.esf.org/euresco)

ADVANCES IN ANTI VIRAL DRUGS AND ANTI VIRAL VACCINE TECHNOLOGIES

The Hatton, London
13–14 September 1999

CONTACT: SMi Customer Services (Tel. 0171 252 2222; Fax 0171 252 2272)

FOOD MICRO '99. ECOLOGY AND PHYSIOLOGY OF FOOD RELATED MICRO-ORGANISMS. THE 17TH SYMPOSIUM OF THE INTERNATIONAL COMMITTEE ON FOOD MICROBIOLOGY AND HYGIENE (ICFMH)

Veldhoven, The Netherlands
13–17 September 1999

CONTACT: ICFMH, Congress Service Brabant, The Netherlands (Fax +31 40 2546566; e-mail KSB@koningshof.nl; http://www.cbs.knaw.nl/foodmicro)

A PROTOZOOLOGIST'S GUIDE TO MODELING

Linnean Society, London
16 September 1999

Contact: Harriet Jones (e-mail harry@BSSPweb.freeserve.co.uk)

DIET, GUT FUNCTION AND HEALTH

The Royal Society of Medicine London
27–28 September 1999

CONTACT: Emma Bryce, The Royal Society of Medicine, 1 Wimpole Street, London W1M 8AE (Tel. 0171 290 3919; Fax 0171 290 2977; e-mail: events@roysocmed.ac.uk)

october 99

PROTEIN TARGETING: MECHANISMS AND COMPONENTS OF PROTEIN SORTING TO SUBCELLULAR COMPARTMENTS

Obernai, nr Strasbourg, France
1–6 October 1999

CONTACT: J. Hendekovic, European Science Foundation, Office of European Research Conferences (EURESCO), 1 quai Lezay-Marnésia, 67080 Strasbourg Cedex, France (Fax +33 3 88 36 69 87; e-mail euresco@esf.org; http://www.esf.org/euresco)

MOLECULAR BIOLOGY OF CELLULAR INTERACTIONS: ADHESION NETWORKS AND CYTOSKELETAL ORGANIZATION

Castelvecchio Pascoli, Italy
23–28 October 1999

CONTACT: J. Hendekovic, European Science Foundation, Office of European Research Conferences (EURESCO), 1 quai Lezay-Marnésia, 67080 Strasbourg Cedex, France (Fax +33 3 88 36 69 87; e-mail euresco@esf.org; http://www.esf.org/euresco)

november 99

SECOND FOCUS ON FLUORESCENCE SYMPOSIUM: EXCITING DYES AND THEIR APPLICATIONS

Leiden, The Netherlands
26–27 November 1999

CONTACT: Ms Irme van der Heijden, Molecular Probes Europe, Poortgebouw, Rijnsburgerweg 10, 2333 AA Leiden, The Netherlands (Tel +31 71 523 3378; Fax +31 71 523 3419; e-mail eurotech@probes.nl)

december 99

ADVANCED COURSE ON MICROBIAL PHYSIOLOGY AND FERMENTATION TECHNOLOGY

Delft University of Technology, The Netherlands
6–17 December 1999

CONTACT: Dr Ir.L.A. van der Meer-Lerk, Institute for Biotechnology Studies Delft Leiden (BODL), Kluyver Laboratory, Julianalaan 67, 2628 BC Delft, The Netherlands (Tel. +31 15 2781922; Fax +31 15 2782355; e-mail bodl@stm.tudelft.nl; http://www.kluyver.stm.tudelft.nl/BODL/ACS.htm)

january 2000

ESACT-UK ANNUAL MEETING 2000

Keele University, Staffordshire
6–7 January 2000

CONTACT: Julian Hanak, Meetings Secretary ESACT-UK, Cobra Therapeutics Ltd., The Science Park, Keele, Staffordshire ST5 5SP (Tel. 01782 714181; Fax 01782 714167; e-mail julian.hanak@cobrat.com)

may 2000

(FEMS) XITH BI-ANNUAL MEETING OF THE EUROPEAN STUDY GROUP ON MOLECULAR BIOLOGY OF PICORNAVIRUSES (EUROPIC)

Zagare Bay, Gargano, Italy
25–31 May 2000

CONTACT: Prof. R. Pérez Bercoff, Department of Cellular and Developmental Biology, Viale Porta Tiburtina 28, 00185-Rome, Italy (Fax +39 06 446 2306; e-mail bercoff@caspur.it; http://www.europic2000.it)

july 2000

BEYOND THE GENOME. 18TH INTERNATIONAL CONGRESS OF BIOCHEMISTRY AND MOLECULAR BIOLOGY

International Conference Centre, Birmingham
16–20 July 2000

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