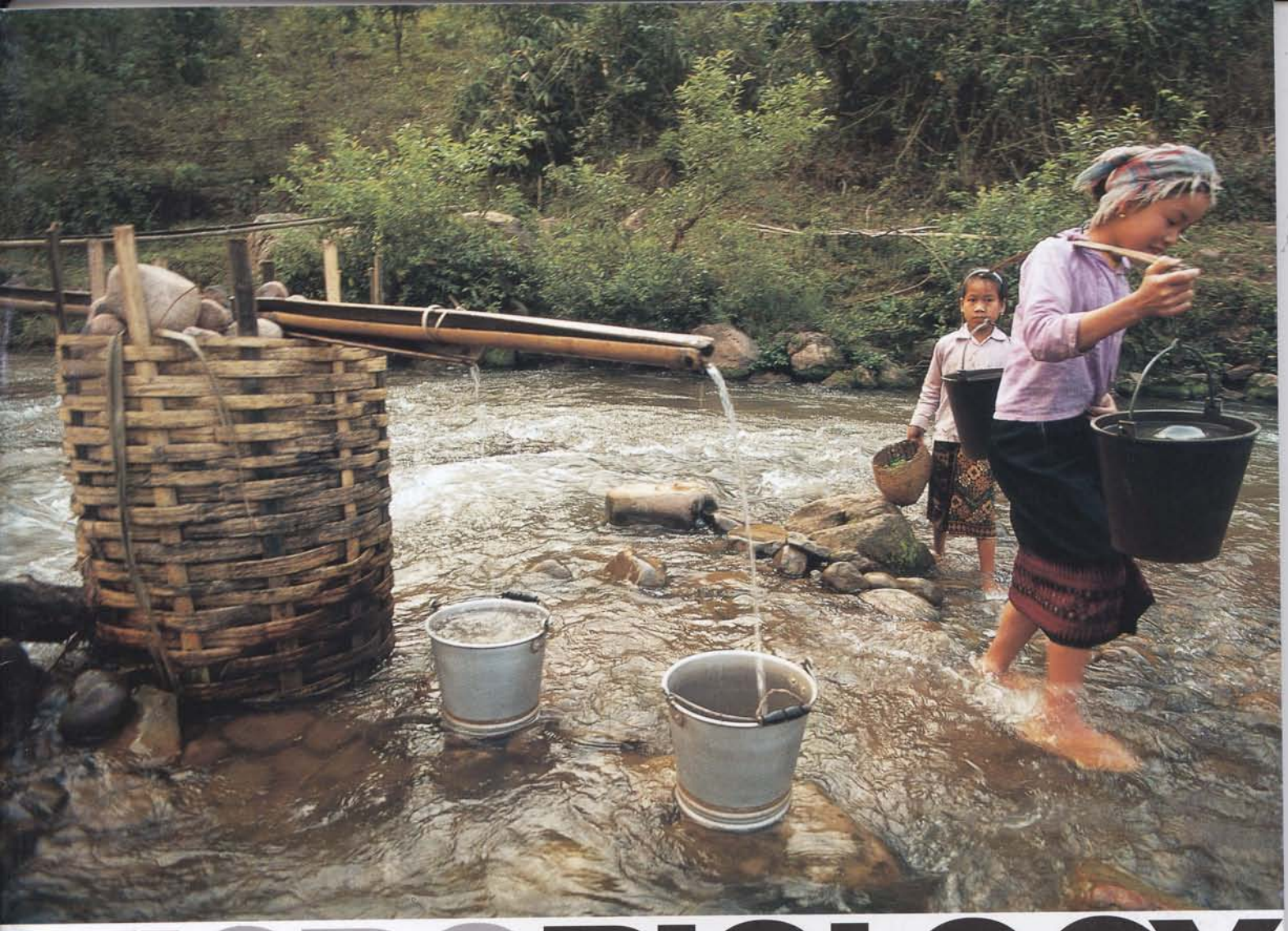

MICROBIOLOGY TODAY

QUARTERLY MAGAZINE OF THE SOCIETY FOR GENERAL MICROBIOLOGY VOLUME 27 MAY 2000

How safe is our water?
Bacterial overkill in the kitchen?
Contact lenses and personal hygiene
Immunization and vaccination
Influenza: the changing scene
Pets, poop and parasites
Photographic competition

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Above: Young girls collecting drinking water via bamboo pipes at Soupsung, Laos. *Photo courtesy Travel Ink/Charlie Marsden.*

Vol. 27, Part 2, May 2000

Microbes are all around us, most of them harmless, but what can we do to protect ourselves from pathogens that might threaten us in the home?

Should we eat a 'peck of muck' to boost our immune system? Hugh Pennington thinks not in an overview of the risks posed by microbes in our domestic environment on p. 62. Down in the kitchen, hygiene is vital to avoid food poisoning, but is it really necessary to use antimicrobial products? Charles Penn and Anthony Hilton (p. 64) argue that they might do more harm than good. And that water coming from the tap, is it safe to drink? Is global clean water attainable? On p. 78 Peter Wyn-Jones explores the issues, past, present and future.

Wearing contact lenses can be a hazardous business, as Simon Kilvington describes on p. 66, for inadequate cleanliness may lead to nasty eye infections.

Immunization is an essential tool in protecting the population, particularly the young and the elderly, against life threatening infections. Liz Miller (p. 70) describes current practice in childhood vaccination, Philip Minor explains the problems of developing new vaccines on p. 74 and on p. 76 Douglas Fleming covers that winter scourge – influenza.

Should we think twice before stroking a dog or cat? G. Suresh Kumar and Huw Smith (p. 84) assess the risks to our health from a whole range of parasites transmitted by domestic pets.

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

Erratum

The Editors apologize for an error in the February 2000 issue of *Microbiology Today* (Vol. 27, part 1). In the article entitled *Fit to eat? Food scares and safe food prodcution* by Tom J. Humphrey, Karen L. Mattick & Frieda Jørgensen, pp. 10–12, the legend to Fig. 1 is incorrect.

Recent trends in *Salmonella* (red) and *Campylobacter* (green) infection in England and Wales

should read

Recent trends in *Salmonella* (green) and *Campylobacter* (red) infection in England and Wales

Articles

Regular Features

Other Items

Immersed in a microbial sea

Hugh Pennington

It cannot be denied that the public has a deep and abiding interest in microbes. The viewing figures of TV programmes on killer viruses (even if they are really bacteria) and the response to food scares – to take two typical and topical examples – prove the point. A particular concern of many is what one can call the 'clean dirt' hypothesis. It is that because we are so cosseted and hygienic these days our immune systems are not being properly challenged, thus leading to a decline in our resistance and a consequentially bad response when we actually meet a pathogen for the first time. Its proponents believe that there was a golden age in the past when the dirt we consumed at our mother's knee provided a protective stimulus that we now lack.

Certainly, some immunologically mediated diseases, like asthma, have become much commoner in recent years. Whether this has anything to do with people taking baths more often, the frequency of deodorant use or having whiter teeth is, of course, uncertain. It could equally be due to more houses having more mites because of fitted carpets. Whatever, we can be sure that the dirt that our forebears ate and drank as children was not innocuous or benign. It killed them like flies. Go into any churchyard and look at 19th century tombstones. Many babies in most families never made it because of infection. These factors underpinned my response to John Humphries when he challenged me on the BBC Radio *Today* programme recently about cleanliness predisposing us to disease. I felt obliged to use that fine old Scottish word '*bollocks*'.

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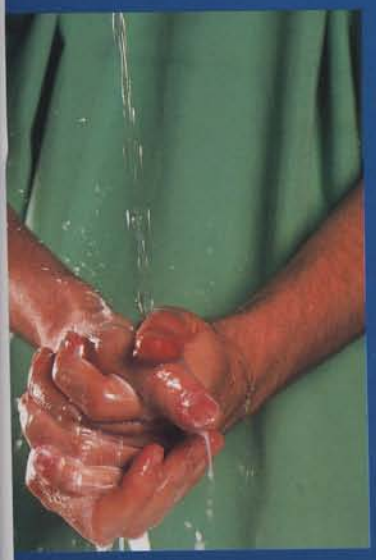

Despite the massive lengthenings of lifespan that have coincided with increases in cleanliness, as microbiologists we know that despite regular and frequent showers, clean drinking water and pasteurized milk we still live immersed in a richly diverse microbial sea. The bacteria living on our skin and in our throats and bowels are constantly challenging our defences and keeping our immunology very busy. We all carry potential pathogens like *Staphylococcus aureus*, *Streptococcus pyogenes* and *Neisseria meningitidis* from time to time – some of us for long periods – but resist some of them much more effectively than in the past and cope with all of them at least as well. Indeed, for organisms like *S. aureus* a strong case can be made that because our nutritional state is no longer defective, our immune systems now work at optimal levels, in contrast with the 19th century when systemic staphylococcal diseases like osteomyelitis were common. Our major *S. aureus* problem just now is quite a different one. We can only blame ourselves for MRSA, not just doctors for inappropriate overprescription of antibiotics and patients for shouting for them too loudly, but as microbiologists for forgetting about evolution and failing to remind everybody often enough about its power, its inevitability and its unforgiving nature.

Rather than immunological inexperience accounting for the current levels of disease, the present day incidence of infection provides overwhelming evidence that there is still plenty of dirt about. The landmark and massive Infectious Intestinal Disease Study in England, the biggest and most detailed of its kind conducted to date anywhere in the world, has just published its final report. It showed that 9·5 million cases occur annually, of which 1·5 million see a general practitioner and half a million have stools sent for microbiological examination. Only a small fraction of these cases require any specific treatment and even fewer need to go to hospital or suffer complications. The vast majority of victims recover without intervention because their immune responses and other antimicrobial defences are in fine fettle.

The real problem is posed by those micro-organisms that cause nasty diseases not because our immune defences have been enfeebled by clean living, but because the causative bacteria and viruses have evolved in ways that assist their evasion of our responses, even when these are working at their best. These are the organisms on which we have concentrated our efforts to develop preventive and therapeutic measures. Not only can we be proud of our microbiological successes against them, we can claim to be responsible for a significant proportion of the most important and effective preventive measures in current medical practice. For surgeons to operate on people without regularly killing a significant proportion there is an utter dependence on aseptic technique. We have eradicated smallpox by vaccination and polio will follow soon. Measles, diphtheria, whooping cough and *Haemophilus influenzae* meningitis have moved from being common killers to rare diseases because of this approach.

Nevertheless, and despite all these successes, there is much unfinished business. It is one thing to interrupt the spread of bacteria in operating theatres designed for the purpose by using elaborate rituals applied with an obsessional attention to detail. But the application of the same aseptic principles in the other parts of hospitals is scandalously defective. Despite the principles being fully worked out for more than a century and in spite of the training of doctors and nurses in basic microbiology, the Comptroller and Auditor General pointed out in a report to the House of Commons in February of this year that 1 in 11 hospital patients at any one time has an infection caught in hospital, which apart from causing pain, permanent disability and death, costs the NHS as much as £1,000 million every year. If things are this bad in hospitals, which have as their mission statement Florence Nightingale's dictum '*to do the sick no harm*', goodness only knows what they are like in kitchens in homes and restaurants.

The success of vaccines has raised expectations that existing problems can be solved by them – even those like malaria that have a rather intractable air about them and those against influenza and pneumococcal infections that have been around a long time, without inducing the hoped for step-change in prevention. Success brings its

own difficulties. When the infections they effectively prevent become rare, a very low incidence of vaccination complications – or the suggestion of one – becomes a problem in itself.

As if these difficulties were not enough, it is salutary to remember that our failures to prevent disease do not come just from an inability to apply known principles. There is still a lot of microbiological ignorance about. Take two topical examples, *Escherichia coli* O157 on farms and the winter surge of influenza. Wouldn't it be nice to know how to eradicate the first from cattle and how to stop the second. So much important work remains to be done. The articles that follow show us the way.

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Photo2000
Photographic competition

Are you a keen photographer?

Do you have any good images of micro-organisms, scientists at work, food, farming, the environment, industry, biotechnology or academia?

If so, why not enter our new competition? Entries may be used in *Microbiology Today*, perhaps even on the cover, or in SGM educational resources.

Rules

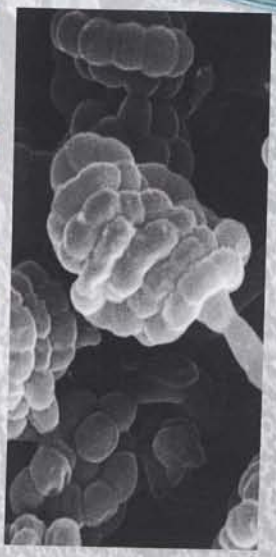
Each entry must be submitted in the form of a labelled transparency and photograph, black & white or colour, accompanied by a separate A4 sheet containing a descriptive legend and the full title, name, position, address and contact telephone/email information of the entrant.

Entries will be retained by the Society and entrants will be required to sign a form giving permission for use of the photographs in Society publications and on the website at **http://www.sgm.ac.uk** In the event of their use, credits will include the name of the photographer.

Entries will be displayed and judged by a panel at the Autumn 2000 Society meeting in September at the University of Exeter. The panel's decision will be final. The winner will receive a certificate and cash prize of £250, to be presented at the Society Dinner on 13 September.

Send your entries to: Janice Meekings, *Microbiology Today*, Marlborough House, Basingstoke Road, Spencers Wood, Reading RG7 1AG, UK

Closing date for entries: **31 July 2000.**



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Is there a risk of bacterial overkill in the kitchen?

Charles Penn & Anthony Hilton

Poor kitchen hygiene can lead to foodborne infections. But do the new antimicrobial products provide the right remedy? And can we ever eliminate human error in the home?

The kitchen as a source of infection

There is little doubt that the domestic kitchen is a significant source of foodborne infection. It has been estimated that in western European societies, 50–80% of foodborne infection outbreaks originate in the home. Most of the risk factors in the kitchen are quite well known and include incorrect storage of foods, particularly with respect to temperature, contamination of raw or cooked foods before consumption, by contact with other foods or utensils carrying pathogens, and inadequate or poorly controlled cooking which may allow persistence of pathogens in food. Other factors are less well understood, for example the potential role of domestic pets which may be considerable but for which firm data is hard to find. It is also unclear to what extent organisms originating from the domestic human food handler are implicated in disease.

The vehicles involved

What then of the routes and vehicles for dissemination of micro-organisms in the kitchen? Again, it is self-evident that direct contact between raw and prepared foods can be avoided by an understanding of the route of infection coupled with appropriate handling. For example, it is quite well known that there are risks in storing raw meat, which may be dripping juices, on high shelves in the fridge where foods stored lower down may be contaminated. It is also obvious that knives, chopping boards and hands should be properly washed between operations with raw and prepared foods. There are adequate data to support the obvious risks from moist, dirty locations such as sink wastes. In other contexts, however, there is still a lack of basic information about the importance of potential routes of infection, and some new approaches to control are now being explored. One aspect of kitchen hygiene where the possibility of infection is clear, but hard data is lacking, is the use of dishcloths for general wiping of surfaces and spills. Despite the introduction of disposable paper products such as kitchen rolls, many domestic kitchens still contain a cloth which is used for general wiping of surfaces and sometimes also chopping boards after use. The cloth may typically be rinsed, more or less thoroughly, under the tap after use and frequently will be washed out in the washing up water or bowl and stored damp. It may seldom be properly washed and dried or disinfected and is a prime microbiological habitat! What is the likelihood that this is a key factor in dissemination of pathogens? Again there is very little hard data from recent investigations – older figures may not be reliable against the background of use of modern detergents and kitchen surfaces. The limited information available suggests that while total microbial populations in these cloths may be high, perhaps in the hundreds of millions per cloth, pathogens are sometimes but not always present. One survey suggests they may include members of the *Enterobacteriaceae* such as *Salmonella*, while another indicates little evidence of pathogens other than staphylococci. This is clearly a topic for further exploration.

Strategies for prevention

There is great scope for intervention to improve the microbiological safety of food preparation in the home, and despite the gaps in knowledge indicated above, we are better informed than ever before about the causes of infectious disease and its transmission. Safety of food, and more so its preservation from spoilage, have for centuries been the main drivers in the development of the science of microbiology outside the medical field. Thus the major foodborne pathogens are known and much is understood of their mechanisms of pathogenicity. Less is known generally about their survival outside their human or animal hosts and their transmission between individuals. It is true that the stress resistance mechanisms and survival in the environment of some of the 'paradigm' species such as *Escherichia coli* and *Salmonella enterica* have been well researched. For others, such as *Campylobacter* species, currently the most prevalent foodborne bacterial pathogen, although not the best known to the general public, there is little understanding of persistence and transmission. One of the tools that is available for interruption of this cycle is the use of antibacterial substances to keep these pathogens in check in our food preparation environments.

Antibacterial agents can be broadly categorized into antibiotics, generally taken to be substances with therapeutic potential in infection and therefore by definition harmless or only marginally harmful to the host human or animal, and antiseptics and disinfectants. The latter are generally toxic not only to micro-organisms but also to other life forms, including our own, although limited topical or local application of some 'antiseptics', for example in mouthwashes or skin treatments, may be tolerated. It is mainly with disinfectants that food handling safety is concerned, but there may be parallels in the history of antibiotic use which we should heed.

Risks of overkill

It is well known that micro-organisms have evolved rapidly during the past half century since antibiotic use became widespread to become widely resistant to many of the most useful agents. Their resistance genes have been disseminated both by well understood mechanisms, such as transfer of conjugative plasmids between species, and by newly discovered mechanisms, such as the movement of genetic cassettes or integrons between different genetic elements capable of their expression. It is also becoming clear that horizontal transfer of genetic information, by means not always understood, can lead to 'quantum leaps' in the biological fitness and

adaptation of bacteria to new lifestyles, such as ability to behave pathogenically. Horizontally acquired DNA of this kind can often be detected as an 'island', distinguishable by its differing G+C content for example, in a 'sea' of chromosomal DNA. Thus mechanisms for rapid evolution of resistance, and its spread as genetic elements to other organisms, are prevalent in the context of antibiotic resistance. Why should these processes not also lead to evolution of microbial resistance to disinfectants or antiseptics? To date there is little evidence that they have done so, but clues are beginning to appear that resistance to these agents may currently be evolving in bacteria. Such evolutionary processes are of course driven by selective forces.

It is therefore alarming to see that antimicrobial agents are being used indiscriminately to counter microbial hazards in the home. Although there has been a long history of use of simple disinfectants such as phenolics and hypochlorite in sporadically used domestic cleaners, new approaches and new philosophies are now increasing dramatically the interaction of more discriminating agents with bacterial populations. Incorporation of agents into plastics and cloths, wide-spread use of disinfectant aerosols and impregnated wipes and greater focus on anti-microbial soaps and personal hygiene products are now generating conditions of continuous low-level exposure of bacteria to the antimicrobial agents, exactly the conditions required for selection of resistance mechanisms. Much of this 'progress' is driven by the potential for commercial profitability, and of course advertising is often used to increase the interest and motivation of potential customers. While there is no doubt that antibacterial agents can reduce populations of organisms on surfaces, is there evidence that this will reduce the incidence of foodborne disease? If so, their use can perhaps be justified, but if not, we should stop their abuse and reserve them for use where they are really needed.

Until we have a better understanding of the routes of transmission of pathogens in the kitchen, it is impossible to answer such questions about the value or otherwise of widespread use of these agents. They cannot prevent direct spread of organisms by contact between raw and prepared foods. If routine and 'traditional' washing procedures with hot water and surfactants are incapable of removing pathogens from utensils and surfaces, there is a case for greater use of disinfectants. We need better information and clear answers.

Human factors

We should not neglect to consider the human side of the equation in our delicate equilibrium with micro-organisms. First, what if we eventually virtually eliminate common pathogens from our daily environment? There does seem to be a risk that natural immunity to them will diminish. For example, it is known that *Campylobacter* diarrhoea is commonly less severe, with a lower incidence of dysentery-like symptoms, in developing parts of the world than in environments such as Western Europe or North America. Julian Ketley of the University of Leicester has suggested that in the developing societies this may be due to background immunity, stimulated probably by relatively frequent exposure to the organisms. There is the suggestion that a bit of 'healthy dirt' is beneficial to the maintenance of an effective immune system. Perhaps we are lessening the natural resistance of our own population by over-emphasis on hygiene. Second, is human behaviour modified by over-use of these agents? It is being suggested that if people are reassured by the presence of antimicrobial agents in their kitchen, they may see them more as a substitute for, rather than an addition to, established domestic hygiene practice. For example, impregnated chopping boards and wiping cloths have in some cases been misinterpreted as 'self-cleaning' therefore increasing the potential risk of cross-contamination. Antimicrobial agents are known to be poorly effective in dirty environments. Clearly, it is necessary that consumers be provided with the necessary information to incorporate these types of products effectively into a domestic cleaning regime.

ABOVE:
Incorrect and correct storage of raw and cooked meat in a refrigerator.
PHOTO SGM

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Through a glass darkly – Contact lenses and personal hygiene

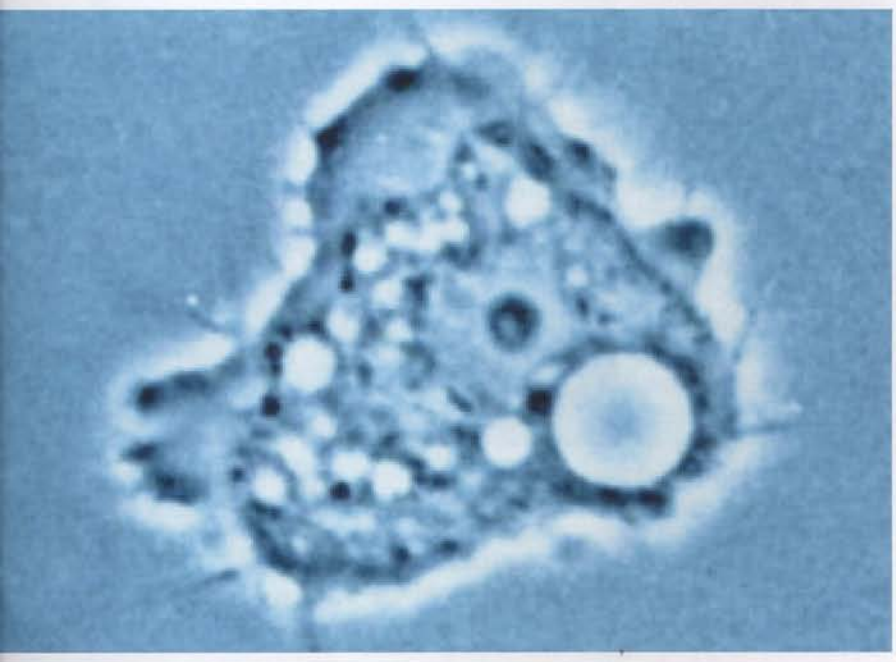
Simon Kilvington

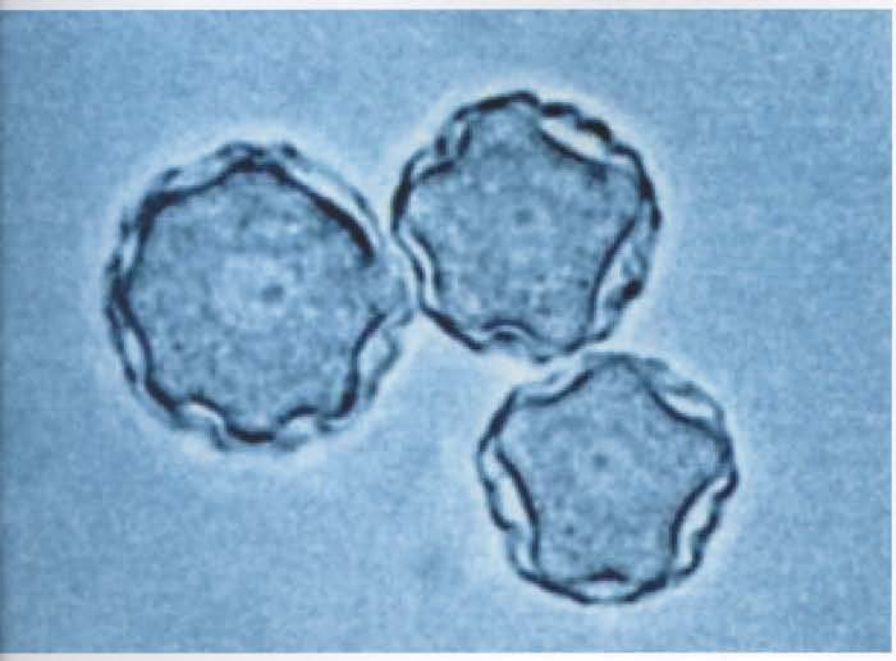
Contact lenses are a popular alternative to spectacles, but poor hygiene in their use can lead to serious eye infections.

Contact lenses

Contact lenses were first described in 1508 by Leonardo da Vinci but it was not until the 1950s that they became routinely available. Originally, these were 'hard lenses' that were inflexible and caused a level of discomfort that few wearers could tolerate. Today, most people wear soft contact lenses that are made from flexible, water-absorbent plastics with a 35–80% water content which are designed to be discarded either daily, weekly or fortnightly. Another form is rigid gas-permeable (RGP) lenses made of firmer plastics that are better suited for the passage of oxygen and other gases between the lens and the corneal surface. Both types provide the user with increased comfort and wearing times.

There are approximately 2·5 million contact lens wearers in the United Kingdom of whom 85% use soft lenses and the remainder RGP lenses. Contact lenses offer practical alternatives to spectacles for vision correction and safety during sport and recreational activities. They are also increasingly being worn as fashion accessories, whereby lenses with no power of sight correction are tinted to alter the colour of the iris or even to depict images such as animals or sports logos over the cornea!





Corneal infection (keratitis)

The exposed nature of the cornea, with its warm moist environment, makes it vulnerable to infection (keratitis) by a variety of viruses, bacteria, fungi and protozoa. This typically presents as a central abscess that can lead to corneal perforation and blindness. The cornea is constantly challenged by microbes either from the normal flora of the conjunctiva and skin or from the environment. Fortunately, the surface of the cornea is protected by highly efficient natural defence mechanisms in the tear-film. These include:

Lysozyme – active against Gram-positive bacteria (e.g. staphylococci and streptococci);

Lactoferrin – complexes iron and deprives bacteria of an important growth factor;

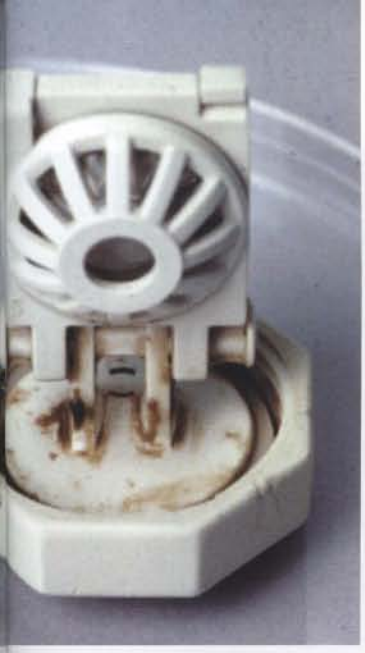
Secretory IgA antibody – coats microbes and hampers attachment.

In association, the tear-film and blinking action of the eyelids prevents attachment and wipes micro-organisms from the eye surface.

Due to these protective mechanisms, keratitis is a rare disease and usually results from surgery or direct injury. However, for contact lens wearers the risk of microbial keratitis is greatly increased. The presence of a contact lens on the cornea represents a foreign body that can alter tear-film flow, prevent oxygen and ionic diffusion and cause superficial alterations to the integrity of the epithelium layer. This in turn may render the cornea susceptible to microbial attachment and infection.

Contact-lens-associated pathogens

Numerous microbes can cause keratitis but it is the bacterium *Pseudomonas aeruginosa*, several types of yeast and fungi (e.g. *Candida albicans*, *Fusarium* and *Aspergillus*) and the free-living amoeba *Acanthamoeba* that are most commonly seen in contact lens wearers. Of these, the most devastating and potentially blinding infection is caused by *Acanthamoeba*. This article will focus on the reasons why acanthamoeba keratitis is most frequently seen in contact lens wearers and what measures can be taken to reduce its incidence.



Acanthamoeba keratitis

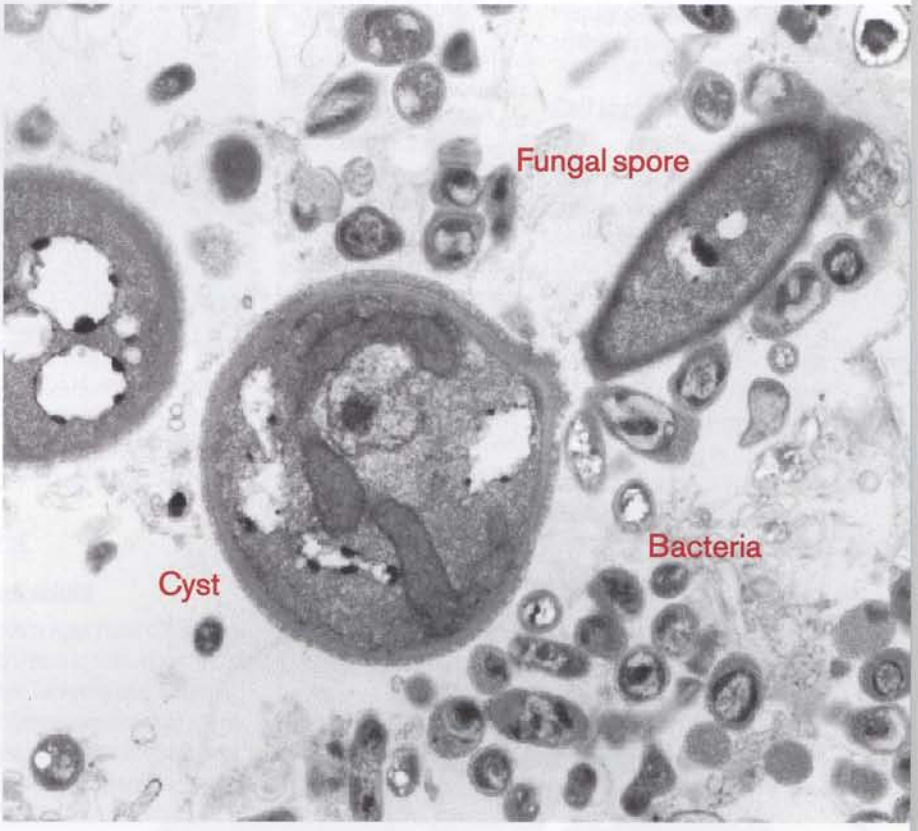
Acanthamoeba is a common soil and water amoeba characterized by a feeding and replicating trophozoite and dormant cyst stage (Fig. 1). The resistance of *Acanthamoeba* cysts to extremes of temperature, desiccation and disinfection accounts for the presence of the organism in virtually all natural and man-made aquatic sites. Contact lens wearers are most at risk from infection and account for 95% of all reported cases. Approximately 400 cases of acanthamoeba keratitis have occurred in the UK since the disease was first recognized in 1971. Acanthamoeba keratitis is not a notifiable disease but estimates suggest that approximately 50 new cases arise each year in the United Kingdom. This figure far exceeds the total annual number of cases from the rest of Europe.

Contact-lens-associated acanthamoeba keratitis results from a primary contamination of the contact lens storage case. Lens storage cases can be grossly contaminated with bacteria ($>10^6$ cells ml^{-1}) and this provides the food source for the growth and replication of *Acanthamoeba*. From here, the trophozoites and cysts adhere to the surface of the lenses and so inoculate the cornea. An example of a grossly contaminated contact lens storage case with thick biofilm around the neck is shown in Fig. 2. A sample of the biofilm in the photograph was removed for electron microscopy (Fig. 3) and was found to contain a high concentration of bacteria, *Acanthamoeba* cysts and fungi.

Acanthamoeba and domestic tap water

Acanthamoeba can gain access to the contact lens storage case from any environmental source, but studies in the United Kingdom indicate that this is most likely to be from bathroom tap water. Most homes in this country have a water storage tank in the roof that is used to supply the bathroom and toilet. The history of the domestic water storage tank dates from the 19th century when water supplied to homes from the municipal water companies was intermittent. Water would therefore be stored for use when the supply was unavailable. This is not the case in other parts of Europe where all household water is supplied directly from the mains. Many such tanks are poorly maintained and can be open to airborne contamination and accumulation of sludge in the bottom. With modern roof insulation, the water in the tank can become warm enough to provide an ideal environment for microbes, including *Acanthamoeba*, *P. aeruginosa* and fungi, to multiply.

In a survey, free-living amoebae were recovered from the domestic tap outlets in 23/26 (88·5%) homes of acanthamoeba keratitis patients diagnosed at Moorfields Eye Hospital, London. Amoebae were most frequently isolated from cold water taps supplied from the roof storage tank. *Acanthamoeba* contamination was found in 7/26 (27%) cases, all from cold water taps supplied by the roof tanks. In five cases the strains showed identical mitochondrial DNA RFLPs between the patient's corneal isolate and that made from the home tap water, firmly implicating this to be the source of infection. Fig. 4 shows the microscopic appearance of a swab sample taken from a bathroom cold water tap supplied from a roof storage tank. Note the presence of fungal hyphae and *Acanthamoeba* cysts.



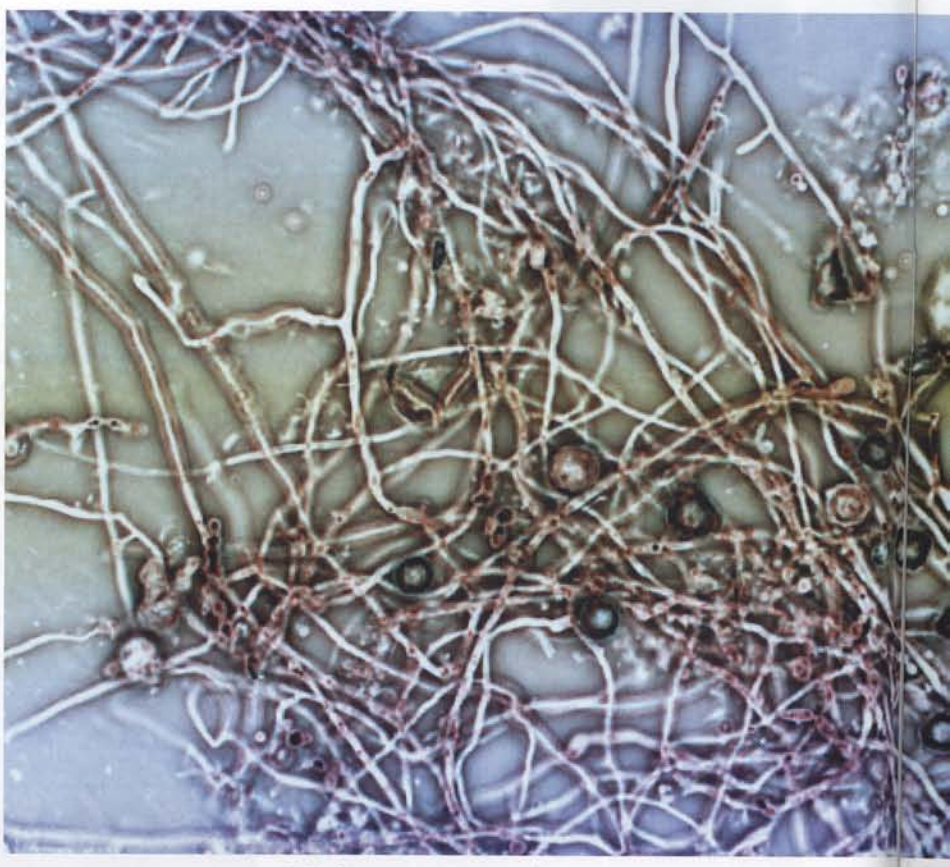
Contact lens disinfection

Disinfection is a fundamental part of the contact lens hygiene regime. It serves to prevent the growth of potentially pathogenic organisms on the lens surface and also within the storage case. Although the *Acanthamoeba* trophozoites are sensitive to contact lens disinfectants, the cysts are usually resistant (Fig. 5). Two-step hydrogen peroxide (3%) systems (where the peroxide is neutralized after disinfection) are effective, provided an exposure time of at least 4 hours is used before neutralization. One-step hydrogen peroxide systems (where the neutralization is achieved during disinfection) are not effective as the peroxide is neutralized too rapidly. With both systems, once the peroxide is neutralized there is no residual

OPPOSITE PAGE:
Fig. 1. *Acanthamoeba* trophozoite (top) and cysts (bottom).

TOP LEFT:
Fig. 2. Grossly contaminated contact lens storage case with biofilm around the neck (recovered from a patient with acanthamoeba keratitis).

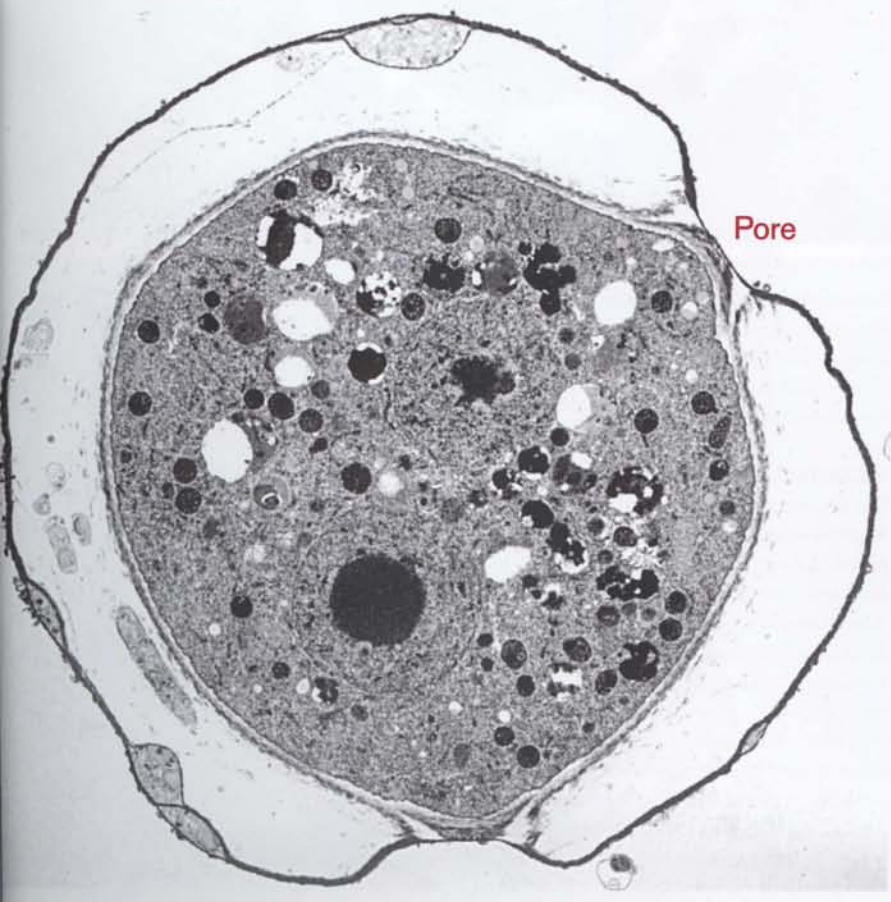
ABOVE:
Fig. 3. Electron micrograph of biofilm removed from storage case shown in Fig. 2 showing bacteria, *Acanthamoeba* cysts and fungi.



RIGHT:
Fig. 4. Microscopic appearance of a swab sample taken from a bathroom cold water tap showing the presence of fungal hyphae and *Acanthamoeba* cysts.

BELOW:
Fig. 5. Electron micrograph of an *Acanthamoeba* cyst showing thick wall and pores through which the trophozoite excysts.

disinfectant activity to prevent re-growth of surviving organisms inside the storage case. Chlorine tablet systems are also ineffective and their use has been implicated as a risk factor in acquiring acanthamoeba keratitis because of abuse through the use of tap water to dissolve the tablets. The advent of multipurpose solutions (MPS) is considered advantageous as they may improve user compliance because the one solution is used for rinsing, disinfecting and storing the contact lenses. Although few MPS are cysticidal, they may provide greater safety due to their residual disinfectant activity during lens storage and so prevent the growth of a bacterial food source for *Acanthamoeba*.



Safe contact lens use

Acanthamoeba keratitis is a potentially blinding infection occurring almost exclusively in contact lens wearers in the UK. The intense pain, loss of vision, prolonged medical treatment (that may include corneal grafting) and impaired working, social and sporting activities all combine to have a profoundly distressing effect on the patient. Loss of earnings or employment may also result and medical costs to the patient, medical insurer or Health Service are also significant factors.

The common presence of the *Acanthamoeba* in the environment, particularly domestic tap water, presents a constant challenge to the contact lens wearer. However, acanthamoeba keratitis must be viewed as a preventable disease as most cases can be attributed to some form of abuse or negligence by the user. To this end, contact lens wearers must strictly comply with recommended lens cleaning and disinfection protocols using only fresh, sterile solutions and they must never rinse or store lenses in tap water. Indeed, it may be wise not to perform the lens hygiene regime in the bathroom. If possible, contact lenses should not be worn whilst swimming and should the eye become contaminated with environmental matter, the lenses should be removed immediately and reinserted only after thorough cleaning and disinfection. The lens storage case should be thoroughly cleaned each week with a mild detergent and soft brush, followed by rinsing with sterile saline and left to dry. The storage case should also be replaced every month. These recommendations would also serve to reduce the incidence of contact-lens-associated bacterial and fungal infections.

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MicroShorts

Monitoring disease

AIIAID

A coalition of the World Health Organization (WHO), the International Centre for Genetic Engineering and Biotechnology in Trieste and a range of public health organizations has set up the Alliance Against Infectious Diseases (AIIAID). *New Scientist* (8 April 2000) reports that the alliance aims to reduce suffering in developing countries by monitoring infectious disease, spotting outbreaks of new pathogens and devising methods of detection and control. Surveillance of emerging diseases will also have worldwide benefits to public health. Funding for the venture has yet to be found, but it is hoped that some may be diverted from an unusual source – the Bioweapons Treaty due to be signed in 2001 which will require epidemiological data to be effective.

Resisting TB

Tuberculosis is back as a big killer, with drug-resistant strains spreading fast throughout the world as shown by a recent WHO report. Now help in the fight against TB is to come from the profits of the computer software industry. Microsoft's Bill Gates has set up a charitable foundation which is donating $25 million to the Global Alliance for TB Drug Development, which will develop and carry out trials of new treatments.

Food for thought

Food Standards Agency launched

The long awaited UK Food Standards Agency came into existence in April under the chairmanship of Sir John Krebs, former head of the Natural Environment Research Council. The Agency has been created to '*protect public health from risks which may arise in connection with the consumption of food, and otherwise to protect the interests of consumers in relation to food*. With an annual budget of £126 million and independent of other government departments, the Agency aims to deal with all aspects of food safety and standards throughout the food chain. It will set and audit standards for the enforcement of food law and has taken over responsibility for the Meat Hygiene Service from MAFF. The Agency claims that it is committed to openness, with information channelled through its website (www.food standards.gov.uk), including notes on its board meetings as well as reports on research findings and on nutrition and food safety generally.

European food safety

The Europeans are following the UK lead with the adoption of a recent EC white paper which proposes a major overhaul of EU food safety legislation. This is likely to include the creation of a European Food Authority to carry out research, provide advice to EU institutions and co-ordinate national responses to emergencies. The new body should be up and running by 2002. It aims to restore public confidence in the 600 billion ecus European food industry after a series of scares, including the BSE controversy.

Bioscience means business

Prize proteins

Aegis Pharmaceuticals, a Bristol-based company set up by SGM member Professor Tim Hirst and Dr Neil Williams, has won a £10,000 prize in the first UK Bioscience Business Plan competition run by the BBSRC in conjunction with the Medical Research Council and other sponsors. The award was presented by Lord Sainsbury, Minister for Science, at a ceremony held in London.

Aegis is developing new products for the prevention and treatment of autoimmune and infectious diseases, such as rheumatoid arthritis and influenza. The Bristol team was one of five finalists selected from more than 100 entries for taking science to the market place. They were judged on the quality of the business plans they produced. Aegis now has to attract the necessary investment to allow it to advance its treatments into the clinic. Hopefully, the success of the company in the competition will facilitate this.

Environmental challenge

Not to be outdone, the Natural Environment Research Council (NERC) has recently launched a National Environmental Sciences Business Plan Competition. It is being run with support from private and public sector organizations, including the Department of Trade and Industry. Teams or individuals working in the environmental sciences are invited to submit proposals for exploiting their scientific ideas and those offering the best suggestions will be offered professional training from business experts to enable them to develop a business plan. The objective of the competition is to encourage the transfer of publicly funded science to the business sector. For further details contact Dr Chris Miller at NERC (Tel. 01793 411764; email cmill@nerc.ac.uk).

Cell factories

Bacillus species are important commercially as producers of antibiotics and biochemicals, but their potential as 'cell factories' for the large-scale production of a wide variety of industrially important molecules has yet to be fully exploited. BACELL, the *Bacillus* Cell Factory, is an umbrella organization which aims to change all this by facilitating research into these versatile bacteria and identifying opportunities for commercial development of their activities. For further details see the website at **www.ncl.ac.uk/bacell** or contact SGM member Dr Colin Harwood (email colin.harwood@ncl.ac.uk).

It's in the stars

Does extraterrestrial life exist? A UK Astrobiology Forum has been set up to find out. SGM member David Wynn-Williams of the British Antarctic Survey has a key role in the forum, which is made up of scientists from many disciplines – geology, atmospheric physics, chemistry, biology and astronomy. Work on extremophiles has led astrobiologists to believe that microbes could well survive in the conditions on other planets. The forum will co-ordinate a programme to take research in this exciting field forward.

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Immunization against the classic infectious diseases of childhood

Liz Miller

Immunization has caused massive reductions in childhood sickness and mortality over the past 50 years. Liz Miller explores current practice and describes the impact of the anti-vaccine lobby.

What has immunization achieved over the last 50 years?

The development of vaccines for the prevention of infectious diseases is without doubt one of the most significant achievements of medical science. Over 80% of the world's children now receive immunizations against one or more of the killer diseases of childhood, with an estimated prevention of over 3 million unnecessary deaths each year. In countries such as North America and Western Europe, deaths from vaccine-preventable infections such as polio, measles, diphtheria and tetanus are now virtually unknown. The reduction in the burden of suffering from the common childhood infections achieved in England and Wales since the 1940s as a result of immunization is shown in Table 1.

Table 1. Reduction in the incidence of vaccine-preventable diseases in England and Wales

Diseases	Before vaccination		After vaccine use (1997)	
	Baseline year	No. of cases	No. of cases	Reduction (%)
Measles	1940	409,521	186	>99
Mumps	1989	20,713	175	>99
Rubella	1989	24,570	99	>99
Congenital Rubella	1971	73	0	100
Diphtheria	1940	46,281	4	>99
Polio	1940	1,066	0	100
Hib	1989	655	30	95
Pertussis	1940	53,607	2996	94

Note: cases of measles, mumps and rubella in 1997 include only laboratory confirmed cases.

One of the most important factors in determining the success of an immunization programme is achieving high vaccine coverage. For highly infectious diseases such as measles and pertussis, coverage rates of around 90% must be attained before a reduction of virus transmission between unvaccinated members of the population (i.e. herd immunity) is achieved. Following the national measles–rubella vaccination campaign in 1994, endemic measles transmission has been interrupted in England and Wales (Fig. 1) and confirmed cases are now only seen in association with outbreaks spread in unvaccinated communities which decline vaccination. However, unless coverage rates are sustained, these achievements may be rapidly reversed as we saw with whooping cough in the 1970s (Fig. 2).

Old and new methods for vaccine production

The success of our current immunization programmes has been largely accomplished with vaccines produced by simple technologies without the benefit of our present-day understanding of immunology and molecular biology. The vaccines which are now routinely offered to all children in the UK are made by one of the following four techniques:

Diphtheria and tetanus – inactivated extract of the toxin responsible for the disease symptoms

Whooping cough – killed suspension of whole *Bordetella pertussis* organisms

Measles, mumps, rubella, oral polio – naturally occurring virus which has been attenuated by growing it in tissue culture

Haemophilus influenzae b (Hib) and meningococcus C – conjugation of the protective polysaccharide antigen with a protein

The diphtheria and tetanus toxoid vaccines are among the simplest yet most successful vaccines, although the requirement for repeated doses to ensure adequate priming and maintenance of protective antibody levels in the individual is a drawback. Methods for sustained slow release of antigen by its encapsulation in micro-spheres which are broken down by the body at different rates according to their size are now being developed and offer the prospect of delivering the full priming course in a single shot.

Use of killed suspensions of the organism, although now regarded as a rather crude approach, has also had some outstanding successes, such as the whole-cell pertussis vaccines developed in the 1940s and 1950s, the killed polio vaccine of the 1950s made by Salk (Fig. 3) and more recently the killed hepatitis A vaccines. Attempts to develop improved pertussis vaccines by incorporating only those antigens which are important for protection while excluding unnecessary toxins has met with varied success. Although generally less reactogenic, most acellular pertussis have failed to match the protection afforded by the best whole-cell vaccines due to the lack of key protective antigens.

The technique of attenuating a pathogenic organism by adapting it to grow under altered environmental conditions was pioneered by Pasteur over 100 years ago with the development of the first rabies vaccines, produced by serial passage of the virus in rabbit spinal cord. This empirical approach to viral attenuation was further developed by Sabin in the 1950s, with the production of live oral polio vaccine – the instrument now being used to achieve global eradication of polio. The development of polio vaccines benefited greatly from the tissue culture technique for viral propagation pioneered by the American virologist Enders and his colleagues in the late 1940s , as did the development of the three other live viral vaccines which have proved so successful in combating the classical diseases of childhood – measles, mumps and rubella. The application of molecular biology to the identification of virulence genes has now allowed a detailed understanding of the basis of microbial pathogenesis and the important antigenic epitopes. It has opened the way for a more rational and less empirical approach to vaccine design.

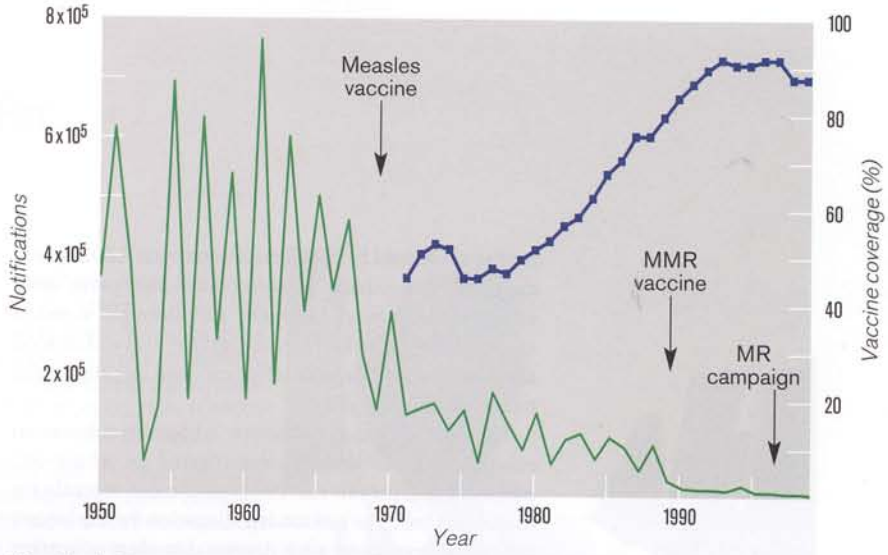
One of the most promising advances in vaccine technology in recent years has been the use of glyco-conjugation to protect against some of the common invasive bacterial infections such as Hib, *Neisseria meningitidis* and *Streptococcus pneumoniae*. All these organisms possess a polysaccharide capsule which is normally a poor immunogen, particularly in young children, and, being T-cell-independent, fails to induce immunological memory even in older age groups. By covalently coupling the polysaccharide to a carrier protein such as tetanus toxoid these deficiencies can be overcome and a T-cell-dependent antibody response achieved even in the very young infant. Because conjugate vaccines reduce carriage as well as protecting the individual against invasive disease, herd immunity can be generated which protects infants too young to be vaccinated.

Conjugation technology has now been used to develop vaccines against meningococcal serogroup C disease and early surveillance data for the UK, the first country to introduce these vaccines into routine, suggests that they will be just as successful as Hib vaccines. The first cohorts to be offered the vaccine were adolescents aged 15–17 years (in November 1999) and infants under 1 year (from December 1999) and a reduced incidence of serogroup C disease is already apparent within a few weeks of the introduction of the vaccine (Fig. 4). Unfortunately, the similarity between group B polysaccharide and human tissue antigens has resulted in a reluctance to develop conjugate B vaccines. Other protective antigens based on outer-membrane proteins, which are highly variable between strains, are being explored as potential vaccine candidates. The application of conjugation technology to the pneumococcus has also presented problems as protection against the different capsular polysaccharide serotypes (currently numbering nearly 90) is serotype-specific. A seven-valent conjugate vaccine has recently been shown to be highly effective against invasive pneumococcal disease, pneumonia and otitis media caused by serotypes represented in the vaccine in trials in California and Finland. The serotypes in this vaccine comprise about 88% of the invasive pneumococcal isolates typed by the England and Wales Central Public Health Laboratory Service in the first 6 months of 1999. Nine- and eleven-valent vaccines, which cover 90 and 92%, respectively, of the prevalent serotypes in England and Wales are now under evaluation.

The anti-vaccine lobby

Despite, or possibly because of, the outstanding success of our immunization programmes, they have recently become the target of organized and vocal criticism from a minority group which questions the wisdom of universal immunization against diseases, some of which currently pose no public health threat, precisely because they are well controlled by vaccination. Such opposition is not

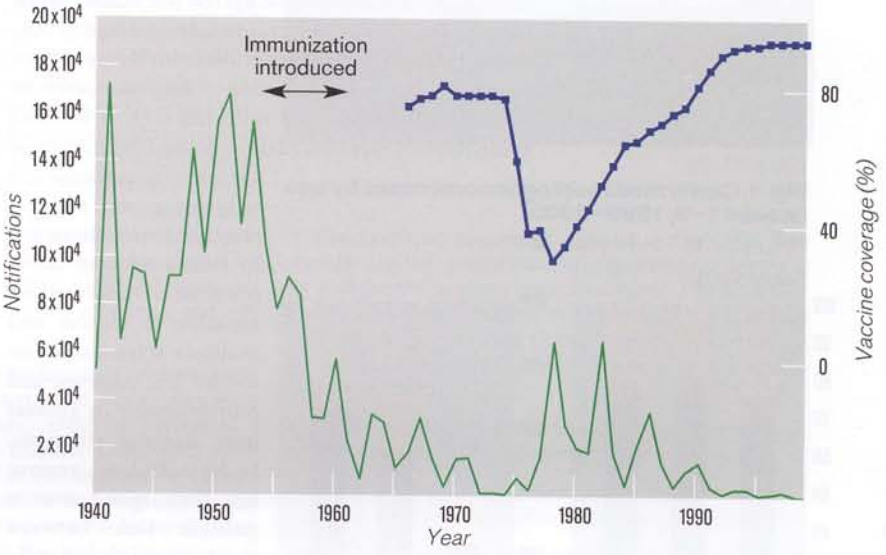
Fig. 1. Annual measles notifications and vaccine coverage (England and Wales 1950–1999*)



*Provisional data

Source: Office for National Statistics and Department of Health

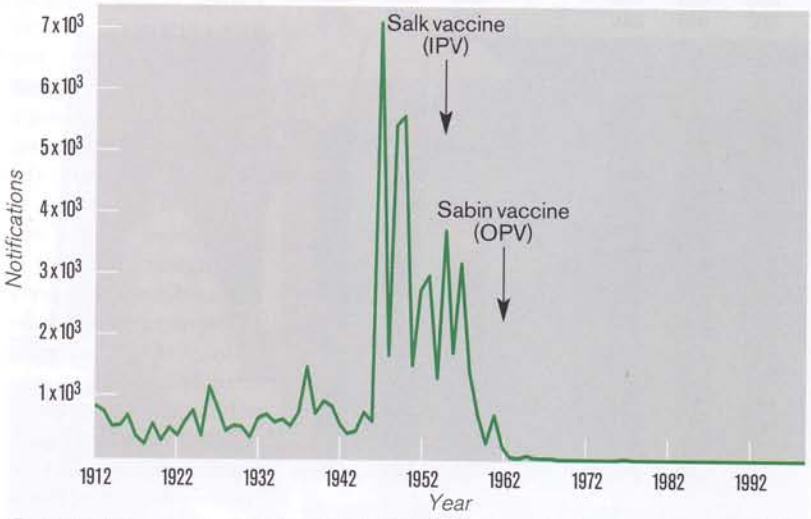
Fig. 2. Whooping cough cases and vaccine coverage (England and Wales 1940–1999*)



*Provisional data

Source: PHLS Communicable Disease Surveillance Centre, Department of Health, ONS

Fig. 3. Acute paralytic poliomyelitis (England and Wales 1912–1999*)



*Provisional data

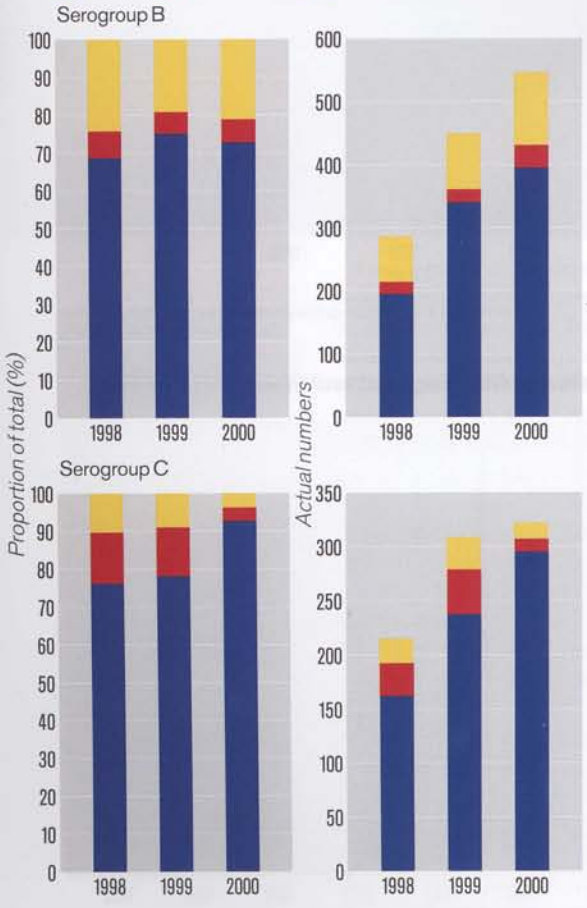
Source: Notifications to ONS 1984; cases ascertained from any source after 1985

new as evidenced by the famous cartoon of 1802 which depicted individuals growing cow-like parts after smallpox vaccination. However, with the rapid access to material through the internet, myths and unfounded allegations about vaccine safety can now be propagated rapidly around the globe.

The focus of the anti-vaccine lobby varies between countries and in the UK was centred on whole-cell pertussis vaccines in the 1970s and more recently on MMR vaccines, the unfounded allegation for the latter's safety encompassing such diverse disorders as autism and inflammatory bowel disease. Although there is no scientific evidence in support of these concerns, MMR coverage rates have recently declined (Fig. 1) and one in four children is not taking up the pre-school MMR booster. Unless reversed, this trend could lead to outbreaks of disease in school-age children in the future. Such resurgences can have devastating consequences, even for those living in developed countries such as Holland which recently experienced three deaths from measles as a result of an outbreak in a religious group with an objection to immunization. In France vaccine safety concerns have focused on hepatitis B vaccine and multiple sclerosis, while in the US diabetes and immunization in general have received attention. In New Zealand, anxiety has been raised over a possible link between atopic disorders and early immunization.

Fig. 4. Confirmed meningococcal cases by age (weeks 1–9, 1998–2000)

■, <1 year; ■, 15–17 years; ■, others



Source: Laboratory confirmed cases – PHLS Meningococcal Reference Unit (MRU)

The diseases currently receiving attention as alleged vaccine reactions have a number of features in common. First, the diseases in question are of unknown aetiology and usually of increasing incidence. Second, the postulated association is championed by one investigator/group but is not confirmed by peers or subsequent research. Third, these rebuttals often fail to attract the publicity of the original claim alleging a link. For example, a paper by workers at the Royal Free Hospital reporting an apparent increase in Crohn's disease in a cohort exposed to measles vaccine received considerable media attention (despite the numerous flaws in its design pointed out in the many letters to *The Lancet* that followed its publication), whereas the subsequent negative study from the same group was merely published as a conference abstract and largely ignored.

The literature put out by the anti-vaccine lobby often plays on parental fears of the alleged unknown effects of vaccines and seeks to endorse its views by misquoting the work of others. For example, when the new meningococcal C conjugate vaccination programme was recently introduced, the November edition of the anti-vaccination publication entitled *What Doctors Don't Tell You* (WDDTY) ran an article in which the PHLS was quoted as saying that '*The old vaccine doesn't work – and neither does the new one*'. In fact the PHLS had pointed out via its website that neither the old plain AC polysaccharide nor the new C conjugate vaccines would protect against B disease and that continued vigilance was necessary as meningococcal B infection would still occur. I was subsequently contacted for advice by one parent who said that his child was about to be vaccinated with the C conjugate vaccine but he was now reluctant to go ahead having read the article from WDDTY. Fortunately, I was able to give this parent the correct information but I wonder how many others were dissuaded by this irresponsible article from letting their child have the life-saving vaccine.

For those who are concerned about having their child vaccinated as a result of reading material from groups opposed to vaccination it may be useful to apply the following criteria when judging its credentials:

- Do the authors have any medical or relevant scientific qualifications?
- Have their views been subjected to the normal peer review process achieved via publication in a journal?
- Do the authors have any professional accountability?

The last point is particularly telling. What would the position be with respect to liability of the author of the WDDTY piece if a child had died of meningococcal C disease having refused vaccine as a result of this article? A medical practitioner giving unsound advice would, of course, be professionally accountable.

It is perhaps encouraging that, despite the considerable media attention given to the safety of MMR vaccine in the UK in recent years, coverage has only fallen by a few percentage points. The robust, evidence-based defence of the vaccine organized in a timely manner by the Department of Health, plus a refusal to bow to the irrational and dangerous demands to provide single antigen vaccines in place of MMR vaccine, has undoubtedly helped to sustain coverage rates. The painful lessons learnt with pertussis vaccine in the 1970s may now be paying dividends.

Obituary

Professor S. John Pirt

■ Robert Poole

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On 22 February 2000, the Society lost an Honorary Member and a creative and influential scientist, Professor S. John Pirt. Distinguished for his efforts to place the study of microbial growth on a sound theoretical base, he embraced also the practical importance of microbiology, including antibiotic production, algal technology, disposal of sewage sludge by biocombustion, cell culture nutrition and the microbial triggers of autoimmune diseases.

Most Society members will know John Pirt from his many years at King's College London, formerly Queen Elizabeth College. In 1961, he established the first non-medical Department of Microbiology in the University of London, and one of the earliest in the United Kingdom. He was a vigorous and vociferous champion of the 'new' science of microbiology and the Department grew strongly and quickly. He was appointed first Professor of Microbiology at the College in 1966. His Department was not only highly successful and innovative in research and teaching (being among the first in the UK to offer a BSc in Biotechnology), but was also happy, collegiate and sociable. John presided over the infamous Beermats Club (motto $dx/dt = mx$) – a name that is credited to a student's unaccountable confusion with the term 'biomass' in one of John's lectures – which organized fungal forays, dinners, quizzes and hilarious Christmas parties. John relinquished running the Department early (1987) and became Emeritus Professor, spending more time in the laboratory, with his wife Margaret, who is also a microbiologist and who ran his fermentation laboratory in London, and with his young sons.

John Pirt in 1988.
PHOTO COURTESY ROBERT POOLE

Like many distinguished microbiologists of his generation, John Pirt initially trained as a chemist. His studies were interrupted by the war, during which he served as a navigator in Lancasters in Bomber Command. After completing his BSc (1947) in Birmingham, he carried out research on starch structure and degradation for his PhD in Bangor. In 1950, he joined the research group of Professor Ernst Chain at the Istituto Superiore di Sanita in Rome. Chain had worked with Florey in Oxford, and shared the Nobel Prize for Physiology and Medicine in 1945 with Florey and Fleming for their work on penicillin. It was in Italy, while researching the effects of fermentation conditions on its biosynthesis, that Pirt recognized the need for a rigorous understanding of microbial growth dynamics and the control of microbial processes. Subsequently, he was appointed Principal Scientific Officer at Porton where he worked until 1961 on engineering, industrial and physiological aspects of microbial growth.

The scope of his interests and expertise was phenomenal, but perhaps the most enduring contributions concern the concept of maintenance energy. This concept was particularly amenable to study, even at very slow growth rates, in the continuous culture apparatus that Pirt had championed but '*whose precise engineering... seems to be a deterrent to many microbiologists*'. The scientific literature has been enriched by his numerous, sometimes controversial, publications. Of these the best known must be the classic *Principles of Microbe and Cell Cultivation* (Blackwell, 1975).

In 1988, introducing the proceedings of a Festschrift symposium marking his retirement, he wrote,

> '*I hope I may have sprinkled some seeds which will bear fruit in the garden of microbial growth dynamics*'.

John Pirt certainly did: those seeds have produced some of the most eminent microbiologists in industry and the universities. The sower is sorely missed.

John Pirt (right) and Peter Hobson (left), Bangor, 1948.
PHOTO COURTESY PROFESSOR J.R. QUAYLE

Problems in the development of new vaccines

Philip D. Minor

The scientific difficulties of vaccine development must not be underestimated, but as Philip Minor discusses, the socio-economic and ethical issues also pose many problems.

The effects of successful vaccines on public health are dramatic. The best known example is that of smallpox, the first disease of humans to be deliberately eradicated from the world. Poliomyelitis is likely to disappear in the very near future and measles vaccine has abolished the epidemics that used to occur in the UK before coverage rose, saving a great deal of misery and an estimated 50–100 lives per year. These three examples are long established but novel materials continue to be introduced. Vaccines against *Haemophilus influenzae* b (Hib) were introduced in 1992 in the UK and *Haemophilus* b meningitis has virtually disappeared as a result. The same is likely to be true for meningococcus C meningitis following the introduction of the vaccine in 1999. The cheapest way to have a big impact on public health is to vaccinate. The difficulties of developing and using new vaccines are substantial, however, and while the scientific hurdles are usually no greater or less than in other areas of biology, there are a range of socio-economic and ethical problems which seem to be particularly acute for this type of approach.

The first issue is that vaccines are given to healthy individuals to prevent disease, not to sick individuals to cure them. This makes them extremely sensitive products both for the public and the medical establishment. It is relatively easy to bring someone into the television studio who would have died but for some active medical intervention such as surgery, but it is actually impossible to find an individual who would have died if they had not been vaccinated, first because they might not get the disease and second because they might not die of it if they did. On the contrary it is relatively straightforward to find individuals who were either adversely affected by vaccination or believe that they were. Levels of risk which would be readily acceptable if associated with other activities or medical treatments are therefore completely beyond the pale with respect to vaccines, a fact accepted by producers and the medical establishment alike.

Second, there is a subtle but significant difference in the approach of public health officials and clinicians to medicine which is marked with respect to vaccines, namely that the clinician is concerned with the health of the individual patient, while the public health official is concerned with the health of the population. A hypothetical vaccine which prevented an infected individual passing on the disease but did not protect from infection would have a real effect in eradicating epidemics if used universally, but might be considered unjustifiable on an individual basis; similarly, when a disease is rare as a result of widespread vaccination, the benefit for the individual may not be thought worth whatever risk is involved. Vaccines must therefore be of high efficacy and very low risk to be medically acceptable.

Costs

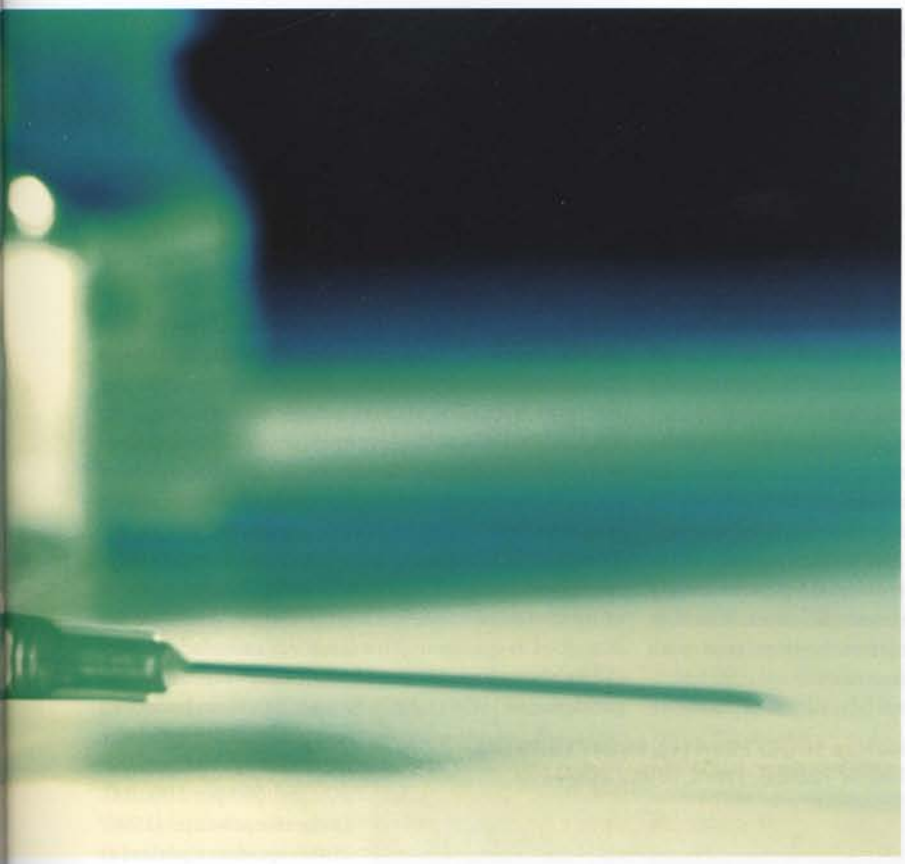
For these kinds of reasons the investment required to develop a vaccine is enormous; governments, international organizations and charities have great difficulty in doing it and where they try they usually come to grief. On the other hand, historically the price of vaccines has tended to be kept down relative to chemical drugs, and profits depend on the usage of large numbers of doses on a regular basis. There are as a result a decreasing number of vaccine producers in the world, a trend which has been continuous since the 1960s as manufacturers have turned to more immediately profitable areas. Those who remain in the field tend to serve developed countries where higher prices are sustainable and this is a particular feature of those developing entirely novel vaccines (although there are exceptions, for example in China).

Malaria

This leads to a situation which seems intrinsically unjust. Malaria is one of the major infectious killers in the world at present and is concentrated in tropical areas which tend to include few wealthy countries. Vaccination against malaria is believed to be possible in principle. This is based on early studies in the USA where army volunteers (chosen presumably on the basis that everyone else took one step backwards) were locked up in rooms containing thousands of malaria-infected mosquitoes which had been X-irradiated to kill off the parasites. When the volunteers were challenged with non-irradiated mosquitoes they were protected to a significant level. The costs of identifying satisfactory protective antigens which can be produced on the required scale, and developing a vaccine as a result, are unlikely to be easy to recover in developing countries which would be the principal market. Such a vaccine might be developed for business or other travellers from developed countries to malarious regions, or for the military, and this could provide a route for its ultimate use in developing countries.

Hepatitis B and AIDS

Hepatitis B is effectively a sexually transmitted disease in developed countries, but is endemic in other parts of the world such as Africa, or particularly China. It is the major cause of liver cancer worldwide, making hepatitis



LEFT:
PHOTO COURTESY BRIAN YARVIN/ SCIENCE PHOTO LIBRARY

vaccine the first anti-cancer vaccine to be developed. Hepatitis B vaccines were initially targeted at specific at risk groups, including healthcare workers and business travellers, and were made either from antigen from the plasma of infected donors or from antigen expressed in genetically modified organisms, such as yeast. They were (and remain) expensive, but have now been incorporated into global vaccination programmes, including universal usage in most developed countries as the impact on incidence following targeted use was not great. The usage in developed countries can therefore subsidize that in developing countries, but only if valid and recognizable uses in wealthy markets exist. Apart from the intrinsic scientific difficulties, this may be an additional socio-economic obstacle to the development of vaccines against AIDS. HIV is not endemic in developed countries, still being surprisingly confined to those with defined high risk lifestyles; the development of antiviral chemotherapy makes vaccine usage in developed countries possibly less likely. In Africa and other areas, however, the only real hope is a vaccine because of the scale of the epidemic and the costs of current treatment.

Epstein–Barr Virus (EBV)

A final example concerns EBV. In developed countries such as the UK or USA, EBV causes glandular fever or infectious mononucleosis. As the virus is transmitted in saliva this tends to occur in the teens to twenties when people discover kissing; unfortunately this is also the time when they become seriously embroiled in the examination machinery. An EBV vaccine would therefore have a clear market in the reasonably well-off of the developed world even if it was not suitable for a universal vaccination programme. It could probably command a significant price. In contrast, EBV is the causative agent of Burkitt's lymphoma in Central Africa and of nasopharyngeal carcinoma especially in the coastal regions of China, both of which are seriously life-threatening and are thought to follow on from infection early in life. An EBV vaccine in these settings would have to be aimed at all children and would there-fore need to be both cheap and plentiful. The requirements in the different settings are not the same, and the developed country requirements of small supply and high price seem most likely to prevail.

Scientific problems

The scientific difficulties of vaccine development are also significant. It is necessary to identify antigens which can induce a long-lived protective immune response against whatever strain of agent is likely to turn up. For something like HIV it is still not clear that any such antigen exists because of the variability of the virus and the nature of the infection. For agents such as encapsulated bacteria the protective antigens may induce a feeble immune response or one which is strain-specific. Vaccines against pneumococcus contain up to 23 different carbohydrates. Long-lived effects are essential unless you have some idea of when you are likely to be infected and in normal life (as opposed to trips to exotic places) this is as difficult as predicting when you are going to be run over by a bus.

Production of the antigen and proving that it works in a clinical trial, never mind that it is safe (for example, with fewer than one serious adverse event per 100,000 recipients, which is a rough benchmark figure) may all be formidable projects. Linking the problems to the socio-economic global–political difficulties and the ethical risks related to prophylaxis makes it seem impressive that vaccines are developed as rapidly and as frequently as they are, especially for developing countries. Their public health impact and their high cost effectiveness suggest an explanation.

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Influenza: the changing scene

Douglas Fleming

Influenza is an unpleasant illness which can lead to death, mainly in the elderly. Douglas Fleming describes the current incidence of flu, some new methods of diagnosis and recent advances in treatment.

What is influenza?

The word influenza is currently used to describe an infection caused by an influenza virus: it has been used for centuries, but the influenza virus was not identified until 1933. As a clinical entity, what doctors generally describe as influenza is better described as influenza-like illness since there are several viruses which can cause a febrile illness with sore throat, cough, headache and myalgia. Though there is a low level of influenza-like illness throughout the winter, there are clearly identifiable periods of increased incidence which in recent years have been consistently associated with increased isolation of influenza viruses.

The incidence of influenza-like illness reported to general practitioners is highly variable, though some cases are seen in every year (Fig. 1). Many European countries have developed monitoring systems for influenza with clinical and virological components. In England and Wales the best known surveillance system is the Weekly Returns Service of the Royal College of General Practitioners which provides information on influenza-like illness and other respiratory diagnoses. Winter outbreaks usually last 8–10 weeks, but have varying impact by age. Those in which the weekly incidence of influenza-like illness exceeds 400 per 100,000 are described as epidemic. This level was exceeded in 1989 (580), though this was only half that reached in the pandemic of 1968 (1,180). Since 1990, there have been four outbreaks in which the incidence peaked between 200 and 300 per 100,000. In the recent winter (1999/2000) incidence peaked at 231 per 100,000 (all ages) in week 2 of 2000 and there were particularly high rates in people aged 65 years and over. During influenza outbreaks there is also an increased incidence of acute bronchitis and acute otitis media. The reported incidence of acute bronchitis in the 65 years and over age group in week 1 of this year reached the highest level recorded in the last 20 years of the Weekly Returns Service.

Fig. 1. Incidence of influenza-like illness during winters 1993/1994 (+), 1994/1995 (■), 1995/1996 (△), 1996/1997 (×), 1997/1998 (✳), 1998/1999 (○) and 1999/2000 (◇)

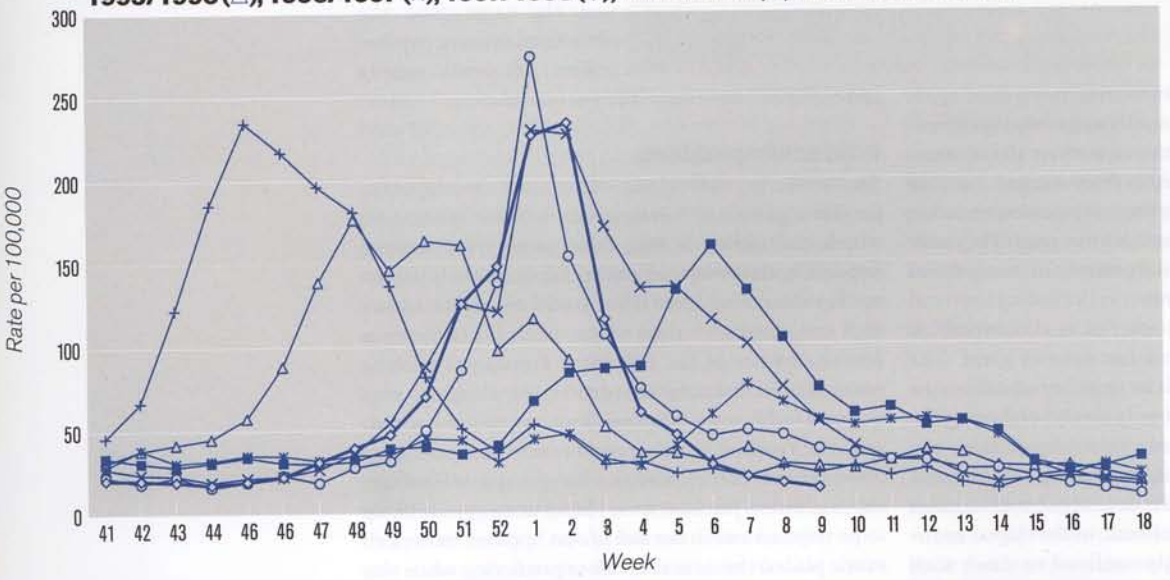
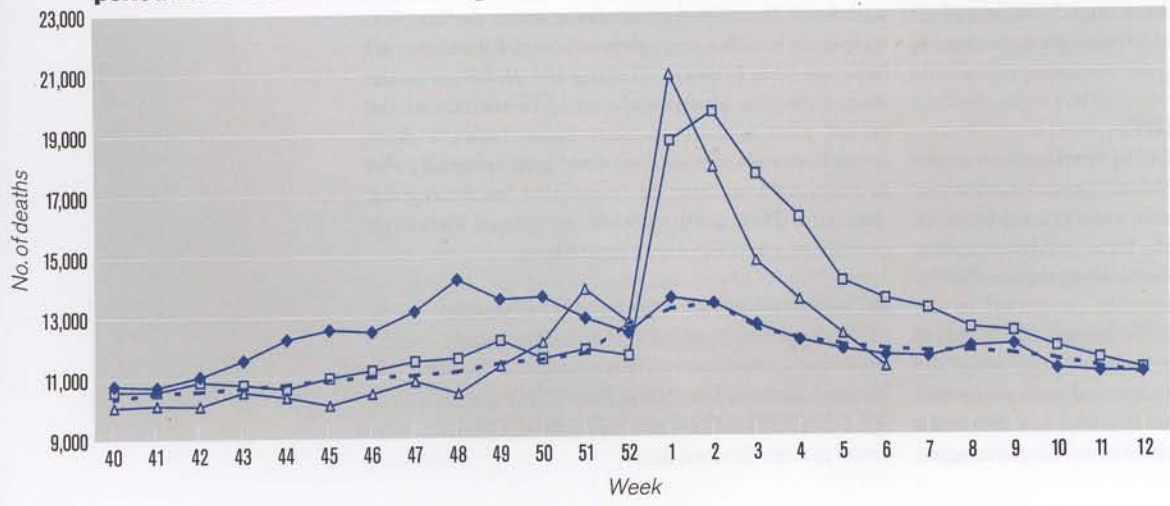
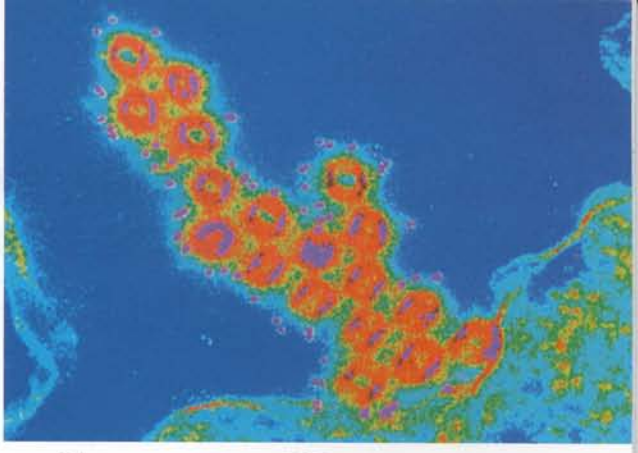


Fig. 2. Death notifications in England and Wales during winters 1993/1994 (◆), 1996/1997 (□) and 1999/2000 (△) compared with expected numbers of deaths derived from data from the period 1987–1997 in weeks during which there was minimal influenza activity (baseline, – – –)



The word pandemic is used to describe a worldwide epidemic of influenza attributable to a major change in the influenza virus, usually involving the nucleus and known as antigenic *shift*. Antigenic *drift* describes continuous change involving the haemagglutinin and neuraminidase processes of the outer shell of the virus. Identification of the molecular structure of neuraminidase has led to the development of the class of drugs known as neuraminidase inhibitors.

Influenza varies considerably in its impact on



ABOVE:
Coloured electron micrograph of influenza virus-like particles.
PHOTO COURTESY P. GÓMEZ-PUERTAS AND A. PORTELA, CENTRO NACIONAL DE BIOLOGÍA FUNDAMENTAL, MADRID, SPAIN

individuals, ranging from sub-clinical infection, through trivial symptomatic illness and illness prompting consultation, to illness causing hospitalization and even death. In Fig. 2 weekly deaths in England and Wales observed in the influenza AH_3N_2 outbreak in 1993, the mixed AH_3N_2 and B outbreak in 1996/1997 and the AH_3N_2 outbreak in 1999/2000 are plotted against a baseline of deaths derived from mortality data over the period 1987–1997 and based on weeks when influenza viruses were not circulating. The excess mortality (observed over expected) in the three winters estimated by this method amounted to 16,000, 28,000 and 18,000 respectively. There is no period of apparently reduced mortality after the influenza period has passed, indicating that influenza-related deaths are not in people in the terminal phase of another illness. Influenza therefore can be a serious illness, though it is not serious for the majority of people who get it. Nevertheless, its epidemic character and high attack rate make it a serious public health problem.

Diagnosis

Influenza cannot be diagnosed solely on clinical presentation. The likelihood of influenza as the cause of an acute respiratory infection involving rapid onset, fever and cough is considerably increased when influenza viruses are known to be circulating. Currently, such information is available through data from national systems of influenza surveillance, though this does not involve intensive local sampling. This, however, may not be necessary, since spread across a country the size of the UK is usually rapid. A new and effective near patient test capable of use in the consulting room may be imminent. It is unlikely that every person who might have influenza could be tested. Tests currently available take about 15 minutes to apply and cost more than £10 each. In addition, they have a limited shelf life. The likelihood that a skilled person would be instantly available to perform such tests is remote and not justifiable economically. Selected medical practices in a locality could be designated to undertake these to identify influenza in that area, but increased use of near patient tests must not interfere with current virological surveillance based on culture and strain type identification.

Influenza management

The mainstay of influenza control is based on annual vaccination of risk populations. Risk is defined in relation to co-morbidity (chronic respiratory disease, ischaemic heart disease, diabetes, immunocompromised), age (currently 75 years and over), or institutional living. There is good evidence showing these people are at increased risk if they get influenza, though severe illness due to influenza is not confined to these groups. Vaccination has been shown to be clinically effective in almost all populations in which it has been examined. However, there is a need for improvement in the logistics of the annual vaccination programme which favours targeted vaccination, though uptake in risk groups is less than desirable.

Amantadine and rimantadine have been available for treatment (and prophylaxis) for several years, but in the UK only amantadine is licensed. Amantadine is infrequently prescribed because it is only effective against Influenza A. It is not well tolerated with adverse central nervous system (CNS) effects, particularly in the elderly. Resistant strains of influenza virus emerge during treatment and these are transferable to other people.

In 1999, the first neuraminidase inhibitor (zanamivir) received a licence in the UK for the treatment of Influenza A and B in adults. Two drugs in this class (zanamivir, an inhaled topical presentation and oseltamivir, an oral systemic preparation) have been shown to be clinically effective against influenza provided they are given early in the course of the illness (up to 48 hours). They have also been shown to be effective for prophylaxis. These drugs block the function of the neuraminidase enzyme which is essential to the release of daughter virions after replication in the epithelial cells lining the respiratory tract. The clinical trials involving these drugs have shown benefits between 1 and 3 days. The degree of benefit is influenced by the severity of illness at recruitment, and the age and risk status of the patient. Clinical trials have involved recruitment of subjects who in some cases have had a comparatively minor illness (temperature <37·8 °C at recruitment) and people infected with differing virus strains, some more pathogenic than others. In its interim evaluation of zanamivir, the National Institute for Clinical Excellence considered the results in patients at most risk from influenza were inconclusive and that the overall benefits of the drug were insufficient to recommend prescription on the National Health Service. They entered a caveat emphasizing the responsibility of the individual doctor in making prescribing decisions. The decision presents considerable difficulty for the general practitioner. There are people who show signs of severe illness and who present early in the illness who would benefit from a neuraminidase inhibitor. The licensing mechanism involves assessment of efficacy and safety. The adverse effects and viral resistance associated with amantadine, the only reasonable alternative, makes this a less attractive option in the patients who are most likely to benefit. National policy should be directed towards identifying the sensible use of neuraminidase inhibitors rather than blanket discouragement.

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Water, water, everywhere – But is it safe to drink?

Peter Wyn-Jones

Most of us expect clean water to be on tap, but in many parts of the world there is no piped water. Even in developed countries constant vigilance is necessary if water is not to be a hazard to health.

The provision of clean water is something we in so-called developed countries take for granted; the quality of life is dependent on the quality of water. The need for sufficient quantity of water is self-evident, but the need for clean water has been understood for less than 200 years. This recognition has been linked to a realization that faecal waste must be disposed of in a way that does not jeopardize the provision of clean drinking water. It is a fact not always understood even today in developing countries; township dwellers in South Africa, for example, are impatient for the building of new houses, but do not appreciate that the water supply and sewerage system must come first. This need is recognized by the UK water industry in the support it gives to WaterAid in developing countries. We turn on a tap and out comes water we can drink, or bathe in, or use for cooking. We rarely doubt that, provided we pay our bill, water will be provided, even if it has to be transported hundreds of miles.

WATER SUPPLY,—NO SUPPLY. FRYINGPAN ALLEY, CLERKENWELL.

ABOVE:
A Victorian illustration of a water shortage in Frying Pan Alley, Clerkenwell, London.
COURTESY PETER WYN-JONES

But that is exactly what has to be done every day in many lands. Piped water supplies are the exception rather than the rule for most of the world, and fetching water from a well is one of the day's tasks for many peoples. Often this water will be of, at best, doubtful quality. But if it is a question of drinking polluted water or watching your child die of thirst then there is no real choice. It is a testament to history, engineering and science that we have a water supply in which we have confidence.

Poor quality water brings various effects, including intoxication with poisonous chemicals and life-threatening infectious diseases. Exposure to such effects may occur through drinking contaminated water, consumption of food grown or prepared in polluted water, or domestic activities in contaminated water necessary because there is no other. It is not only developing countries which face serious problems in the future if use or re-use of water is not carefully controlled in the face of increasing population; developed countries use increasing quantities of water per capita in industrial processes; many ground waters are becoming increasingly contaminated, and replenishment rates are slower than rates of use.

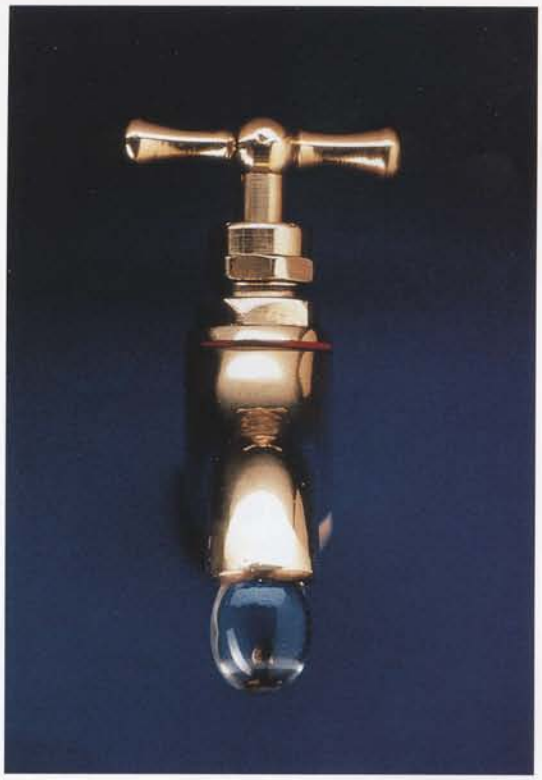
Water in history

Water has figured prominently in history; the City of Jericho owed its survival to the presence of a fresh water spring; the Minoan civilization in ancient Greece built a sewerage system to protect its water supply and the ancient Egyptians realized that contamination of their water supplies by dead dogs and rats was a cause of illness. Two thousand years ago the Roman and Persian Empires transported water in aqueducts; the Roman town of Durnovaria, modern Dorchester, was supplied with water from chalk wells and along an aqueduct from sites upstream on the River Frome.

Cholera

The worst of all waterborne diseases has undoubtedly been cholera. Cholera is a disease easily spread by water and has had major worldwide effects. Cholera outbreaks instigated many developments in water supply and allowed the progress that gave rise to the development of major cities. It first became a common, serious disease in Europe in the 1820s as a result of the increased trade with India. It had such a dramatic effect because of its ease of spread within the crowded and unsanitary conditions of the poor housing in which large numbers of people were obliged to live. The industrial revolution had drawn huge numbers of workers into the newly expanding cities where living conditions were very poor. Polluted drinking water sources, open sewers and polluted rivers combined to encourage the spread of the disease. The poor, without political power and common voice, suffered the greatest hardships and loss of life. Medicine had no effective understanding of the causes of outbreaks of cholera and no method of dealing with the overwhelming symptoms that could kill within a few hours. The first major epidemic in Europe killed over a million people during 1830–1832. Wars and social upheaval throughout the later 1800s led to a succession of further outbreaks.

Progress in microbiology, epidemiology and medicine was stimulated by the need to understand, prevent and treat cholera. In London, outbreaks of cholera in 1832, 1848–1849 and 1853–1854 prompted the formation of local government health boards. In 1847, local water supply companies were required by law to supply pure, wholesome and sufficient water for consumption. During the following years the worst slums were cleared in London, sewers built and water cleaned by slow sand filtration. In 1855 physician John Snow recognized that a larger number of people who used the water pump in Broad Street, Soho, were dying of the disease compared with communities using a different water supply and pump in the neighbourhood. He persuaded the authorities to remove the pump handle to prevent the use of the suspect water supply. The local outbreak was halted and Snow thus demonstrated that the hitherto controversial theory of waterborne disease was indeed a



LEFT:
Water on tap.
PHOTO COURTESY BSIP MARLAND/ SCIENCE PHOTO LIBRARY

fact, something over which even *The Times* had shown some scepticism:

> *'A certain amount of opposition may doubtless be anticipated in all measures of sanitary reform. Cleanliness is highly becoming and supremely beneficial, but it involves some trouble and, what is worse, some expense. There will always be found people to vote against a rate, for whatever purpose levied, but in the long run common sense prevails, and when the reforms are once accomplished everyone testifies to the advantage of the result.'* (Editorial, 3 August 1854)

Problems with cholera remain; the pandemic of 1991 that began in Chile is a graphic demonstration of the great harm that can be done by a combination of social upheaval, deprivation and climate change. It is possible that peasants, fleeing Shining Path guerrilla violence, migrated in huge numbers to the coastal regions. Shellfish and river water were contaminated with *Vibrio cholerae* and transmitted the disease. The river water was also used for irrigating salad crops which then spread both cholera and typhoid, which in turn precipitated the loss of international confidence in Chilean goods and consequently the collapse of the economy. At the same time the *El Niño* phenomenon caused heavy rainfall in Peru and dramatic increases in cholera cases.

Supplying potable water

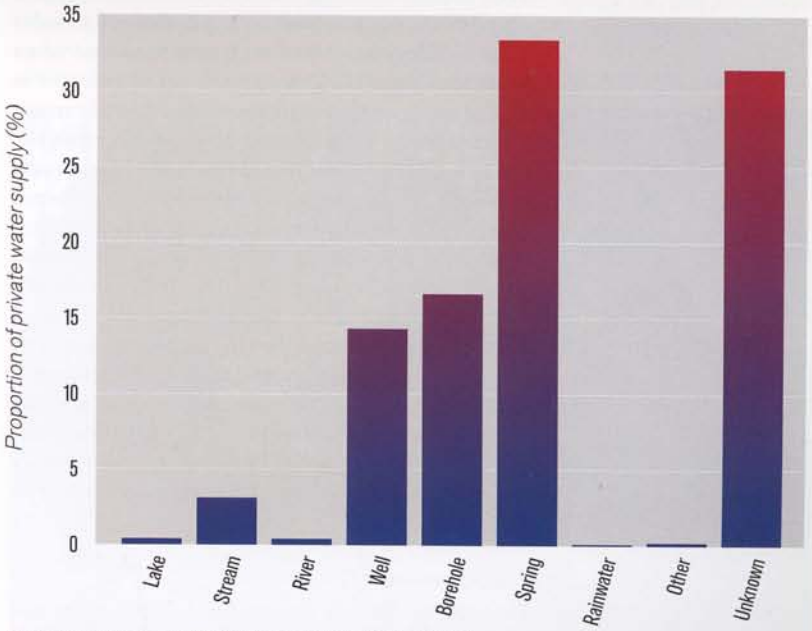
The provision of clean drinking water and adequate waste disposal is always an urgent need in refugee crises or natural disasters. It has been estimated that to prevent illness in an emergency situation there is an estimated requirement of 30–50 litres per person per day for drinking, cooking and washing needs. This starkly contrasts with the typical UK household use of 140 litres of mains potable water per person per day and the US figure of 410 litres per person per day.

In the natural water cycle, rainfall on land accumulates to form streams, rivers and lakes (surface waters), or soaks into the soil and lower rocks (groundwaters), or is taken up by plants. The surface layer of both fresh and marine water bodies evaporates to form water vapour, which in turn becomes rain or snow. Upon this cycle man has imposed a complex network of water abstraction, storage, transportation, usage, disposal and recycling. Abstraction in the UK is from surface waters such as reservoirs of rain run-off, or rivers that may contain wastewater, and also from groundwater. About 35 % of UK drinking water is derived from groundwater and may only require disinfection before distribution.

In making water fit to drink (potable), all abstracted source water in the UK is treated to reach the same standard, the level of treatment given being determined by the quality of the source water. Surface reservoir or river water is treated with a coagulant such as ferric sulphate to assist the formation of flocs of organic matter which are removed as the water is passed upwards through primary sand filters. Secondary filters such as fine slow sand filters remove further bacteria and organic matter. Clarified water is disinfected with chlorine or sometimes ozone. The level of chlorine added allows for a residual to be present throughout the distribution system; a typical level would be 1 mg per litre on leaving the treatment works and a level of 0·2 mg per litre at the consumer's tap.

Most water in the UK is supplied by water companies, but about 1% of the population is supplied with water from a private supply. A private water supply is one which is not managed by a statutory water undertaker, and the responsibility for its maintenance and repair lies with the owner or person who uses it. Private supplies may arise from several sources, including springs, boreholes or wells, and may require no treatment (Fig. 1). Springs are the most common type, comprising about a third of private supplies in the UK. The source and its catchment are often poorly protected from access by wild and domestic animals. Improved protection is offered to boreholes and wells but many are old and in need of repair.

Fig. 1. Relative percentages of private water supply sources in the UK



Source: K. Shepherd, PhD thesis, University of Sunderland

RIGHT:
A sewage pipeline near Hartlepool discharges its waste into the North Sea.
PHOTO COURTESY SIMON FRASER/ SCIENCE PHOTO LIBRARY

Private supplies are differentiated into those used for domestic purposes (Category 1), which are further classified A–F according to the number of people supplied, and those used for other purposes, such as hospitals, camp sites and premises where food and drink are prepared for retail sale (Category 2). The classes within the domestic supplies range from the supply of water to more than 5,000 people down to single premises. A summary of the classification of Category 1 supplies is shown in Table 1.

Table 1. Category 1 private water supplies

Class	No. of people supplied (per day)	Average daily volume (m^3 per day)
A	> 5,000	> 1,000
B	501–5,000	101–1,000
C	101–500	21–100
D	25–100	2–20
E	< 25	< 5
F	Single domestic property	-

Legislation

Legislation to protect the microbiological quality of drinking water is covered by EU Council Directives. Most types of water are covered by Directive 80/778/EEC, the so-called Drinking Water Directive, but this is to be replaced by Directive 98/83/EEC. Water for human consumption includes bottled waters and mineral waters, the latter being governed by regulations different from the Drinking Water Directive. The 1980 Directive included parameters for total and faecal coliforms, enterococci, sulphite-reducing anaerobes and colony counts at 22 and 37 °C. Faecal coliforms are regarded as *Escherichia coli* and UK legislation does not specify numerical values for colony counts. Coliforms must not be detected in 95 % of samples when more than 50 are taken from any one point in a 12-month period. No *E. coli* is permissible. The new Directive will include microbiological parameters and also govern the aesthetic quality of the water and the effectiveness of treatment. Values for coliforms and *E. coli* will remain, though the *Clostridium perfringens* limit will be more stringent. Additionally, in the UK there is now legislation to monitor treatment plants for *Cryptosporidium* oocysts. Following risk-assessment of all treatment works in England and Wales, those designated 'at risk' are required to carry out continuous monitoring to count *Cryptosporidium* oocysts in 1,000 litres of water every 24 hours. It will be a criminal offence to supply water containing more than 10 *Cryptosporidium* oocysts per 100 litres.

Bottled water

The current fashion for buying bottled water has heightened interest in its microbiology. Bottled water other than natural mineral water is governed by the same Directives as mains or private waters. Recognition of water as 'mineral water' is by approval of the source by the relevant local authority, and it must not be altered in any way to affect its microbiological or chemical composition. Bottled waters may contain a variety of micro-organisms, though no potential pathogens are permitted, since survival or even multiplication of organisms may occur on the supermarket shelf. It is sometimes interesting to hear the reasons given for paying for a product microbiologically inferior to that coming out of the tap.

Water-associated disease

Drinking water-associated outbreaks of disease are usually the result of one of four events:

- inadequate removal of organisms during treatment;
- failure in the treatment system so the intended procedures are not carried out;
- failure in the chlorination equipment;
- breaks in the integrity of the distribution infrastructure.

Outbreaks of typhoid, cholera and other bacteria are a thing of the past in developed countries, a reflection of engineering and scientific skills, as well as learning from history. Waterborne disease due to other micro-organisms does occur, however. Viruses have been responsible for a number of drinking water outbreaks worldwide, though less frequently than bacteria or protozoa. Outbreaks due to Norwalk-like viruses (NLVs) are the most widely reported, though the evidence is circumstantial. They include an outbreak at a tourist hotel where sewage had seeped into the borehole water used to supply the hotel through faults in the rock strata. Another outbreak at a mobile home park was the result of sewage gaining access to the well. Contaminated water used in the production of cakes in a bakery is likely to have been the cause of an outbreak of NLV amongst employees and customers in South Wales, and gastroenteritis with a likely viral origin occurred when sewage from a broken pipe contaminated a drinking water supply pipe in Bramham, Yorkshire in 1980 and when sewage contaminated a borehole in Naas in Ireland in 1991. Cruise ships are a favourite haunt of NLVs, which often strike when the vessel is well out to sea and out of reach of any comfort for those affected. Disinfection of the water supply on board and compensation for ruined holidays is an expensive consequence for tour companies.

Inadequate removal of *Cryptosporidium*, and less frequently *Giardia*, and *Toxoplasma* have led to outbreaks when chlorination has been the only barrier used in treatment or sand filters have been contaminated. *Campylobacter* outbreaks are most often associated with wells providing private supplies. These small rural systems are most likely to be contaminated with animal

waste. For the same reason *E. coli* O157 outbreaks may be found in rural situations. For example, at a music festival, in a field previously used for cattle grazing, an infection was transmitted through mud and standing water after heavy rain.

All this pales into insignificance, however, when compared with the *Cryptosporidium* outbreak in Milwaukee in 1993 in which over 400,000 people were affected. The authorities knew something was wrong only when alerted by pharmacists who reported rocketing sales of anti-diarrhoea remedies. Outbreaks due to this organism have occurred in the UK and other EU countries, but not on as grand a scale. Initial blame levelled at farmers for allowing slurry to run into rivers which were later used for drinking water abstraction may have been justified in some cases, but molecular typing of *Cryptosporidium* now allows us to see that much of the *Cryptosporidium* in rivers is actually of human, rather than animal origin, and that its source must be sewage treatment plants and non-point sources other than farms.

The future

The future of drinking water provision lies in continued vigilance against new and known micro-organisms, and in more effective use of our water. The use of 'grey' water, already used for washing, then recycled for similar purposes, is one way of economizing on water treatment costs. More effective detection methods, risk assessment and predictive modelling of risk associated with water use will help to ensure that we use this very valuable resource wisely and with consideration not just for ourselves but for those whose water supply is little more than a stream or a hole in the ground.

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International Development Fund report

The 3rd Workshop in Molecular Biology and its Application to Disease

10–15 January 2000, The Centre for Tropical Diseases, Ho Chi Minh City, Vietnam

■ Simon Cutting

The workshop, sponsored by the Society for General Microbiology and consisting of 6 days of practicals and lectures, was held at the foremost centre in the South of Vietnam for the treatment of tropical disease. This site of a Wellcome Trust overseas unit is directed by Dr Jeremy Farrar (University of Oxford) who co-organized the course with Dr Simon Cutting (Royal Holloway University of London) as part of an initiative to train Vietnamese staff in contemporary techniques in molecular biology. Twelve European scientists contributed to the workshop which was attended by 20 students.

The 5-hour practical sessions, organized by Dr Marita Pohlschmidt, introduced the molecular techniques required to diagnose inherited genetic markers such as cystic fibrosis: PCR, restriction digestion, gel electrophoresis and Southern blotting. While the objectives of mutation analysis may appear advanced for use in a developing country, this technology is already beginning to be applied in Vietnam and some students present at the workshop are about to set up a lab for diagnosis of inherited diseases at the Ho Chi Minh City (HCMC) University of Medicine and Pharmacy. A second and parallel course introduced Bioinformatics to groups of 10 students. Internet access is now readily available in Vietnam and this was the first bioinformatics workshop to be held in the country.

In addition to the practical labs, mornings were taken up by a series of lectures and small group discussions where specific questions relating to the lectures were

ABOVE:
The mountains of North Vietnam.

BELOW:
Practical skills being demonstrated to Vietnamese participants.

PHOTOS COURTESY S. CUTTING

TOP RIGHT:
Group photo of the participants in the 3rd Workshop in *Molecular Biology and its Application to Disease* at the Centre for Tropical Diseases, Ho Chi Minh City, Vietnam.

CENTRE RIGHT:
Workshop participants in a bioinformatics lab.

LOWER FAR RIGHT:
Nha-Trang, Vietnam.

PHOTOS COURTESY S. CUTTING

addressed in greater detail. These tutorials where students could speak in depth to established scientists were highly appreciated. Lecture topics included gene expression, basic molecular biology techniques and infectious diseases relevant to Vietnam. The lectures were attended by the practical participants as well as interested scientists from HCMC, making the turnout about 40–50 each morning. Although students spoke English and the 45-minute lectures were given in English, they were translated into Vietnamese making the total time per lecture almost 90 minutes!

One of the highlights of the workshop was a banquet held on the Saigon river involving all participants and staff accompanied by traditional Vietnamese music.

The significance of these workshops may, for those who are unfamiliar to Vietnam, be difficult to assess. However, they are of vital importance and there is real demand for Western technology. This is a result of years of isolation from developed countries and numerous opportunities now exist for collaboration and development in Vietnam which has a strong background in academia (originating from the French). Techniques in molecular biology are now being applied for their own benefit. One topical example is the development of a potential new oral cholera vaccine which has undergone phase III trials in Vietnam.

The European staff were: Dr Simon Cutting (Royal Holloway University of London, RHUL), Dr Marita Pohlschmidt (RHUL), Dr Ian Graham (RHUL), Professor Robert Glass (University of Nottingham), Dr Neil Fairweather (Imperial College, London), Professor Wolfgang Schumann (University of Bayreuth, Germany), Dr Philippe Bouloc (Université Paris-Sud, France), Dr Alexandra Gruss (INRA, Jouy en Josas, France), Angelo Pantelides (RHUL), Gabriella Casula (RHUL), Ro Prajapati (RHUL) and Ngo Thi Hoa (RHUL).

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Pets, poop and parasites

G. Suresh Kumar & Huw Smith

There are millions of domestic pets in the world. But what threats to human health do they pose, and what can we do to minimize the risks?

More than 50% of all households in the English-speaking world keep one or more animals as pets. Dogs and cats are the most common, with almost 60 million in the USA and 14 million in the UK. Other frequently owned household pets include rabbits, rodents, birds, fish and insects. In recent years, a trend in the ownership of more exotic pets, including non-human primates, exotic mammals, birds, reptiles, amphibians, fish and arthropods as household companions, has emerged.

Pets can have a positive impact on society. There is increasing scientific evidence demonstrating that responsible pet ownership can lead to reduction in the morbidity and mortality associated with heart disease, can substantially reduce health problems and can result in fewer visits to the doctor. For example, exercising dogs on a lead also exercises the owner. Other known benefits include reduction in the feelings of loneliness and a lowered frequency of psychological disturbances among pet owners.

Pets also harbour infections which can be transmitted to susceptible human hosts. It has been estimated that over 30 diseases (bacterial, viral, parasitic and fungal) transmitted to man are pet-associated. Cataloguing a comprehensive list of zoonoses is not the remit of this article which will focus on some of the commoner eukaryotic endoparasitic infections of dogs and cats transmitted to man in pet faeces.

RIGHT:
A sporulated *Toxoplasma gondii* oocyst in a sample of cat faeces.
COURTESY OF DR DAVID BUXTON, MOREDUN RESEARCH INSTITUTE, EDINBURGH

Protozoa

Toxoplasmosis. The coccidian parasite *Toxoplasma gondii* requires two hosts to complete its life cycle. Only felines act as definitive hosts and they excrete the transmissive stage (oocyst) for a period of 7–20 days following a primary infection, which they acquire from eating infected prey or, less commonly, from ingesting infectious (sporulated) oocysts. Oocysts sporulate 1–5 days after excretion and remain viable in the environment for ≥12 months. *T. gondii* infects a broad range of intermediate, warm-blooded hosts, including man, livestock, feral animals and birds, where the parasite multiplies asexually to become quiescent in various tissues, including muscles.

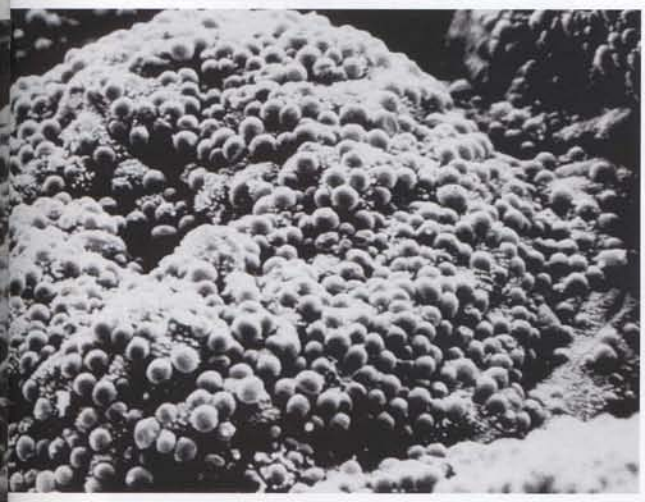
Toxoplasmosis can be acquired in the following ways:

- after ingestion of tissue cysts, in raw or undercooked meat;
- after ingestion of sporulated oocysts in soil/sand (or faecally soiled cat litter), unwashed vegetables or water;
- congenitally, when tachyzoites (rapidly multiplying vegetative cells) from an infected mother pass into the developing foetus.

Congenital toxoplasmosis can result in a range of conditions from clinically unaffected to individuals with hydrocephalus, mental retardation, cerebral calcification and inflammatory eye disease (retinochoroiditis). Severe infection can cause foetal and perinatal death. Occasionally, toxoplasmosis can be acquired from infected organ transplants.

Infections are frequently subclinical, but symptoms include a flu-like illness and/or swollen glands (neck, armpits and groin). The incubation period is 1–3 weeks: 10–23 days after eating undercooked meat and 5–20 days in an outbreak associated with cats. Immunity is long-lasting, the degree of immunity being dependent on age, exposure and immunological status. Tissue cysts may become reactivated in the immunocompromised, for example during immunosuppressive drug therapy or in AIDS sufferers. Toxoplasmosis can be severe in such individuals, with widespread dissemination. It is the most common cause of focal brain lesions in AIDS patients. In immunocompetent individuals, treatment is rarely necessary. Sulphadiazine and pyrimethamine can be considered if illness is severe or protracted, in cases of congenital infection, active ocular disease or AIDS. In the 'at risk' infected pregnant woman, spiramycin is recommended throughout the confinement to minimize the risk of transferring the parasite across the placenta to the developing baby.

Cryptosporidiosis. *Cryptosporidium parvum* is a coccidian parasite with a life cycle involving both asexual and sexual reproductive cycles which it completes within the intestine of an individual host. Oocysts are infective when excreted in the faeces. Symptoms include flu-like illness, diarrhoea, malaise, abdominal pain, anorexia, nausea, flatulence, malabsorption, vomiting, mild fever and weight loss. *C. parvum* can cause self-limiting diarrhoea in the immunocompetent and protracted, life-threatening diarrhoea in the immunocompromised. *C. parvum* infects the intestinal tract of numerous mammalian hosts, including pets. The oocyst is environmentally robust and can remain viable in moist, dark microenvironments for ≥12 months. Transmission is mainly from person to person, although waterborne transmission is well documented. Transmission from pets has also been documented. There is no effective chemotherapy for cryptosporidiosis.



LEFT:
Numerous spherical endogenous stages of *Cryptosporidium parvum* within an enterocyte in the small intestine of a young lamb.
PHOTO COURTESY DR DAVID BUXTON, MOREDUN RESEARCH INSTITUTE, EDINBURGH

BELOW:
What threats to human health do our pets pose?
PHOTO JANICE MEEKINGS, SGM

Giardiasis. The flagellated protozoan *Giardia intestinalis* parasitizes the upper small intestine of man and its life cycle is completed within an individual host. *Giardia* exists in two distinct morphological forms; the reproductive, pear-shaped trophozoite and the environmentally resistant cyst, which is the transmissive stage excreted in the faeces. The acute phase of giardiasis, characterized by flatulence with sulphurous belching and abdominal distension with cramps, is usually short-lived. Diarrhoea is frequent and watery and becomes bulky later. In the chronic disease stage, malaise, weight loss and malabsorption (vitamins A and B_{12}, D-xylose and disaccharidases) frequently occur. Cysts are infectious soon after excretion and are environmentally robust, remaining viable in moist, dark micro-environments for about 3 months. As with *C. parvum*, person to person and waterborne transmission are well documented. The significance of zoonotic transmission remains unclear although domestic pets, livestock, feral and wild mammals have been implicated in the transmission of giardiasis to people. The frequency of human infection directly attributable to animals has yet to be ascertained. Treatment is uncomplicated with several drugs available, including nitroimidazole compounds (quinacrine and furazolidone).

Cestodes

Echinococcosis. *Echinococcus granulosus* and *Echinococcus multilocularis* are primarily pastoral diseases, as the life cycle includes various (predominantly herbivorous) intermediate hosts. *E. granulosus* and *E. multilocularis* have different intermediate hosts. The adult parasite lives in the small intestine of dogs and the transmissive stage, the egg, is excreted in faeces. Eggs are extremely robust, surviving low temperatures (2·5 years at 2 °C; 54 days at –26 °C) and drying. When ingested by an intermediate host, the larval stage (onchosphere) enters the bloodstream and is trapped, normally in the liver (and lungs for *E. granulosus*), by capillary filtering. Here they develop into 'hydatid' cysts. The life cycle is completed by predation of infected intermediate hosts. Humans are also intermediate hosts in whom the larval hydatid stage develops. Symptoms depend on the number and distribution of hydatid cysts and include hepatomegaly (enlargement of the liver) with obstructive jaundice, with secondary spread to lungs, brain and bone. Eosinophilia (an abnormal increase in the number of certain white blood cells) is often present. Treatment options include surgery to remove cysts and albendazole which reduces cyst mass.

Dipylidiasis. The life cycle of the dog and cat tapeworm, *Dipylidium canium*, involves two hosts. Flea larvae ingest tapeworm eggs which develop to the infective larval (cysticercoid) stage in the flea within 18–30 days. Motile proglottids (reproductively mature segments of the tapeworm), containing eggs, are passed in faeces and can adhere to anal hairs. These do not survive drying for more than 1–2 days. The life cycle is completed following ingestion of the infected flea and development of the adult tapeworm in the intestine. Cysticercoid larvae in infected fleas, when ingested accidentally by humans, can develop into adults in the intestine, particularly in crawling infants. Infections are uncommon and often asymptomatic, but symptoms include abdominal pain, diarrhoea and an itching anus, with excretion of the motile proglottids, resembling rice grains, in faeces.

Nematodes

Toxocariasis. *Toxocara canis*, *Toxascaris leonina* in canines and *Toxocara cati* in felines have all been implicated in human toxocariasis, but the majority of documented evidence favours *T. canis* as the aetiological agent. The life cycle of *T. canis* is complex, involving direct transmission following ingestion of infective eggs, indirect transmission following predation of infected, intermediate hosts and transplacental transmission of larvae to the foetus. The latter ensures that most puppies are infected at birth. Eggs are not infective when excreted in faeces and take up to 3–4 weeks, depending upon the climate, to develop into the infective larva contained within the eggshell. Therefore, recently excreted faeces do not present a risk. In common with many other animals, man is an intermediate host. Humans become infected following accidental ingestion of eggs in the environ-ment. The larvae hatch in the intestine and migrate

ABOVE:
Safe disposal of animal faeces is of primary importance in preventing the transmission of zoonoses.
PHOTO IAN ATHERTON, SGM

through the soft tissues of the body, but do not multiply. There are three clinical syndromes, namely visceral larva migrans (VLM), ocular toxocariasis (OT) and covert toxocariasis (CT), although infection can be asymptomatic. In VLM symptoms include cough and wheezing from pulmonary migration or abdominal pain, hepatosplenomegaly (enlargement of the liver and spleen) and eosinophilia. In OT symptoms include strabismus (squint), chorioretinitis, failing vision and unilateral blindness, and in CT hepatomegaly, cough, sleep disturbances, abdominal pain, headaches and behaviour disturbance. Risk factors include children in the first decade of life with pica (an abnormal craving for unusual food) or geophagia (eating earth), poor hygiene, contact with puppies and playing in areas where dogs and cats defecate. The condition can be treated with anti-inflammatory glucorticoids and/or anthelmintics (thiabendazole, albendazole, diethyl carbamazine).

Cutaneous Larva Migrans (CLM) – 'Hookworms'. The pet-transmitted infections are caused by infective, free-living larvae of *Ancyclostoma braziliense*, *Ancyclostoma caninum* and *Uncinaria stenocephola*. The infective stage of dog and cat hookworms penetrate skin and migrate to become mature, parasitic adults in the canine or feline intestine. Eggs, excreted in faeces, develop into free-living larvae in soil. Human infection is self-limiting: infective larvae of canine and feline hookworms which penetrate human skin rarely become mature adults. CLM is characterized by intense itching at the penetration site and the development of progressive serpentine erythematous tracts and eosinophilia. *T. canis* and *T. cati* have also been implicated in CLM. CLM is not only pet-associated: the syndrome is associated with a variety of skin-penetrating, parasite larvae.

Infective larvae survive in moist, dark, cool microenvironments. They penetrate bare skin, and transmission is associated with occupational and recreational contact (e.g. walking barefoot) with contaminated, shaded, sandy soils, frequented by dogs and cats, in warm moist climates.

Preventative measures

What can we do to avoid catching any of these infections from our pets? Preventative measures focus upon reducing transmission. Where drug treatment is unavailable, the safe disposal of faeces is the primary measure. Oocyst- and cyst-contaminated litter trays should be cleaned daily, by scooping soiled litter into a sealable polythene bag which is disposed of by incineration. Daily cleaning minimizes the risk of transmitting infection and wearing gloves dedicated to this purpose offers further protection. Wearing protective gloves when gardening also reduces the likelihood of transmission from contaminated soil, etc. Attention to personal and family hygiene after contact with pets and/or faeces also reduces risk. Pets should be regularly dewormed, with minimum treatments at 2, 6 and 12 weeks of age, and at least 6-monthly thereafter to reduce the parasite burden in faeces.

Education plays a significant role in reducing the risk of infection. Various local government departments, health boards, professional bodies and pet health advocacy and awareness groups provide a valuable service by:

- Promoting responsible pet ownership by optimizing conditions under which pets are kept, encouraging their better discipline, care and behaviour and discouraging irresponsible ownership;
- Encouraging co-operation with, and education of, members of the public by bringing incidence data and transmission routes to their attention and providing information on the risks from excreted faeces – a variety of leaflets on pet zoonoses and options for avoiding contact with pet-associated infectious agents are available on request from such groups;
- Putting risks into perspective by identifying 'at risk' groups such as pregnant women and the immuno-compromised;
- Increasing the awareness of owning healthy pets, thus reducing the likelihood of pets contracting infections;
- Promulgating byelaws on fouling.

In general, the risk of contracting parasite zoonoses from pets is regarded as low, but avoidable. An understanding of the parasite life cycle, education and responsible ownership minimize risk further. However, minimizing risk from pets will not necessarily lead to a rapid decline in these zoonoses, as the increase in urban strays, feral cats and foxes, which might harbour large parasite burdens, may pose further challenges to our health.

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Society News

February Council Meeting

New President

● Professor Sir David Hopwood was formally elected President of the Society to succeed Professor Howard Dalton from September 2000. A profile of Professor Hopwood will appear in the August issue of *Microbiology Today*.

New Editor for *Microbiology Today*

● Dr Meriel Jones (University of Liverpool) has agreed to become the next Editor of *Microbiology Today* from September, when Dr Dave Roberts completes his very successful term in the post. Meriel, who has previously held a BBSRC Media Fellowship and was seconded for a time to work on the *Guardian*, currently writes the *Hot off the Press* item in *Microbiology Today*. A profile of Meriel will appear in the August issue of *Microbiology Today*.

International Research Fellowships

● Council approved the establishment of up to 10 International Research Fellowships annually (see p. 91 for full details of this new scheme). This initiative to encourage exchange between scientists in different countries is a further outcome of the recent Strategy Working Party (see report of November Council in the February issue of *Microbiology Today*, p. 34).

The Peter Wildy Prize Lecture for Microbiology Education

● Council was pleased to approve the naming of this new Prize Lecture after the distinguished virologist and past President of SGM, the late Professor Peter Wildy. A brief biography of Professor Wildy and an announcement of the prize can be found on this page and on p. 89, respectively, of this issue.

Prize Lecture Nominations

● Council has decided that in future it will be possible for applicants to nominate themselves for all of the Society's Prizes. It also agreed to move the deadline for the receipt of nominations for this year to **30 September 2000**. It is hoped that this will provide more time for members, returning refreshed from their holidays (!), to find time for this task. Full details of this year's prizes for which nominations are sought can be found on p. 89.

The Jamieson Report: *Into the New Millennium*

● Council considered this report, commissioned by the Institute of Biology and the UK Life Sciences Committee, on opportunities for the bioscience community and its learned societies. There was support for the need for a respected common voice of biology, to speak on generic issues affecting the whole community, and the Society would be willing to participate in discussions on the way forward on this. However, Council did not support some of the wider suggestions in the report, on pooling management and resources. It was felt that these were inconsistent with the Society's primary purposes, to advance the science of microbiology, and to promote activities of value to members and the profession.

● *Alan Vivian, General Secretary*

Annual General Meeting 2000

The AGM of the Society will be held on **Wednesday, 13 September 2000** at the Society Meeting at the University of Exeter. Agenda papers, including reports from Officers and Group Conveners, and the Accounts of the Society for 1999 will be circulated with the August issue of *Microbiology Today*.

SGM joins UKLSC

The Society has recently been accepted as a member of the UK Life Sciences Committee. The Committee, with 14 other learned societies as members, exists to co-ordinate and advance the interests of the life sciences in areas such as government policy, science education, professional matters and careers, and the public understanding of science.

New Clinical Microbiology Group

The Society has been concerned about the precipitous decline in academic clinical microbiology and formed a working party to address this issue. After two meetings it was proposed that the Society form a new Clinical Microbiology Group. Its aim will be to enhance the opportunities for clinically qualified microbiologists to meet with basic scientists and for effective research collaboration. SGM Council formally approved the establishment of the Group at its February meeting.

The topics covered by the new Group will be:

- the diagnosis of microbial infections
- the immune response to micro-organisms
- treatment and prevention of microbial infections
- resistance to antimicrobial agents
- epidemiology of infection
- the determinants of microbial virulence
- the classification of clinically significant micro-organisms

We anticipate that the membership of the Group will be drawn from medical, dental and veterinary microbiologists and science-trained microbiologists with an interest in clinical microbiology. These are likely to work in universities, hospitals, PHLS and NHS laboratories and research institutes. We also anticipate that individuals working in the pharmaceutical industry and infectious diseases physicians with an interest in microbiology will also wish to join. We expect to work closely with the Microbial Infection Group.

The Group will make its debut at the 2001 Easter meeting at Heriot-Watt University. The Convener is Professor Stephen Gillespie, Department of Medical Microbiology, Royal Free Hospital School of Medicine, Pond Street, Hampstead, London NW3 2QG (Tel. 0207 794 0500 ext. 3539; Fax 0207 794 0433; stepheng@rfc.ucl.ac.uk). Any enquiries about the Group should be addressed to him.

Peter Wildy

● The new Society prize for microbiology education has been named after the late Peter Wildy, in recognition of his teaching skills.

Professor Wildy was a distinguished virologist who was deeply involved in many SGM activities, culminating in his becoming President in 1978. Born in 1920, he trained originally as a doctor, qualifying in 1944. He joined the Royal Army Medical Corps, returning to the bacteriology department of his old medical school at St Thomas's Hospital, London in 1947. He soon became interested in the developing field of virology and spent a year in Australia carrying out pioneering genetical studies on herpes simplex under the direction of Sir Macfarlane Burnett. Back in the UK, he became senior lecturer in virology at Glasgow University and was instrumental in setting up the new Institute of Virology there. Peter Wildy's next move was to Birmingham University where he was appointed to a chair, spending much time in teaching and organization of the medical school in addition to his research. His work on the genetics, biochemistry and immunology of herpes viruses continued for 25 years, but he also became an international authority on viral taxonomy and made a significant contribution to the study of the structure of virus particles. In 1975 he accepted the chair of pathology at Cambridge, where he revitalized the department. An able diplomat, he held office in many bodies outside the university. He was a founding editor of *Journal of General Virology* with Colin Kaplan. Peter Wildy died in 1987.

Peter Wildy was a large man, of great charm and character and a good friend to his colleagues. He is remembered as a natural teacher, honest but never unkind. SGM Council is delighted to dedicate the new prize to his memory.

Prize Lectures and Awards

Colworth Prize Lecture

The Colworth Prize is awarded biennially for an outstanding contribution in an area of applied microbiology. It is sponsored by the Colworth Laboratory of Unilever Research. The prize is £1,000 and the winner gives a lecture on his/her work. The lecture is usually published in a Society journal.

1. The Colworth Prize Lecture shall be awarded biennially for an outstanding contribution in an area of applied microbiology.

2. Nominations shall be made by any two members of the Society: the nominee need not be a member of the Society. Nominations should be accompanied by a statement of the contribution to applied microbiology made by the nominee, supported by reprints or other appropriate documentation. A brief CV of the nominee and a full bibliography of his or her work should also be included. Alternatively, candidates may submit all of the information listed above, together with the names of two members who are familiar with their work, who will be asked to supply the appropriate statement with regard to the candidate's contribution to applied microbiology.

3. There will be no restriction by reason of age or nationality of those eligible for nomination for the Colworth Prize Lecture. Recipients of the Lectureship may not be nominated on a subsequent occasion.

4. The recipient of the Colworth Prize Lectureship will be expected to give a lecture based on the work for which the Prize Lectureship has been awarded to a meeting of the Society, normally the spring meeting following the announcement of the award, and to repeat the lecture at the Colworth Laboratory. The recipient will be strongly encouraged to publish the lecture in either *Microbiology* or *Journal of General Virology*, whichever is the more suitable. The choice will be at the discretion of the Editors of the two journals.

Peter Wildy Prize for Microbiology Education

This is a new award which is awarded annually for an outstanding contribution to microbiology education.

1. The Peter Wildy Prize of £500 shall be awarded annually for an outstanding contribution to microbiology education, without restriction on the area of microbiology in which the award is made. Microbiology education for the purpose of the award need not be confined to university teaching. It may also include education of the general public, school pupils or professional groups.

2. Nominations for the Peter Wildy Prize shall be made by any two members of the Society; the nominee need not be a member of the Society. Nominations should be accompanied by a statement of the contribution to microbiology education made by the nominee, supported by appropriate documentation if available. A brief CV of the nominee should also be included. Alternatively, candidates may submit all of the information listed above, together with the names of two members who are familiar with their work, who will be asked to supply the appropriate statement with regard to the candidate's contribution to microbiology education.

3. There shall be no restriction by means of age or nationality of those eligible for the Prize. Recipients of the Prize may not be nominated on a subsequent occasion.

4. The recipient of the Prize will be expected to give a presentation based on an aspect of educational work for which the Prize has been awarded to a meeting of the Society, normally within a year of the announcement of the award. The presentation may take the form of a lecture, workshop, audiovisual display or any other appropriate activity. The recipient will be strongly encouraged to publish an article based on the presentation in *Microbiology Today*.

Procedure for nominations

In recent years Council has been disappointed by the lack of nominations for the range of prestigious awards made by the Society in recognition of distinguished contributions to microbiology. To facilitate nominations, a form is included in this issue of *Microbiology Today*, together with the rules for each prize lecture due to be awarded in 2001. It is now also possible for self-nominations to be made for all awards. The award panel will consider the submissions in the autumn and their recommendations will be taken to November Council for approval. The outcome will be announced in the February 2001 issue of *Microbiology Today*.

Nominations are now sought for the prize lectures listed here. Please complete the form overleaf and send it to Professor Alan Vivian, Department of Biological and Biomedical Sciences, University of the West of England, Coldharbour Lane, Bristol BS16 1QY. Professor Vivian will be pleased to discuss the criteria for nominations, should any queries arise.

The closing date for all nominations is **30 September 2000**.

Fleming Award

The Fleming Lecture is awarded annually 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.

1. Nominees should normally have been engaged in research for not more than 10 years after doctoral qualification or equivalent. Years may be added to this total in respect of career breaks, for parenthood or other substantive reasons.

2. There should normally have been a connection with the scientific activity of the Society, either by means of past and continuing membership of the Society (a minimum of 3 years' membership of the Society would normally be expected), or past presentation(s) at a Society meeting or publication(s) in a Society journal, or an organizational or administrative contribution to the scientific work of the Society.

3. Candidates should submit an outline CV including details of qualifications, scholarships, research grants obtained, etc., a list of publications, an outline of their career progression (posts held in postdoctoral research) and the names of two members who are familiar with their work, who will be asked to provide a statement detailing the candidate's contribution to microbiology and merit for the award. Alternatively, members who wish to make a nomination should provide such a statement and should arrange for a second member willing to support the nomination to provide a statement, and should ask the candidate to provide the CV and publications list.

4. The recipient will be expected to give a lecture based on his or her work to a meeting of the Society, which will usually not be that which takes place in the spring. He or she may be asked by the Council of the Society to repeat the lecture at another centre in this country or in Europe. Expenses of the lecturer will be paid by the Society. Requests for such a second lecture should be made to the General Secretary and will be considered by Council. The text of the lecture will be published in either *Microbiology* or *Journal of General Virology*, whichever is the more suitable. The choice will be at the discretion of the Editors of the two journals.

5. In the event of there being no successful nominee in any particular year, the Award money will be returned to the funds of the Society. Any given nominee may be chosen once only.

Fred Griffith Review Lecture

This Lecture is held biennially and commemorates the pioneering contributions of Fred Griffith to bacterial genetics. It is awarded in recognition of long and distinguished service to microbiology. The winner receives £500 and gives a personal overview of an area of microbiology. The lecture is usually published in a Society journal. Please contact the General Secretary for further details.

Grants

New Grant Scheme

International Research Fellowships

Council is pleased to announce a new scheme which has been established to allow scientists to travel to or from the UK and Republic of Ireland to carry out a defined piece of research in any field of microbiology. Applicants must be of postdoctoral level or above. The visits may be of up to 3 months duration. The awards cover the costs of return travel, a subsistence allowance and a contribution towards the costs of consumables in the host laboratory. Applications for awards are now invited.

Rules

1. Applicants must be scientists of at least postdoctoral level who are practising microbiologists. Postdoctoral workers in periods between contracts or those who do not have salaried employment are ineligible to apply. Postdoctoral workers must supply a supporting statement from their head of department. All applicants must submit a CV with their completed application form.

2. UK scientists whose salary is provided by a Research Council, government department, major charitable funding body or other organization which runs an international fellowship scheme should supply evidence that sponsorship has been sought unsuccessfully from their funding body.

3. The scheme enables applicants resident and employed in the UK or Republic of Ireland to visit any other country to carry out research in a suitable laboratory, or scientists from other countries to carry out research in the UK or Republic of Ireland.

4. The research work to be carried out in the host laboratory must be clearly defined. It must also be microbiological, but any appropriate area of the science will be considered for funding.

5. The scheme is intended to support new initiatives but applications which offer innovative projects with established collaborations will be considered.

6. A supporting letter from the head of the laboratory to be visited must be supplied.

7. Fellowships will be awarded for up to a maximum of 3 months.

8. Awards are available to cover the cost of travel by the most economical means and route, subsistence at up to £1,000 per month and a contribution towards the cost of consumables at up to £1,000 per month. Fellows will normally be expected to continue to receive a salary from their home institution or other source.

9. Applicants are expected to have adequate insurance arrangements and to provide evidence of this. The scheme does not cover the costs of insurance.

10. On completion of the fellowship, a report must be submitted to the SGM Grants Office within 1 month.

11. FOUR copies of the completed application form and all supplementary documentation must be submitted to the SGM Grants Office for consideration.

There will normally be three rounds of applications during each calendar year. In the first year of the scheme, the closing dates are **31 July 2000** and **30 November 2000**.

Education Development Fund 1999

Only one application for funding was received. **Dr Henry Tribe** of Cambridge was awarded up to £2,700 to facilitate construction of a model bacterium, 'The Millennium Bug', and to transport it to the University of Warwick for display at the SGM Millennium Meeting. A photograph of a prototype of the 'Bug' was published in the February issue of *Microbiology Today*.

Education Development Fund 2000

Members are invited to apply for small grants to fund either (a) relevant science promotion initiatives or (b) to support developments likely to lead to an improvement in the teaching of any aspect of microbiology relevant to secondary or tertiary (including postgraduate) education in the UK.

Applications are now invited for either category of award.

Rules

1. Applicants must be members of the Society, currently residing in the UK or Republic of Ireland.

2. *Practical teaching aids*

(a) Applicants may seek support, normally within the range £200–£3,500, for:

(i) purchase of consumable materials, but not capital equipment.

(ii) short-term assistance, e.g. vacation employment of an undergraduate, or exceptionally a postgraduate after expiry of a studentship.

(b) Examples of projects 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. It is not intended that the Fund should subsidize normal departmental teaching practices; the Society wishes to encourage innovation.

(c) Successful applicants will normally be required to make the results of their work available to Society members within 18 months of the award being made. This will include a presentation at a Society meeting and publication of an article in *Microbiology Today*. Physical materials, whether offprints, videos, slides, computer programs, microbial strains or in other forms, should be readily available to Society members on free or low-cost loan or purchase for a period of at least 5 years after termination of the project.

(d) The Society would encourage commercial or other dissemination of the results of the project to a wider public. All Intellectual Property Rights, including copyright and design rights, in any materials produced as a result of the grant will be vested in the Society.

3. *PUS awards*

(a) Applicants may seek funding of no more than £1,000 for small projects to promote the public understanding of microbiology. These might include talks, workshops, demonstrations, posters, leaflets, broadcasts, activities at science festivals and audio-visual or computer-based packages. These activities can take place as part of a SET event at the applicant's place of work, but PUS activities that are part of the programme of an open day to promote the institution are ineligible for funding.

(b) Applicants must provide a detailed description of the proposed initiative, which it is anticipated will take place in 2000/2001, full costings and evidence of any collaborations or other sponsorship. Each application should also include a safety risk assessment and evidence of, or costing for, appropriate public liability insurance cover if the activity is to be held at a public venue. Payments to helpers such as undergraduates who are giving up their free time to deliver the activity may be included in the costings.

Applicants should also indicate how they will assess the success of their event.

(c) Successful applicants must submit a report of the activity to the Society within 3 months of the completion of the project. This should take the form of an article for publication in the 'Going Public' section of *Microbiology Today*. A copy of the results of the assessment exercise (a simple questionnaire or summary of public comments on the event will suffice) should also be provided.

Application forms

Application forms are available from the Grants Office at SGM HQ or may be downloaded from the website.

Please state clearly whether a form is required for a teaching aid or a PUS award.

There is no closing date for applications, which will be considered on a first come, first served basis during the period 1 June 2000–31 May 2001.

Undergraduate Microbiology Prizes

The prizes are intended to encourage excellence in the study of microbiology by undergraduate students and to promote scholarship in, and awareness of, microbiology in universities. The prizes are 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 undergraduate membership of the SGM.

One prize is 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 2000 SGM Undergraduate Microbiology Prize. Submissions can only be accepted on the form which has been sent to all institutions. The full rules and further copies of the form may be downloaded from the SGM website or obtained from the Grants Office at Marlborough House. The closing date for nominations is **31 August 2000**.

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. 35 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 **6 October 2000**.

Details of all Society grant schemes are now available on the SGM website at **http://www.sgm.ac.uk**. You can also download the application forms for most schemes. Click on the Grants & Funding button for details.

Any enquiries should be made to the Grants Office, SGM, Marlborough House, Basingstoke Road, Spencers Wood, Reading RG7 1AG (Tel: 0118 988 1821; Fax: 0118 988 5656; email: grants@sgm.ac.uk).

Seminar Speakers Fund 2000/2001

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. Written submissions should be sent to the Grants Office at SGM Headquarters for consideration.

Rules

1. The scheme is open to higher education institutions in the UK and Republic of Ireland where microbiology is taught. Normally, only one department within an institution will be eligible for an award within each academic year, which is defined as running from September 2000 to June 2001. It is expected that departments will collaborate in selecting a seminar speaker.

2. Applications will only be accepted from departments, not from Student Microbiology Societies.

3. One or two speakers may be funded each year; either two at a maximum of £100 each or one up to a maximum of £200.

4. Seminars must be advertised regionally as sponsored by the Society.

5. Awards will be paid retrospectively on receipt of evidence of the actual expenses incurred.

6. Applications should contain the following information:

(a) The names and addresses of the speaker(s) to be invited and the topic of the talk(s).

(b) Evidence, in the form of a programme, that an active seminar programme is already established in the department(s). Where no previous programme exists, good reason should be given for the request, such as the establishment of a new department.

(c) Details of any sponsorship for seminars that the department already has (or is anticipating).

(d) An indication of the target audience for the seminar, which may include undergraduates and postgraduates.

There is no application form for this scheme.

International Development Fund

Council aims to assist microbiologists in developing countries and Eastern Europe through the International Development Fund. Awards are made by competition.

Purpose

1. Support visits (travel and accommodation) by members of the SGM to laboratories in countries where microbiology is inadequately developed but where its further development may assist education or the economy of these countries. The purpose of the visits must be to give short lecture courses and laboratory training in subjects designed to meet the needs of these countries. The countries may vary from time-to-time but at present these include many places in the Far East, Africa, South and Central America, the Indian sub-continent and Eastern and Central Europe. Host laboratories are usually expected to provide some evidence of local support for the courses.

2. Allow purchase of basic equipment essential for the needs of such training courses.

3. Provide Society journals, symposia and special publications to established libraries for a limited period of time at reduced or zero cost, especially when it can be shown that these publications are not currently reasonably available in the country concerned.

4. Support national microbiological facilities, e.g. culture collections (which underpin microbiology), where these run into temporary difficulties.

5. Support any other small project to assist in technology transfer from Western Europe to the areas mentioned above for which other sources of funding do not exist. This might include provision of equipment to a nominated centre at which a member is working permanently.

Guidelines

1. Applications for sums between £1,000 and £5,000 will be considered first. No applications above £7,000 will be accepted.

2. Applicants must be members of the Society.

3. In making applications for support for giving short lecture courses or laboratory training, detailed information must be provided about the relevance and quality of the training course and the degree of local support for the course.

4. Each application must be accompanied by full supporting documents.

5. A condition of funding (except for provision of publications) is that a brief report, suitable for *Microbiology Today*, be provided.

Applications to the Fund are now invited. Four copies, including full supporting documents, should be sent to the International Secretary, (Professor J.W. Almond, Senior Vice-President of Research and Development, Aventis Pasteur SA, 1541 Avenue Marcel Mérieux, F-69280 Marcy L'Etoile, France).

The closing date for applications is **2 October 2000**.

Group European Fund

European Virology 2000, Glasgow 17–21 September 2000

Small grants for younger members of the Society wanting to attend the European Virology meeting at the University of Glasgow are available from the Group European Fund. Applicants must be resident and registered for a PhD or employed in their first postdoctoral post in a European Union country. The awards provide assistance towards travel, registration fees and accommodation costs. Funds are limited, so early application is advised. Applications will be considered on their individual merit but preference will be given to those presenting their work at the meeting.

Rules

1. All applicants must be paid up members of the SGM of at least 3 calendar months standing before the date of their application for a grant.

2. All applicants must be resident and registered for a PhD, or in a first postdoctoral position, in a country in the European Union.

3. All applicants who are funded by a research council or other funding body that regularly supports conference attendance or activities connected with the applicant's work must submit evidence that they have applied for sponsorship from that body. Salaried applicants must submit evidence of their annual income (net, after tax).

4. TWO copies of the completed application form and all supplementary documentation must be submitted to the Grants Office at Marlborough House. Applicants must ensure that the relevance of the meeting to their research interests is clearly stated and that a statement of support from their Head of Department is included.

5. If presenting data, copies of both the abstract and confirmation of its acceptance by the conference organizers must be included with the application form.

6. Retrospective applications will not be considered.

7. Grants are usually limited to a maximum of £300.

The closing date for receipt of applications is **21 July 2000**.

New postcode for SGM

The Society has recently been assigned an individual postcode, which will speed deliveries of mail. From now on, please use **RG7 1AG** when writing to us. Mail addressed with the old postcode of RG7 1AE will still arrive at Marlborough House.

SGM visits ASM

IThe Society is taking a stand in the trade exhibition at the American Society for Microbiology 100th General Meeting, Los Angeles Convention Center, USA, from 21 to 25 May. Members attending the meeting are cordially invited to drop in on Booth 129 in the Publishers' Park area and meet the SGM staff. There will be a display of journals and other Society publications, with literature to take away.

News of Members

Professor Geoffrey L. Smith (Convener of the Virus Group) is leaving the Sir William Dunn School of Pathology, University of Oxford to join the Imperial College School of Medicine on 1 October 2000. His new address will be Wright-Fleming Institute, Imperial College School of Medicine, St Mary's Campus, Norfolk Place, London W2 1PG (Tel. 0207 594 3971/2; Fax 0207 5894 3973; email glsmith@ic.ac.uk).

'I'm looking forward to working at Imperial College and having given the Almroth Wright lecture at St Mary's and received the Fleming Award from SGM, the Wright–Fleming Institute seems a perfect place to go!

Geoffrey Smith has been awarded a Wellcome Trust Principal Research Fellowship for 10 years from 1 October 2000 and will continue to direct a research group working with poxviruses. He has also been elected a Fellow of the Institute of Biology and a Fellow of the Academy of Medical Sciences.

Howard Jenkinson, Professor of Oral Microbiology, University of Bristol, and Convener of the SGM Cells & Cell Surfaces Committee, is in receipt of the 2000 Research in Oral Biology Award from the International Association for Dental Research (IADR), supported by the Church & Dwight Company. The award is for outstanding research in any field of oral biology, and was presented to Professor Jenkinson at the Opening Ceremony of the 78th IADR General Session at the Washington DC Convention Center in April.

The Society notes with regret the death of **Dr J.A. Cameron** (member since 1958), **Mr D. Jagadish** (member since January 2000) and **Dr J.B. Ursing** (member since 1988 and Associate Editor of IJSB/IJSEM since 1995).

The Society also notes with regret the death of **Professor Martin R. Pollock, FRS**, an Original Member of the Society who also served on Council 1962–1966. With the late Professor Bill Hayes he founded the first teaching department of molecular biology in the UK at the University of Edinburgh.

Staff News

Recently we have been sorry to say goodbye to two members of staff who have worked for SGM for several years. **Susan Andrews**, Staff Editor on JGV, has left to have a baby and **Mandy Scott**, Membership Assistant, has gone overseas with her family on their army posting to Germany. A party was held at Marlborough House to mark the occasion and farewell gifts were presented.

Valerie Adams, who has been temping in the Journals Sales Office and Meetings Office this year, will be moving to the Membership Office.

Meetings

Meetings on the web

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

Meetings organization

The SGM meetings programmes 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. 106 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 1AG
Tel. 0118 988 1805
Fax 0118 988 5656
email meetings@sgm.ac.uk

Millennium meeting

University of Warwick
April 2000

Fighting Infection in the 21st Century

Symposium volume

This will be available later in the year from Blackwell Science. The price will be £65, with a 40% discount for members of SGM and SfAM. To receive an order form when the book is published, please complete the form on the meetings page of the SGM website, or contact the Events Administrator.

Abstracts book

The full text of the abstracts book is now available as a PDF file on the SGM website.

Autumn 2000

147th Ordinary Meeting

University of Exeter
12–15 September 2000

● Main Symposium (12–13 September) Community Structure and Co-operation in Biofilms

Organizers: P. Gilbert, P.M. Goodwin, H.M. Lappin-Scott and M. Wilson

Speakers:
J. WIMPENNY (Cardiff) *Overview*
H.J. BUSSCHER (Groningen, The Netherlands) *Initial adhesion events*
D. DAVIES (Montana, USA) *Physiological events in early stages of biofilm formation*
P. STOODLEY (Exeter) *Factors influencing biofilm structure*
P. KOLENBRANDER (NIH, USA) *Coadhesion in biofilms*
H.-C. FLEMMING (Mulheim, Germany) *Cohesiveness in biofilm matrix polymers*
H. LAPPIN-SCOTT (Exeter) *Detachment*
C. PICIOREANU (Delft, The Netherlands) *Modelling and predicting biofilm structure*
P. MARSH (CAMR) *Community interactions in biofilms*
S. MOLIN (Denmark) *Probing complex biofilms*
L. EHLERS (Washington, USA) *Gene transfer in biofilms*
P. GILBERT (Manchester) *Population dynamics*
G. WOOLFAARDT (Stellenbosch, S. Africa) *Biodegradation by biofilm communities*
R. BAYSTON (Nottingham) *Biofilms and prosthetic devices*
D. ALLISON (Manchester) *Problems of control*
J. COSTERTON (Montana, USA) *Current status/future prospects*

● Other Symposia, Workshops and Events

● Applications of recombinant technology to industrial fermentations (12 September)

Fermentation & Bioprocessing Group

Organizer: Matthew Duchars (matthew.duchars@avecia.com)

Some areas to be discussed include: Construction of novel biosynthetic pathways to unnatural amino acids; Overproduction of phenylalanine in *E. coli*; Application of fungal expression systems in *Aspergillus*; Stability of recombinant fermentations; Production of vaccines from recombinant *E. coli*; Increased productivity from recombinant fermentations.

Please contact the convener, Reg England (r.england@uclan.ac.uk), if you are interested in presenting a poster

● Evening workshop: Biofilm formation and control (12 September)

Environmental Microbiology Group

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

Keynote speaker: Bill Keevil
Is control of biofilms really feasible?

The workshop is a forum for short presentations by postgraduate students and young scientists and all are welcome to attend and join in the discussions. If you would like to present a short talk or a poster on your research, please contact the organizer.

The workshop will be followed by a *Young Members Reception*, where postgraduate and postdoctoral delegates can chat over wine and a finger buffet. Entry is free, but must be prebooked when registering for the meeting.

● Promega Prize Final (13 September)

Promega sponsors this competition to encourage excellence in scientific communication by young scientists. Group Committees have now judged the oral or poster presentations by members under 28 related to recent Group symposia. The finalists go forward to compete for Promega Prizes at a special session of short oral presentations on their research. There are two prizes of £200 to be won and in 2001 the winners will go on to compete for the title of *Young Life Scientist of the Year* against finalists from other learned societies.

● Mathematical Skills and Microbiologists (14 September)

Education Group

Organizer: Ron Bishop (rh.bishop@ulst.ac.uk)

R.BENN (Exeter) *Why are we so scared of maths?*
K.HACK (Ulster) *Why are we so much worse than the rest of Europe?*
D. ORR (Ulster) *What basic numeracy skills are really needed by microbiologists?*
P. PICKARD (North London) *Approaches to the acquisition of numeracy skills by non-mathematical scientists*
P. FOSTER (Central Lancashire) *Developing a maths textbook for biologists*

The afternoon session will focus on case studies and demonstrations.

● Medical implications of biofilms (14–15 September)

Cells & Cell Surfaces and Microbial Infection Groups

Organizers: D. Devine (ORL6DD@oralbio.novell.leeds.ac.uk) and M. Wilson (mwilson@eastman.ucl.ac.uk)

14 September a.m. Biofilms in implant-associated infections

I. RAAD (Texas, US) *Intravascular-catheter-related infections*
S.P. GORMAN (Belfast) *Preventing the complications associated with urinary tract devices*
C.HEILMANN (Muenster, Germany) *Molecular basis biofilm formation by Staphylococcus epidermidis*
M.R.W. BROWN (Aston) *Antibiotics and biofilms*

14 September p.m. Oral biofilms

D. BRADSHAW (CAMR, Porton Down) *Microscopic structure of oral biofilms*
M. WILSON (UCL) *Control of oral biofilms*
J. DOUGLAS (Glasgow) *Candida biofilms and their susceptibility to antifungal agents*
R.A. BURNE (New York, USA) *Regulation of genes in response to pH and carbohydrate in adherent oral streptococci*

15 September a.m. Biofilms on shedding surfaces

U. ROEMLING (GBF, Germany) *Dissection of the genetic pathway leading to multicellular and biofilm behaviour in Salmonella typhimurium*
G.T. MacFARLANE (Dundee) *Sessile versus biofilm growth in the large intestine*
G.B. PIER (Harvard, USA) *Pseudomonas aeruginosa biofilms in lung infection*
J.K. STRUTHERS (Coventry) *The use of the Sorbarod biofilm system to investigate the interaction of medically important bacteria*

● OFFERED POSTERS: the deadline for receipt of titles/abstracts is **12 May 2000**

● MEETING FLYER – PLEASE DISPLAY

A small poster to advertise the Exeter meeting is enclosed with this issue of *Microbiology Today*.

Please display it on your departmental noticeboard or pass it on to colleagues. If you would like further copies to distribute, these are available from the Meetings Office.

Future Meetings

SPRING 2001 – 148th Ordinary Meeting

Heriot-Watt University, Edinburgh
26–30 March 2001

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

Organizers: P.M. Goodwin, W.L. Irving, J. McCauley, D.J. Rowlands and G.L. Smith

The following topics will be covered: Surveillance and detection of viruses/Epidemiological impact of viruses – overview/ Hantavirus – bunyarvirus/Calicivirus/Influenza virus/Hepatitis virus/HIV/ Morbilliviruses/TSEs/Endogenous retrovirus – xenotransplantation/ Gammaherpesviral infections in immunocompromised populations/ Ebola and Marburg viruses/ Dengue virus/Borna viruses/Drug development and drug resistance

● Other Symposia, and Workshops

● Wall-less organisms

Cells & Cell Surfaces Group

Organizers: I. Sutcliffe and M.J. Woodward

● New enzyme targets for anti-microbials

Microbial Infection Group with Biochemical Society

Organizer: L. Piddock

● Microbiology of nitric oxide

Physiology, Biochemistry and Molecular Genetics Group

Organizer: M. Larkin

● Post-transcriptional control of gene expression

Virus Group

Organizer: I. Brierley

● Microbe–pollutant interactions: biodegradation and bioremediation

Environmental Microbiology Group

Organizer: K. Semple

● Benchmarking in microbiology education

Education Group

Organizer: T. Cartledge

● Monitoring and treatment of blood-borne viruses

Clinical Virology Group

Organizers: J. Connell and C. McCaughey

● Biotransformations

Fermentation & Bioprocessing and Physiology, Biochemistry and Molecular Genetics Groups

Organizer: R. Hall

● Special symposium: Genomics

Systematics & Evolution Group

Contact G. Saddler (g.saddler@cabi.org) for details

● Evening workshop for young members: Genomics

Physiology, Biochemistry and Molecular Genetics Group

Organizer: M. Larkin

● OFFERED POSTERS: the deadline for receipt of titles/abstracts is **17 November 2000**

AUTUMN 2001 – 149th Ordinary Meeting

University of East Anglia
11–13 September

● Main Symposium Mycobacteria: New Developments

Organizers: M. Goodfellow, P.M. Goodwin, H.M. Lappin-Scott, G. Saddler and D. Smith

Offered Papers

Offered posters are welcome but each one should be associated with a Group. General Offered Posters will no longer be accepted. Titles and abstracts should be sent to the appropriate Convener, preferably by email. 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. Abstracts are required in a standard format – see website for details or contact the Events Administrator.

Irish Branch

Microbiology of Pulmonary Pathogens

National University of Ireland, Maynooth
7–8 September 2000

For details contact the organizer Kevin Kavanagh (kkavanagh@may.ie)

Title t.b.c.

Waterford Institute of Technology
January 2001

Offered papers from postgraduates welcome.

Organizer: Catherine O'Reilly (coreilly@wit.ie)

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

Other News

Fermentation & Bioprocessing Group

As this is my last contribution to *Microbiology Today* as Convener, I would like to take the opportunity to sincerely thank all the committee members that I have worked with since 1995. Without exception they are/have been very professional, which has made my task so much easier. I would also like to thank the SGM staff, in particular Josiane and Janet for their forbearance. Lastly, I wish the Convener-elect (Glyn Hobbs) well and hope he enjoys the next 5 years half as much as I have enjoyed these last five years.

Reg England

European Virology 2000

17-21 September 2000
Royal Concert Hall, Glasgow

Supported by a wide range of European virology organizations, including the SGM, the meeting aims to provide a forum for basic researchers and clinical virologists to exchange insights and information and enhance interactions. It is hoped that 1200+ delegates will attend from around the world. Each day the plenary sessions will be followed by four workshops with a keynote speaker and offered papers and posters.

Plenary sessions include: Vaccines, Neurovirology, Hepatitis, Viruses and cancer, Respiratory viruses, Emerging/disappearing viruses, Viruses and the immune system.

For further details and to register, see the website **www.euro-virology.com** or contact In Conference Ltd, 10B Broughton Street Lane, Edinburgh EH1 3LY (Tel. 0131 556 9245; email inconference@cableinet.co.uk).

● BURSARIES

Grants are available from the SGM for young members wishing to attend this meeting. Application forms can be downloaded from the website: **www.sgm.ac.uk**

See p. 93 for details.

International Conference on Recombinant Protein Production

5-8 October 2000
Semmering, Austria

Organized by the European Federation of Biotechnology, Section on Microbial Physiology

Host physiology plays a key role in the production of recombinant proteins. A three-day conference, to be held at the Hotel Panhans in the scenic mountain region south of Vienna, will address the physiological aspects of recombinant protein production in bacteria, yeasts, filamentous fungi and animal cells. Early registration deadline: **14 July**. Details and registration information at **www.boku.ac.at/iam/metaboliceng/efb103.htm** or email **efb103@iam.boku.ac.at**

Going Public

A sense of community

Many companies promote science to the public, as well as their products. Ian Davidson describes the educational activities of Unipath for 16+ students.

Unipath is an operating company within the Unilever Corporation. Founded in 1984, the company has developed and launched a number of products based on patented immunochromatographic technology.

In the area of microbiology, Unipath developed and launched the world's first, rapid test for the detection of *Chlamydia*. Other tests include those for the detection of *Clostridium difficile* toxin A, *Listeria* and *Streptococcus* A."

Over the past 3–4 years Unipath has hosted a number of visits from 6th form students from local schools. Groups of 12–16 students come for a day and are given a couple of presentations, one with a biological/chemical bias and the second with a measurement science bias.

The first starts with a question: '*How would you make a pregnancy test that a lady can use in the privacy of her own home, does not require any equipment and can be used on or around the day of the missed period?* From there we explore antibodies, specificity, sensitivity, materials used within immunoassays and the process required to move from lab scale to mass production. The thread we try to weave through this presentation is that delivery of a product requires input from many scientific disciplines.

The second presentation starts with the 'signal', the results of a single pregnancy test. We develop this into the area of quantitation, covering sensitivity, precision, different labels and therefore different measuring systems, again trying to emphasize the multidisciplinary approach required: in this case using chemistry, optics, electronics and industrial design.

After sitting for a couple of hours the students get to stretch their legs with a tour of the R&D labs seeing (perhaps) more sophisticated equipment than they are used to with scientific staff at hand to give a few minutes on, say, IR or HPLC.

Lunch follows, definitely the highlight of the day: 16- and 17-year-olds seem to be nothing but highly developed eating machines. I'm pleased we only provide one meal, otherwise the programme would soon be bankrupt!

The afternoon provides an opportunity to see the preparation of reagents at scale, equipment used to carry out controlled procedures and the assembly of pregnancy test sticks.

The day hopefully provides an overview of development of a concept, optimization of the concept and transfer of these optimized procedures into a manufacturing environment.

We ask for feedback from the students to refine the day and below are a few reactions.

'*The trip to Unipath enabled me to see how the industrial processes behind the chemical industry are performed. It emphasized the importance of the research and development stage and also the co-operation and co-ordination between different chemical companies when designing new products.*'

'*The visit to Unipath was very interesting, and it was good to see the chemistry that I have learnt being used on a large scale.*'

'*The trip was not very useful all the way through as some parts did not link into our course. However, some parts were very useful and interesting, for example, visiting the labs and also speaking to the workers on a one to one basis was very interesting.*'

'*I really enjoyed one day, it was very useful to me. It helped me to reinforce my plan of continuing a career of research and development. The atmosphere of the labs and building was very encouraging. It helped me to see the end product of a chemistry 'A' level.*'

'*I never realised the size and number of people that it took to produce, research, etc. The tour brought home to me how busy and how much work was involved in producing things. I also saw jobs I never knew existed. I saw how the development of an idea occurred and the number of processes and standards they had to reach. I learnt a lot about the industrial process, especially about R&D which I was very interested in. I had a very enjoyable day and took away a wealth of knowledge about how the chemical industry functions and possible ideas for my future in it.*'

RIGHT:
Examples of detection kits produced by Unipath.
PHOTOS COURTESY UNIPATH

The following quotation is taken from a Unilever publication *A Sense of Community* (hence my title):

> '*The crucial importance of education to the future well-being of the UK and its people has been stressed repeatedly both by Government and community organizations. So it is hardly surprising that education has been a core priority within Unilever's community programme for many years. As a major company, it is in our long-term interest that the UK has a modern, successful and inclusive education system – an attribute which is essential for economic success and social cohesion.*
>
> *In pursuit of this goal, we actively support education projects in selected focus areas, both by making cash donations and sharing our internal resources. Of course, the most important of these resources is the time, skill and enthusiasm of our people. Unilever Group companies have established links with around 200 schools and colleges – and in 1998 alone, our total contribution to education was £1·7 million.*
>
> *Unilever companies and individual sites respond to their own local schools' needs. At the same time, they can all contribute to our nationwide programmes, as Unilever takes advantage of its decentralized infrastructure to deliver national projects on a local basis.*
>
> *Whether they are run centrally or locally, all Unilever's educational programmes are created in partnership with respected specialist education organizations. Some of these bodies are involved directly in the management of Unilever programmes. Others receive funding for their own projects, which complement our focus areas. In either case, the key to success is our shared vision, pursued through partnership and co-operation.*'

Unipath's involvement with 6th forms is an example of conversion of a corporate vision into a grass-roots initiative. For me and for others from Unipath who get involved in these days it is fun and rewarding.

Teachers we are not! Having just joined the Education Committee of the SGM, I would be pleased to hear from industrial institutions about their experiences interfacing with schools in their local community, or advice from academic institutions on '*getting the message over*'.

● *Ian Davidson, Product Development Manager, Unipath Limited, Bedford MK44 3UP*
Tel. 01234 835479; Fax 01234 835001;
email ian.davidson@unilever.com

National Science Week 2000

Willie Wilson

■ Explaining marine virus ecology to the public

'Viruses are the most abundant biological agents in the ocean; consequently, they affect global biogeochemistry, nutrient flow in the marine microbial loop…'

…AAAAAAAGH

Wait a minute, its children I'm meant to be explaining this to, *NOT* scientists. And there lay the challenge. National Science Week (NSW), formerly SET week, was fast approaching. My task was to explain the importance of viruses in the ocean and how we use molecular tools to detect them. We also had to make an interactive display. All part of the Marine Biological Association (MBA)'s NSW effort this March to promote science to the public at the National Marine Aquarium in Plymouth.

I approached the SGM for ideas and they provided some posters to augment our display, made a few suggestions on how to explain PCR and asked us to report how the event went. However, it was back to the drawing board for a brainstorming session with my team (Emma Hambly, Matt Hall and a visitor to the MBA, Susie Wharam). Our central theme was oceanic microbiology/virology. Essentially I wanted to get across the following points: viruses are extremely numerous in seawater (over one million per ml); they are very small (i.e. smaller than bacteria); they are not bacteria (sorry SGM audience, but you know what the media are like!); molecular probing is used to detect them; and they can influence the weather (viral lysis of phytoplankton causes a flux of dimethylsulphide (DMS) into the atmosphere which is oxidized into acidic cloud condensation nuclei).

Emma helped with the first couple of points by producing a poster illustrating the relative abundance of each food-web component in the ocean: '*There are a few sharks, some fish, lots of small fish, hundreds of zooplankton* (the adjacent display showed live footage of zooplankton, so we didn't need to explain what they were), *thousands of phytoplankton, millions of bacteria and billions of viruses*.' Emma also constructed a cardboard electron microscope complete with binocular vision of a range of electron microscope images of viruses – good old *Blue Peter*! We also had a 'normal' microscope containing thin sections of phytoplankton to illustrate that viruses are too small to be seen by light microscopy.

Molecular probing wasn't quite so easy but Susie produced a 'seawater sample' bucket, containing polystyrene beads as our seawater, and 30 'morphologically identical' cardboard viruses hidden in the sample. Some of the viruses had either a metal washer or a piece of velcro attached. Our 'probes' were coloured sticks: a red probe carrying a magnet and a blue probe with some velcro hooks. The children loved delving in the seawater to find our viruses and testing them with our probes. The red (magnetic) probe attached to some of the viruses and when the children opened them up, most seemed genuinely amazed when they found a piece of red DNA (a piece of ribbon) inside. Blue DNA was found inside the viruses located by the blue (velcro) probe. However, neither probe could detect the viruses containing green DNA that was found inside the third 'genotype'. The reason for this, of course, was that we are still developing the probes back at the laboratory!

The whole process was helped along by a giant model of a phage, constructed by Matt, complete with a contractile tail with DNA spiralling out after contraction. This helped to explain the process of phage infection. Although some of the smallest children didn't understand the principles of gene probing, they certainly enjoyed themselves and many accompanying Mums and Dads learnt a lot – a truly interactive success.

The backdrop to the display contained posters explaining the importance of viruses in the sea and their role in sulphur cycling, and hence climate, through the production of DMS. I also showed a BBC video *Beyond the Naked Eye*. It contained an excellent 30-second animation of a virus infection cycle and footage of bacterial lysis (with some unusual Christmas cracker sound effects!) amongst some other brilliant footage of various microbial processes.

Our effort was part of a larger display by the MBA under the general theme *Sea Food Special*. Other areas covered were cephalopod camouflage, filter feeders, limpets 'scraping a living', the plankton and aquatic photosynthesis. The whole event was a resounding success with about 1,000 people passing through the doors over the 3-day period.

● *Dr Willie Wilson is an MBA Research Fellow investigating the molecular ecology of viruses in aquatic environments (email whw@mba.ac.uk). Further details of the MBA can be found on their web site (http://www1.npm.ac.uk/mba).*

Hot off the Press

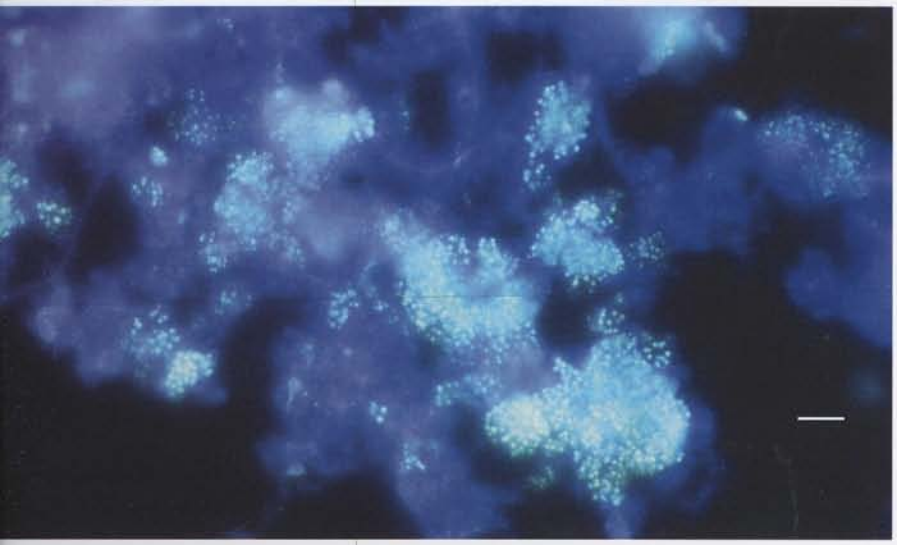
Science writer Meriel Jones takes a look at some papers in current issues of the Society's journals which highlight new and exciting developments in microbiological research.

The mystery of the missing phosphate

All living organisms need a supply of phosphate. So one of the aims in waste water treatment is to remove it and thus prevent polluting blooms of algae in lakes and rivers. The activated sludge process at treatment plants is one method of removal by incorporating the phosphate into micro-organisms. Ever since the 1950s people have known that more phosphate is removed than is needed to sustain the microbes in the sludge. Some of the microbes store it as polyphosphate granules within their cells. Despite considerable work, the identity of these beneficial organisms has been in doubt until recently. Grape-like clusters of large cells containing polyphosphate are usually visible when fresh sewage sludge is viewed under a microscope. Several bacteria are capable of accumulating polyphosphate, but the link between their laboratory performance and the real world has never been clear.

Hannes Melasniemi and Anne Hernesmaa from the University of Helsinki have gone back to basics, looking at real sewage sludge. As they point out, there is no reason why the cells have to be bacteria. Algae, fungi, protozoa and invertebrates, as well as bacteria, are all present in activated sludge. Their microscopic study, involving staining for characteristic features of microbes, clearly shows that the principal polyphosphate accumulator is undoubtedly a yeast. It has a cell surface covered with typical fungal compounds, is unaffected by antibacterial antibiotics, and has large oval cells. It vanishes rapidly once fresh sludge is dropped into conventional laboratory growth media, being replaced by bacteria. This may be one reason why it has taken so long to appreciate that it is even present in activated sludge. Back in 1888 Liebermann identified baker's yeast as the first organism to contain polyphosphate. The beneficial activities of one of its relatives have eventually been revealed over a hundred years later.

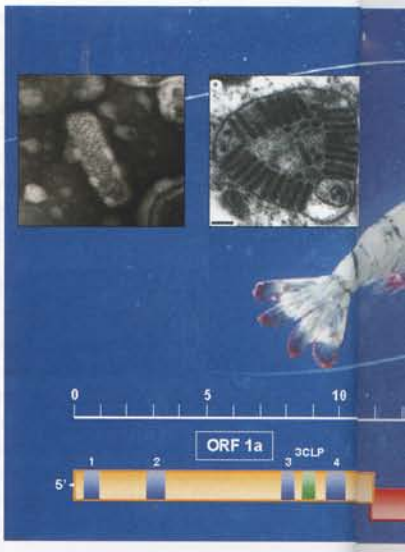
Melasniemi, H. & Hernesmaa, A. (2000). Yeast spores seem to be involved in biological phosphate removal: a microscopic *in situ* case study. *Microbiology* **146**, 701–707.



CENTRE:
Virion morphology and ORF1a–1b genomic region of gill-associated virus: an invertebrate nidovirus infecting *Penaeus monodon* prawns.
REPRODUCED WITH PERMISSION OF INTER-RESEARCH SCIENCE PUBLISHERS

BELOW:
Clusters of the principal polyphosphate-accumulating organism in a biological phosphate-removing process treating municipal waste water on a technical scale at the Suomenoja waste water treatment plant, Southern Finland. Polyphosphate in fresh activated sludge was stained fluorescently with DAPI. Bar, 10 µm.
PHOTO COURTESY H. MELASNIEMI, UNIVERSITY OF HELSINKI, FINLAND

Genes in knots



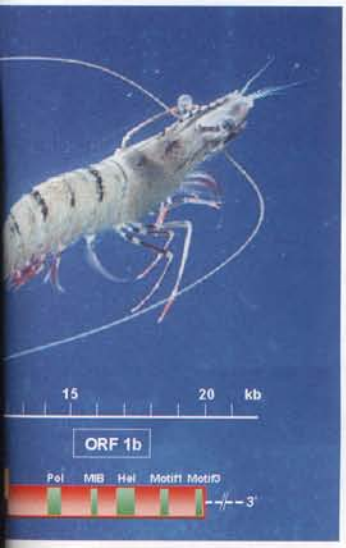
A central tenet of molecular biology maintains that nucleic acids are the genetic material of all living things. Deoxyribonucleic acids (DNA) carry the instructions for most organisms and ribonucleic acids (RNA) are generally used to make everyday working copies. However, some viruses use ribonucleic acid as their information repository. Although philosophers can argue about how well the word 'alive' applies to a virus, for prawn farmers surrounded by dead and dying black tiger prawns, a virus is as much a predator of their prawns as an animal would be.

Gill-associated virus (GAV) has caused massive production losses in farmed prawns in Australia. It replicates in the prawn's lymphoid organ, turning its cephalothorax a characteristic yellow colour. A group of Australian researchers has now reported their analysis of the characteristics of GAV.

The genetic material of GAV is single-stranded RNA. In some ways, this is very convenient for the virus, because the prawn cells that it exploits can immediately carry out the RNA instructions. However, the virus has to ensure that it provides a way to copy its RNA genes, because that is something that cells never do. The researchers examined the viral RNA in great detail and realized that a large part of it consisted of only one gene, which contained instructions for two sets of proteins needed to replicate and transcribe the genome. Since there is a single molecule of genomic RNA, this can only work if the frame for translation makes sense when slipped along a little, as well as in its original format. The experiments showed that the viral RNA forms into an elegant pseudoknot to achieve this slippage. Two very large proteins were produced, which look as if they had to be processed into smaller units to form the replication machinery.

The authors obtained enough information to be confident about the taxonomic position of GAV for the first time. It is a member of the nidoviruses, a group of viruses found in animals and typified by a large RNA genome and complicated ways of expressing their proteins. This scourge of modern prawn farming may have an ancient origin. It is the first nidovirus found in an invertebrate, and since marine invertebrates were abundant prior to the evolution of land animals, it may be an example of an ancestral form of the virus.

Cowley, J. A., Dimmock, C. M., Spann, K. M. & Walker, P. J. (2000). Gill-associated virus of *Penaeus monodon* prawns: an invertebrate virus with ORF1a and ORF1b genes related to arteri- and coronaviruses. *J Gen Virol* **81**, 1473–1484.



Passing the acid test

Microbes will grow in the most unlikely places. For example, the liquid of a pilot bioreactor designed to leach gold from arsenopyrite/pyrite ore from Kazakhstan at a temperature of 30 °C and a pH around 1·7 does not sound like a promising location. However, Russian researchers have found the first member of a previously unknown family in exactly this location. Their studies, in collaboration with the GBF National Research Centre for Biotechnology in Germany, have ranged from tempting it to consume 101 different organic compounds, mass spectrometry of its cell constituents and sequencing parts of its DNA.

It has some pretty unusual characteristics. To begin with, it is not actually a bacterium. Instead, it is an archaeon, a member of the third great kingdom of life on this planet. These single-celled organisms are as different from bacteria as we are, with the differences lying in fundamental cellular activities. The organism, *Ferroplasma acidiphilum*, enjoys a very acidic environment at pH 1·7, uses carbon dioxide as its sole source of carbon for building cell materials and obtains all its energy from the oxidation of iron. This is undoubtedly the physiological key to its presence in the bioreactor because of all the iron seeping from the pyrite ore. The structural key is that the cells, which divide by budding, are entirely wall-less and have exposed membranes, the characteristics of which are probably essential to survival in such a hostile environment.

F. acidiphilum is sufficiently different from other archaea that it belongs to a new family, *Ferroplasmaceae*. It will be interesting to see whether other organisms join it in the future.

Golyshina, O. V., Pivovarova, T. A., Karavaiko, G. I., Kondrat'eva, T. F., Moore, E. R. B., Abraham, W.-R., Lünsdorf, H., Timmis, K. N., Yakimov, M. M. & Golyshin, P. N. (2000). *Ferroplasma acidiphilum* gen. nov., sp. nov., an acidophilic, autotrophic, ferrous-iron-oxidizing, cell-wall-lacking, mesophilic member of the *Ferroplasmaceae* fam. nov., comprising a distinct lineage of the *Archaea*. *Int J Syst Evol Microbiol* **50**, 997–1006.

Toxic shock

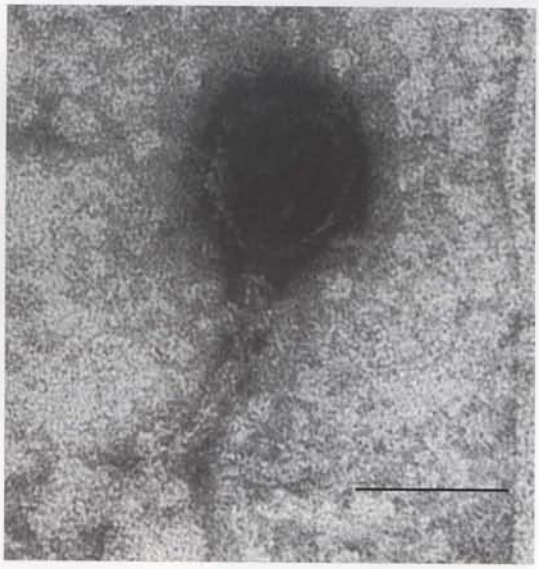
The European Community permits the use of some antibiotics as additives in animal feeds for their growth-promoting properties. Although these antibiotics are not used in human medicine, there are concerns that they may encourage the development of antibiotic-resistant bacteria. The German researchers Bernd Köhler, Helge Karch and Herbert Schmidt have now reported on another possible danger.

Escherichia coli is sometimes capable of producing a toxin that causes diarrhoea and haemorrhagic colitis. On rare occasions, the infection can lead to kidney failure and life-threatening blood or neurological disorders. There are very many versions of these Shiga-toxin-producing *E. coli* (STEC) and they frequently occur in farm animals. The infamous *E. coli* O157 : H7 is one of them.

The genes for the toxin are actually not part of the genome of *E. coli*, but of a parasitic virus within it (called a phage). The toxin is probably produced as part of the phage life-cycle, at the point where it has started to multiply within its bacterial host, prior to bursting out and seeking more bacteria to parasitize. This stage is triggered by environmental stress – such as the presence of antibiotics, perhaps. The German group wanted to know if the feed additives could really do this.

They grew clinical isolates of STEC strains in media containing antibiotics used as animal growth promoters; the concentrations of the antibiotics were selected to allow the bacteria to grow poorly. Then they tested the growth medium for the presence of both Shiga toxin and phage particles. The tests always found the two together. Two of the growth promoters, olaquindox and carbadox, strongly enhanced phage release in all of the strains tested, while the other two (tylosin and monensin) did not.

Of course, bacterial cells growing in laboratory media are in a very different environment from an animal's gut. However, growth promoters are used with clear regulations on the amounts permitted in feed and studies have measured the concentrations in animals' digestive tracts. The sub-lethal amounts used in this study were within the range really experienced within animals. The researchers had to draw the conclusion that some growth promoters might increase the amount of phage present in intestines and so possibly contribute to the spread of Shiga toxin genes to all the bacteria living there. This is obviously a topic that we will hear about again.



ABOVE:
Stx2-phage 933W isolated from *Escherichia coli* O157 : H7 strain EDL933. Bar, 50 nm.
PHOTO COURTESY H. SCHMIDT, UNIVERSITÄT WÜRZBURG, GERMANY

Köhler, B., Karch, H. & Schmidt, H. (2000). Antibacterials that are used as growth promoters in animal husbandry can affect the release of Shiga-toxin-2-converting bacteriophages and Shiga toxin 2 from *Escherichia coli* strains. *Microbiology* **146**, 1085–1090.

Turned on by milk

Mastitis is an unpleasant infection of cows. Not only is it painful for the animals and means their milk is unfit for consumption, but it often does not respond to treatment with antibiotics. The bacterium *Staphylococcus aureus* is the most common cause. It can colonize the mammary glands within hours, multiplies rapidly and becomes resistant to attack by the immune system. Current data suggests there is a particular set of genes that become active in milk to aid its success in this environment. Knowledge about their identity might allow the design of new prevention measures.

This was the aim of a group of scientists from the Netherlands. Their experiments mutated a pathogenic strain of *S. aureus* with a transposon. This is a short length of DNA that has the ability to insert itself anywhere in a chromosome. Transposons occur naturally and were first detected in the 1940s by Barbara McClintock in maize plants. The Dutch researchers used a transposon containing the gene for a protein that they could easily detect. However, it lacked any 'commands' to turn the gene on. So the protein would only appear when the transposon landed next to suitable 'instructions' from *S. aureus* genes. The researchers were, of course, looking for genes that were switched on by milk and so grew *S. aureus* on media containing it. Once they detected the protein, all they had to do was isolate and sequence the DNA surrounding the transposon and they would have a milk-activated bacterial gene in their hands.

They eventually identified 28 different genes in *S. aureus*. One group of genes was involved in cell wall synthesis. Other genes had roles in synthesis of DNA or of sensors for monitoring the environment. The function of several further genes could not be identified. One encouraging aspect was that several of the genes had already been fingered by other scientists as important for virulence of *S. aureus*. The picture of what happens during mastitis is becoming clearer.

Lammers, A., Kruijt, E., van de Kuijt, C., Nuijten, P. J. M. & Smith, H. E. (2000). Identification of *Staphylococcus aureus* genes expressed during growth in milk: a useful model for selection of genes important in bovine mastitis? *Microbiology* 146, 981–987.

ABOVE:
Colonies of a staphylococcal transposon mutant (transposon insertion in a homologue of the *Bacillus subtilis phoR* gene) on three different growth media containing the β-galactosidase substrate X-Gal: top, LB medium; middle, raw bovine milk; bottom, 1 vol. 2x LB medium and 1 vol. milk.
PHOTO COURTESY A. LAMMERS, INSTITUTE FOR ANIMAL SCIENCE AND HEALTH, LELYSTAD, THE NETHERLANDS

Hybridization in miniature

Microbiologists have always been interested in accurate and rapid methods for classifying bacteria. A formidable set of tools has been developed over the years as the accepted best methods for dealing with particular groups of bacteria. Unfortunately, there is always a trade-off between speed, cost and precision.

One important way of classifying bacteria at the species level is DNA–DNA hybridization. DNA is extracted from a test strain and mixed with DNA from an authentic strain. This is done in conditions designed to make the DNA of the two strains stick together. The amount that sticks indicates the relationship of the bacteria. There should be 100% hybridization if the strains are identical.

Reliable methods for these hybridizations are time-consuming and require large amounts of DNA. The procedure described in this paper is as accurate as conventional methods, requires only one-hundredth the amount of DNA and should be easy to automate. It relies on hybridization to authentic DNA covalently attached to tiny plastic wells. This is the type of procedure used in DNA sequencing, so robots already exist that could perform the manipulations. The authors point out that this test is currently under-utilized despite its value because of the difficulties in doing it. Their procedure may be the start of its introduction into routine use.

Christensen, H., Angen, Ø., Mutters, R., Olsen, J. E. & Bisgaard, M. (2000). DNA–DNA hybridization determined in micro-wells using covalent attachment of DNA. *Int J Syst Evol Microbiol* 50, 1095–1102.

Seafood cocktail

White spot syndrome virus (WSSV) causes devastating disease in shrimps, crabs, crayfish and other aquatic invertebrates. Not only is the identity of the virus uncertain, but also the way in which it can attack so many different animals. A collaboration between researchers in the Netherlands and the National Taiwan University has been using DNA sequencing to investigate this puzzle. The very large amount of DNA contained in the virus has made this difficult. In addition, there are regions that look like genes but are unlike ones identified in other organisms. However, the scientists have now succeeded in identifying two WSSV genes, opening the way for comparisons with other viruses.

The genes are for the two parts of ribonucleotide reductase, an enzyme used in making the components of DNA. Its identification in WSSV is particularly valuable because its important role means it has been conserved during evolution. The researchers could compare it with sequences for these genes from many other organisms to see WSSV's evolutionary relationships. The WSSV genes turn out to be related to ones found in eukaryotes and their viruses, although it is unlikely that they share a recent common ancestor. More interestingly, they are not closely related to those found in baculoviruses. This is the viral group that seems most like WSSV on the basis of morphology and replication characteristics. Although more information is needed, it looks like WSSV is going to be the first representative of the Whispovirus genus, and perhaps an entirely new virus family.

van Hulten, M. C. W., Tsai, M.-F., Schipper, C. A., Lo, C.-F., Kou, G.-H. & Vlak, J. M. (2000). Analysis of a genomic segment of white spot syndrome virus of shrimp containing ribonucleotide reductase genes and repeat regions. *J Gen Virol* 81, 307–316.

Reviews

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

Receptor Binding Techniques. Methods in Molecular Biology, Vol. 106

Edited by M. Keen
Published by Humana Press (1998)
US$79.50, pp. 304
ISBN: 0-89603-530-1

Radioligand binding is a little like plastering a wall; it is conceptually simple and it looks easy until you try it yourself. This multi-author book, edited by Mary Keen, does much to dispel the mysteries surrounding the technique and provides a good many solutions to practical problems. Most of the chapters are organized on a laboratory protocol basis with complete, easy to follow instructions. The book is written in a uniformly accessible style and there is plenty of benefit to be derived from it for both novices and more experienced scientists wanting to learn a new technique. Although it has clearly been produced with eukaryotic studies in mind there is no reason why workers in other disciplines should not find it equally useful.

■ ***Dave Kendall***
University of Nottingham Medical School

Egg and Ego. An Almost True Story of Life in the Biology Lab

By J.M.W. Slack
Published by Springer (1999)
£19.00/US$24.95/DM49.80/öS364.00/sFr46.00, pp. 195
ISBN: 0-387-98560-3

An amusing, informative and provocative book, that will ring bells with a lot of readers. There are three intertwining strands. The first is autobiographical, from the author's PhD to the present: the 'almost true' in the title refers to various changes of name and compositing of characters to protect people's feelings (or keep m'learned friends at bay). The second is an accessible and informative description of recent advances in his field of developmental biology, including his own contribution, which conveys well the process and excitement of scientific discovery. The third strand, and the real punch of the book, is a wry critique of how scientists operate as competitive, ambitious and vain creatures, in a world ruled by audit, vice-chancellors, impact factors, the need to publish in 'fashion journals' and the relentless pursuit of funding. Essential precautionary reading for young scientists starting their climb up the greasy pole; old cynics will enjoy it too.

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

The Comprehensive Sourcebook of Bacterial Protein Toxins, Second Edition

Edited by J.E. Alouf & J.H. Freer
Published by Academic Press Inc. (1999)
US$159.95, pp. 718
ISBN: 0-12-053075-9

This is a splendid book with many excellent features. For a book in the encyclopaedic genre it is remarkably up-to-date: most chapters refer to 1998 and some to 1999 literature, which makes forward electronic literature-searching very easy. It is a good 'read' helped by a judiciously limited selection of helpful diagrams and an absence of sequence data except where such are crucial to the exposition. It is an expanded update of the first edition, usefully organized into three sections. Two are on site and biochemical mode of action of toxins. The third emphasizes clinical, pharmacological and immunological aspects of bacterial toxins and the potential of some as therapeutic agents; thematic overlap with the first two is both helpful and unavoidable. It has my highest recommendation for all interested in reading their way into the endlessly fascinating world of bacterial toxins as agents of disease or tools for cell biology.

■ ***John Stephen***
University of Birmingham

DNA Microarrays: A Practical Approach. Practical Approach Series No. 205

By M. Schena
Published by Oxford University Press (1999)
£31.95, pp. 272
ISBN: 0-19-963776-8

If you've ever been to one of those conferences that have speakers from both academic institutions and industry you'll know what to expect from this book. It contains a mixture of down to earth protocols and specialist reviews, each of which contains material of interest whether you're already into DNA arrays or whether you want to know why you should (or should not) get into them. Some of the protocols (e.g. on RDA, RNA amplification, fluorescent cDNA labelling) are useful without recourse to DNA arrays; others require a heavy preliminary investment (confocal laser scanner, molecular biology robot, microarrayer). Reading this book you will also find a nominee for the World's smartest biochemist, and discover that there are 24 human chromosomes, which may come as a bit of a shock to the human genome sequencing consortium. Nevertheless, it's an essential purchase and probably the cheapest one a microarraying lab will make.

■ ***Jon Clewley***
Central Public Health Laboratory, London

Bacteria–Cytokine Interactions in Health and Disease

By B.Henderson, S.Poole & M.Wilson
Published by Portland Press Ltd (1998)
£75.00. pp. 375
ISBN: 1-85578-114-X

The interactions that occur between bacteria and host cells can be quite paradoxical. This publication focuses on these interactions with particular emphasis on the role of cytokine networks. This is a timely and much needed monograph that brings together literature from many different areas, microbial pathogenicity and cytokine biology being the two main players. From the viewpoint of a microbial immunologist, this is an excellent text that covers the range of scenarios that represent the encounter of the host with bacteria. Pattern recognition (e.g. lipopolysaccharide) will lead to pro-inflammatory cytokine generation in most instances but this is not necessarily the outcome. Commensal bacteria may have evolved the capacity to modulate the response via the production of 'bacteriokines' and/or the induction of regulatory cytokines. This monograph makes exciting reading and is of particular interest to students in the final year of medical microbiology courses and researchers in bacterial pathogenicity/microbial immunity.

■ ***Eileen Ingham***
University of Leeds

Microbes and Man, Fourth Edition

By John Postgate
Published by Cambridge University Press (2000)
£13.95/US$19.95, pp. 373
ISBN: 0-521-66579-5

It is a privilege to review a classic book. And *Microbes and Man* is certainly a classic of English literature as well as microbiology. This is a fourth edition of his personal view of the way very small life impinges on our own. He says that he aims to change the microbe's unfortunate public image. This book will certainly give its readers an enjoyable few hours and leave them better informed, even if not less prejudiced. It ranges across topics from antibiotics through cheese to BSE. He includes the unglamorous bacteria that eat oil and the many reliant on our sexual activity. Numerous examples enliven the driest of topics – the words of *On Ilkley Moor bath 'at* conjure up a memorable image of the nitrogen cycle. This is a book by one enthusiast, not a committee. Buy it, or give it as a present.

■ ***Meriel Jones***
Donnan Laboratories, University of Liverpool

Encyclopedia of Food Microbiology

Edited by R.K. Robinson, C.A. Batt & P.D. Patel
Published by Academic Press (2000)
£495.00, pp. 4,580
ISBN: 0-12-227070-3 (3 vol. set)

'*Oh no!* I thought, '*Not another collection of loosely linked papers presented at a meeting two years ago and masquerading as a text book*'. Far from it , this marvellous, comprehensive, bang up-to-date, publication sets a new standard for text books and is a must for any library. With an editorial board of 20 from nine different countries, this is a truly international book. Covering virtually every aspect of food microbiology from food safety through spoilage to microbial foods, set alphabetically (from *Acetobacter* to *Zymomonas*) and in three volumes with a comprehensive index it will be an invaluable resource for microbiologists and students everywhere. I tried it out on a range of subjects and it nearly always came up trumps. The only thing I could find that it was a bit light on was bottled water. If you are a food microbiologist, seriously consider obtaining this book. Seemingly expensive, the amount of use it will get compared with other books makes it good value.

■ ***Michael Hurst***
Watermark Consultancy

Intracellular Ribozyme Applications: Principles and Protocols

Edited by J.J. Rossi & L.A. Couture
Published by Horizon Scientific Press (1999)
£74.99/US$149.99, pp. 294
ISBN: 1-898486-17-4

RNA molecules containing RNA cleaving enzymatic activity, so-called ribozymes, have attracted enormous interest since their discovery by the groups of T. Cech and S. Altman in the early 1980s. Great progress has been made in isolating, characterizing and tailoring these RNAs to the extent that they can attack practically any RNA substrate in cells. This makes them an interesting tool for molecular genetics and also for the development of therapeutic agents in genetic and infectious diseases. This volume brings together a number of experts in the field who present methods on selection, purification, characterization of ribozymes and deoxyribozymes and their application for therapeutic purposes. Optimization of expression and appropriate delivery and pharmacogenetic procedures are also discussed. The use of ribozyme gene therapy for the inhibition of HIV replication is presented in an exemplary chapter. This reviewer only missed a description of the ample use of ribozymes in the molecular genetics of many viruses, particularly the reverse genetics of negative strand RNA viruses. The chapters are well written and illustrated. The presentation is very clear and the book simply 'fun' to read. Its wide dissemination among a large audience of scientists (molecular biologists, virologists, bacteriologists, biochemists, molecular pathologists, as well as physicians and clinical pharmacologists, etc.) is highly desirable.

■ ***Ulrich Desselberger***
Addenbrooke's Hospital, Cambridge

Virus Culture: A Practical Approach. Practical Approach Series No. 208

Edited by A.J. Cann
Published by Oxford University Press (1999)
£65.00 (H/B)/£31.95 (P/B), pp. 304
ISBN: 0-19-963715-6 (H/B); 0-19-963714-8 (P/B)

This slim volume contains several useful chapters on methodology for virus isolation detection and purification and will no doubt find a home on the shelves of many diagnostic and research virology laboratories. However, it was disappointing not to see more attention paid to newer methods of cell culture for detection of viruses, including customized genetically engineered cells, rapid cell-based ELISA systems and microneutralization assays. The style (protocol-based to discursive prose) and academic strength of the chapters is variable, Nevertheless, there is something for everyone, from experienced virologist to postgraduate student, and although much of the material is not new, it is helpful having it in one place. The absence of a chapter on risk assessment of working with viruses in culture is a significant omission and would certainly benefit junior researchers at whom this book is mainly aimed. Overall good value for money and highly recommended.

■ ***Maria Zambon***
Central Public Health Laboratory, London

Quantities, Symbols, Units, and Abbreviations in the Life Sciences: A Guide for Authors and Editors

By A. Kotyk
Published by Humana Press (1999)
US$19.50, pp. 144
ISBN: 0-89603-649-9

This authoritative guide has proved useful in the Editorial Office, as it covers a wide variety of disciplines; where the book is let down is in the lack of an index – you need to know under which category a particular unit, for example, belongs: if you had no idea, it could be time-consuming to find what you want. The microbiology section is not very comprehensive, although to avoid repetition and to save space Kotyk has listed some items elsewhere; for example, MIC is listed only under pharmacology. The taxonomy section is reasonable and there is a good listing of virus names. There are many interesting bits, such as the etymologies of names of chemical elements, and names of submultiples and multiples (10^{24} = yotta!). Notwithstanding the odd gripe, this is a pretty good reference text that many authors and editors will find helpful, especially when straying into a new subject.

Aidan Parte
SGM, Marlborough House

Structure and Dynamics of Fungal Populations. Population and Community Biology, Vol. 25

Edited by J.J. Worrall
Published by Kluwer Academic Publishers (1999)
NLG320.00/US$192.00/£112.00, pp. 348
ISBN: 0-412-80430-1

The development of population genetics and demography has largely been concerned with organisms that are easily defined as individuals, that are members of distinct species and that can be enumerated easily. It is evident therefore why these studies have not generally been made with fungi, but mycology is a rich source of ideas about how populations behave and evolve. The chapters covering general aspects like sex and somatic incompatibility are a clear reminder of the limitations of our understanding of why there is such diversity of the ways genetic information can (ex)change within populations. The chapters on specific fungal groups are also interesting, but contain (inevitably) little information on any organisms other than plant pathogens. Pathogens of major agricultural crops will give important examples, but they represent only a subset of the range of population structures the fungi exhibit. This book is timely, thought-provoking and expensive. Get your library to buy it.

■ ***Chris Thurston***
King's College London

Antiviral Methods and Protocols. Methods in Molecular Medicine, Vol. 24

Edited by D.Kinchington & R.F. Schinazi
Published by Humana Press (1999)
US$99.50, pp. 420
ISBN: 0-89603-561-1

This book is another in the series of titles on specific topics in molecular medicine. It is a comprehensive review of methodology which is applicable specifically to hepatitis viruses (HBV and HCV), herpes viruses (HSV1, HSV2, EBV, HHV6, HHV7, VZV and HCMV), HIV, HPV and influenza. Apart from the basic protocols for live viral assays, where appropriate, there are useful chapters on generation and characterization of resistant viruses as well as a limited number of descriptions of biochemical assays against specific viral functions (e.g. HIV RT, HCV NS3 helicase and flu NA). Because the main focus of this volume is the identification and use of novel antiviral agents, each antiviral assay is accompanied with associated protocols to eliminate genuine antiviral activity from cellular toxicity. Together with some useful general discussions on safety and new approaches to antiviral research this volume offers extremely useful information for both the pharmaceutical industry and the academic researcher.

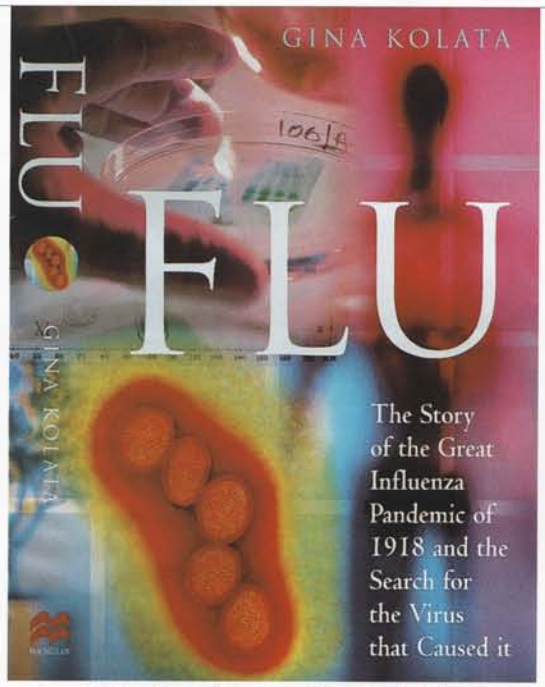
■ ***Berwyn Clarke***
GlaxoWellcome, Stevenage

Natural Toxicants in Food. Sheffield Food Technology, Vol. 2

Edited by D. Watson
Published by Sheffield Academic Press (1998)
£85.00, pp. 335
ISBN: 1-85075-862-X

Covering a wide range of natural toxins found in food, this useful and practical book not only covers toxicants of plant origin, such as the topical nut allergens, but also those of microbial origin, such as bacterial toxins, mycotoxins and the phycotoxins from marine algae found in seafood. With sections on quality control and detoxification this book will be of considerable interest to microbiologists and technologists working in the food or animal feed industries.

■ ***Michael Hurst***
Watermark Consultancy



Flu: The Story of the Great Influenza Pandemic of 1918 and the Search for the Virus that Caused It

By G. Kolata
Published by Macmillan (2000)
£12.99, pp. 330
ISBN: 0-333-75105-1

Gina Kolata writes here from an American perspective, in contrast to Pete Davies who last year published *Catching Cold*, a text with a very similar theme.
The scientific detail is minimal – Kolata weaves a story, including quite gruesome tales of individuals infected in 1918, rather than explaining the workings of the virus. The search for molecular information about the 1918 flu is nicely told from the point of view of Jeffrey Taubenberger, the USA Army scientist who is applying PCR techniques to piece together the genome sequence of the 'killer' virus. This book will stimulate undergraduates and others with a general interest in microbiology. Most frustrating is that both this and the Davies book tease the reader by suggesting that they will explain *why* the 1918 flu was so terrible. This is premature: even Taubenberger, who probably has the best chance, has not solved the 'murder mystery' yet.

■ ***Wendy Barclay***
University of Reading

The Luteoviridae

Edited by H.G. Smith & H. Barker
Published by CABI Publishing (1999)
£60.00/US$110.00, pp. 320
ISBN: 0-85199-324-9

This volume on an economically important and virologically fascinating family of plant viruses, has its origins in a joint meeting between the Association of Applied Virologists and the Société Française de Phytopathologie in 1997. Although the meeting was taxonomy-based, the chapters are extended to cover a wider range of topics. The chapters on genomes, gene expression, movement, virus–vector interactions and transgene-mediated resistance constitute significant and topical contributions and it is pleasing that they are integrated with excellent reviews on biological and practical matters, bringing these aspects of Luteovirus research together in an informative, and sometimes critical manner. Inevitably, a volume written largely in 1998 will lack some recent advances and references, and at £60 perhaps not many virologists other than luteovirologists will buy their own copy. However, as a reference volume and teaching resource it should be a welcome addition to library shelves and for institute purchase.

■ ***Jeffrey W. Davies***
John Innes Centre, Norwich

Microbial Foodborne Diseases. Mechanisms of Pathogenesis and Toxin Synthesis

Edited by J.W. Cary, J.E. Linz & D. Bhatnagar
Published by Technomic Publishing Co Inc. (2000)
US$139.95, pp. 568
ISBN: 1-56676-787-3

If you want to know at the molecular level how microbes produce foodborne disease, then this is the book for you. It is divided into five major sections covering bacterial pathogens, toxigenic fungi and marine dinoflagellates, protozoa, and viral and virus-like agents. Even for a book of this type, the choice of topics is broad and may be somewhat surprising to the reader, such as including *Toxoplasma* but omitting *Staphylococcus* and *Bacillus*. However, I recommend the book; it is well-referenced and will appeal to anyone with an interest in microbial pathogenicity. I would imagine that its level would be appropriate for senior undergraduates and postgraduates. At the price, many of the figures are not of the quality one might expect and it will primarily be purchased by institutions. Nevertheless, it is a timely but quite different book on foodborne diseases and fills a particular gap in the literature.

■ ***Adrian Eley***
University of Sheffield

Genetic Methods for Diverse Prokaryotes. Methods in Microbiology, Vol. 29

Edited by M.C.M. Smith & R.E. Sockett
Published by Academic Press Inc (1999)
US$59.95, pp. 500
ISBN: 0-12-652340-1

Judged against the back cover statement that it '*presents the latest experimental techniques in the detail you require*', I was disappointed because few chapters provide blow by blow accounts of any experimental technique. However, it does provide an effective route to applying a range of genetic techniques to non-standard organisms and complex systems which each present a different challenge. After starting with ways of introducing DNA into bacteria, as well as exploiting phage, plasmids and transposons, it proceeds by filling in the gaps occupied by some tricky species – from *Neisseria* and *Clostridium* to selected *Archaea*. Finally, it details processes from respiratory and photosynthetic apparatus to virulence determinants. While I cannot imagine seeing it open on the lab bench like '*Sambrook*', this will be a useful resource to help enthuse students about the microbial genetics needed to make sense of the mass of genomic sequences which are flooding in.

■ ***Chris Thomas***
University of Birmingham

2-D Proteome Analysis Protocols. Methods in Molecular Biology, Vol. 112

Edited by A.J. Link
Published by Humana Press (1999)
US$79.50, pp. 601
ISBN: 0-89603-524-7

The advent of sophisticated DNA sequencing techniques has made available a large number of complete genome sequences. Thus, in principle, we know what proteins can be synthesized by an organism, but little about which proteins are present in the cell or what their function may be. The next stage in the functional genomics saga is proteomics, or the study of expressed proteins from the genome. The analysis of expressed proteins relies on two techniques, 2-D PAGE to resolve the protein complement of the cell and mass spectrometry [either electrospray ionization (ESI) or matrix-assisted laser desorption time of fight (MALDI ToF)] instruments to identify proteins thus separated. This bench-top manual provides the analytical protocols necessary to enable both novices and aficionados (Link's words, not mine) to work with 2-D gels and ultimately identify the proteins by MS. There are 55 chapters covering everything you really need to know to get you up to speed in the analysis of the proteome. I really liked the layout of each chapter with a pithy introduction followed by materials and methods sections. The fourth notes section often contains the most important things you need to know when handling proteins and gels. All the references are complete with titles of papers. All in all, an absolute must for the proteomic laboratory. There's not much for the microbiologist *per se* – only one chapter devoted to *E. coli*. The assumption that what will work for *E. coli* should work for other prokaryotes is not true and one will need to look at the specialist literature to find out how best to work with other bacteria.

■ ***Howard Dalton***
University of Warwick

Bioinformatics: Methods and Protocols. Methods in Molecular Biology, Vol. 132

Edited by S. Misener & S.A. Krawetz
Published by Humana Press (1999)
US$89.50, pp. 512
ISBN: 0-89603-732-0

There has been a need for a book of this kind for some time. It is remarkably complete and could be extremely useful for those laboratories that are thinking seriously about their bioinformatic requirements. Some of the chapters are devoted exclusively to available molecular biology software. Other chapters tackle the theory behind the algorithms. This gives the reader the unfortunate impression that the book has something of an identity crisis. There are, of course, some areas of bioinformatics that only receive a cursory treatment, but in such a burgeoning field, it is difficult to cover everything. The chapters are clearly laid out and the text is generally easy to read and refreshingly free of much of the jargon that can be found in bioinformatics. However, with a price tag of US$89.50 it is prohibitively expensive and is unlikely to be used as course material. I would highly recommend it for institutional purchase.

■ ***James McInerney***
National History Museum, London and National University of Ireland, Maynooth

Assessing Science Understanding: A Human Constructivist View

By J.J. Mintzes, J.H. Wandersee & J.D. Novak
Published by Academic Press (1999)
US$69.95, pp. 386
ISBN: 0-12-498365-0

Life science academics often complain that although students learn individual facts well, few of them are able to integrate those facts and apply their knowledge across their whole degree topic. This book explains visual and verbal methods to encourage such broad understanding and to properly assess it. Visual methods include 'V diagrams' to demonstrate knowledge of core concepts and experiments for testing them, plus 'concept maps' to explain inter-relationships between facts and processes. Verbal methods include 'structured interviews' to assess student understanding rather than recall, a useful skill when holding a viva. The authors are educational psychologists (and they also give interesting insights into the psychology of multiple choice questions). As a result the language and theories are heavy-going for the science academic; however, the methods and biological examples it contains are useful to learn. Get your staff training unit to buy a copy and to pre-digest it for you.

■ ***Liz Sockett***
Queen's Medical Centre, University of Nottingham

Post Penicillin Antibiotics: From Acceptance to Resistance? Wellcome Witnesses to Twentieth Century Medicine, Vol. 6

Edited by E.M. Tansey & L.A. Reynolds
The Wellcome Trust (2000)
£5.00, pp. 72
ISBN: 1-841290-12-2

This is the latest volume in the series *History of the 20th Century Witness Seminars*, organized by the Wellcome Institute for the History of Medicine and held in London in May 1998. The book is an edited transcript of the proceedings in which individuals '*associated with a particular set of circumstances or events are invited to meet together to discuss, debate and agree or disagree about their memories*'. The transcript reflects very lively discussions on antibiotic research in the UK and elsewhere in the 1950s and 1960s (relating to streptomycin, semi-synthetic penicillins, beta-lactamase inhibitors, R factors and plasmid-related drug resistance).
Of particular interest is the early insight that micro-organisms develop resistances quickly after introduction of any new antibiotic drug, that combination of antibiotics can reduce the development of resistance and thus increase the chance of cures and that strict policies on the usage of antibiotics in hospitals can reduce the number of drug-resistant strains in a hospital.
The debate is professional with fascinating anecdotal elements and demonstrates that many of the problems of antibiotic usage were well formulated and disputed in the early era of antibiotic treatment.
The seminar booklet is highly recommended to all doctors, pharmacists and public health planners as it addresses questions and problems central to their work. Despite their tight training programmes, medical students who make the time will enjoy reading it.

■ ***Ulrich Desselberger***
Addenbrooke's Hospital, Cambridge

Scientist's Guide to Poster Presentations

By P.J. Gosling
Published by Kluwer Academic/ Plenum Publishers (1999)
US$30.00/£19.50/NLG65.00, pp. 150
ISBN: 0-306-46076-9

The title of this book accurately summarizes its content! All aspects of poster production are covered from planning to actual presentation suggestions. Many scientists (myself included) would question the need for such a book; much of its content seems obvious. However, there are many unpalatable poster presentations. Despite recent advances in technology, the poster will continue to be used as a visual aid to discussion at scientific meetings. This volume would be useful in an institute library or perhaps in a department with many junior researchers. Graduate students generally look to their colleagues for a layout to mimic but a dip into this book might help the trainee scientist devise a presentation which has the visual impact lacking in so many posters. The text is concise and the table of contents is clear and informative. However, if cost constraints allowed only one colour plate it should have been reserved for the poster critique section.

■ ***Sara Daw***
SGM, Marlborough House

Dictionary of Infectious Diseases (with CD-ROM)

Edited by D. Raoult & R. Tilton
Published by Éditions Elsevier (1999)
US$260 (North, Central & South America)
FF1,470/E224.10 (EU)
FF1,520/E231.72 (ROW)
pp. 1,144
ISBN: 2-84299-146-X

This dictionary/CD, an English version of a book originally in French, is aimed primarily at clinical microbiology. However, it contains information of great value to any microbiologist interested in infectious diseases, and comprehensively includes most, if not all, bacteria, fungi, protozoa or viruses that have done harm to humans. It is noteworthy for its international perspective, providing very useful maps showing the geographical distributions for major infectious diseases. Each country has risk tables for pathogens potentially to be encountered. Phylogenetic trees for each group of pathogens based on nearest-neighbour analysis of small subunit ribosomal RNAs, capsid protein or virus gene sequences are a particularly noteworthy feature of this book. Densely packed with useful information about specific conditions, disease agents and emerging pathogens, this is a very valuable microbiological resource. Unless engaged directly in clinical microbiology or tropical diseases, it is perhaps most suitable as a library reference book.

■ ***Jon Saunders***
University of Liverpool

Encyclopedia of Virology, Second Edition

Edited by A. Granoff & R.G. Webster
Published by Academic Press Ltd (1999)
£570.00, pp. 2,000
ISBN: 0-12-227030-4

The second edition of the *Encyclopedia of Virology* certainly has a place in the institute library as a reference source for medical students, undergraduates and others with a requirement for up-to-date and easily accessible virological knowledge. Although the scientific content of the entries is not so detailed as that of some other virology reference texts, the encyclopedia is very comprehensive. Moreover, the further reading sections for each entry readily enable pursuit of special interests. The range of viruses covered includes some which might be unfamiliar even to those of us who call ourselves virologists. The general entries constitute useful overviews where they cover virological topics, whereas those which delve into related areas, like immunology, will not satisfy the serious reader. Overall, the encyclopedia offers an excellent starting point from which to pursue a virological topic.

■ ***Wendy S. Barclay***
University of Reading

Cytomegalovirus Protocols. Methods in Molecular Medicine, Vol. 33

Edited by J. Sinclair
Published by Humana Press (2000)
US$69.50, pp. 131
ISBN: 0-89603-749-5

I suspect this research protocols book will become common place in cytomegalovirus labs across the globe and should serve to reinforce 'in-house' methods texts. The multi-authored book has contributions spanning methods for detecting the virus in man, to methods for studying gene expression and protein–protein interactions, and methods for analysing cytotoxic T-cell responses to HCMV. Each chapter is clearly set out and contains detailed recipes for the uninitiated. Many of the techniques highlighted are generic and can be adapted for use across the herpesvirus family. Sadly, some of the more recent innovative approaches, such as microarrays and BAC technology are absent. However, the authors might argue that such techniques still need to work their way into mainstream herpesvirology. In conclusion, a useful laboratory manual for those coming into the field, as well as for experienced cytomegalovirologists wishing to broaden their technical expertise.

■ ***Tony Nash***
University of Edinburgh

Books received

Compendium of Soybean Diseases, Fourth Edition. The Disease Compendium Series

Edited by G.L. Hartman, J.B. Sinclair & J.C. Rupe
Published by APS Press (1999)
US$37.00, pp. 128
ISBN: 0-89054-238-4

Gene Targeting Protocols. Methods in Molecular Biology, Vol. 133

Edited by E.B. Kmiec
Published by Humana Press (1999)
US$89.50, pp. 450
ISBN: 0-89603-360-0

Septic Shock: Methods and Protocols. Methods in Molecular Medicine, Vol. 36

Edited by T.J. Evans
Published by Humana Press (1999)
US$89.50, pp. 224
ISBN: 0-89603-730-4

Diary

june 2000

TUBERCULOSIS 2000: PAST, PRESENT, AND FUTURE

New York, USA
20–24 June 2000

CONTACT: ASM Meetings Department, 1752 N Street NW, Washington DC 20036, USA (Tel. +1 202 942 9248; Fax +1 202 942 9340; http://www.asmusa.org/mtgsrc/mtgs.htm)

FILAMENTOUS FUNGI ASSOCIATED WITH WATER DISTRIBUTION SYSTEMS

CABI Bioscience UK Centre, Egham, 27–29 June 2000

CONTACT: Mrs Stephanie Groundwater, CABI Bioscience UK Centre, Bakeham Lane, Egham, Surrey TW20 9TY (Tel. 01784 470111; Fax 01491 829100; email s.groundwater@CABI.org; http://www.cabi.org/bioscience/training.htm)

july 2000

RECENT ADVANCES IN CELL-BASED IMAGING

University of Bristol
3–5 July 2000

CONTACT: Dr Rita Stephen, School of Biological Sciences, University of Bristol (Tel. 0117 928 9035; Fax 0117 925 7374; email rita.stephen@bristol.ac.uk; http://www.bio.bris.ac.uk)

PCR CHARACTERISATION METHODS

CABI Bioscience UK Centre, Egham, 10–21 July 2000

CONTACT: Mrs Stephanie Groundwater (as above)

A COMING OF PHAGE – BACTERIOPHAGES IN BIOTECHNOLOGY

Society of Chemical Industry, London, 13 July 2000

CONTACT: SCI Conference Secretariat, 14/15 Belgrave Square, London SW1X 8PS (Tel. 020 7598 1500; Fax 020 7235 7743; email conferences@chemind.demon.co.uk)

BIOFILMS 2000

Big Sky, MT, USA
16–20 July 2000

CONTACT: ASM Meetings (as above)

SHORT COURSE – DESIGN OF VACCINATION PROGRAMMES: FROM SERO-EPIDEMIOLOGY TO COST-EFFECTIVENESS

University of Warwick
17–21 July 2000

CONTACT: Dr Stephen Hicks, Dept of Biological Sciences, University of Warwick, Coventry CV4 7AL (Tel. 02476 523540; Fax 02476 523701; email wupert@dna.bio.warwick.ac.uk)

july–sept 2000

INTERNATIONAL COURSE ON THE IDENTIFICATION OF FUNGI OF AGRICULTURAL AND ENVIRONMENTAL SIGNIFICANCE

CABI Bioscience UK Centre, Egham
31 July–1 September 2000

CONTACT: Mrs Stephanie Groundwater (as above)

august 2000

BACILLUS 2000. APPLICATIONS AND SYSTEMATICS OF *BACILLUS* AND RELATIVES

Bruges, Belgium
30–31 August 2000

CONTACT: Dr Roger Berkeley, University of Bristol, Badock Hall, Stoke Park Road, Bristol BS9 1JQ (Tel. 0117 903 2480; Fax 0117 903 2499)

september 2000

SOCIETY FOR LOW TEMPERATURE BIOLOGY ANNUAL SCIENTIFIC MEETING. TIME TRAVEL FOR GENES (ORGANIZED JOINTLY WITH UK FEDERATION OF CULTURE COLLECTIONS)

Ambleside, Cumbria
1–2 September 2000

CONTACT: Dr Glyn Stacey, NIBSC, Blanche Lane, South Mimms, Herts EN6 3QG (email gstacey@nibsc.ac.uk)

BIOTECHNOLOGY 2000: THE WORLD CONGRESS ON BIOTECHNOLOGY. 11TH INTERNATIONAL BIOTECHNOLOGY SYMPOSIUM AND EXHIBITION WITH 4TH CONGRESS ON MOLECULAR MEDICINE, 2ND EUROPEAN CONGRESS ON APPLIED GENOME RESEARCH, 1ST EUROPEAN CONGRESS ON AGRI-BIOTECHNOLOGY AND 18TH DECHEMA ANNUAL MEETING ON BIOTECHNOLOGY

Berlin, Germany
3–8 September 2000

CONTACT: DECHEMA e.V., Congress Office, P.O.B. 15 01 04, 60061 Frankfurt am Main, Germany (Fax +49 69 7564 176; email biotechnology2000@dechema.de; http://dechema.de/biotechnology2000.htm)

EXTREMOPHILES 2000. 3RD INTERNATIONAL CONGRESS ON EXTREMOPHILES

Hamburg, Germany
3–7 September 2000

CONTACT: TUHH-Technologie GmbH, Ms. Gerlinde Loebkens, Schellerdamm 4, 21079 Hamburg, Germany (Tel. +49 40 76618012; Fax +49 40 76618018; email loebkens@tutech.de; http://extremophiles2000.de

MICROBIOLOGY TECHNIQUES – A TWO-DAY LABORATORY COURSE

Hatfield, Herts
4–5 September 2000

CONTACT: Dr Virginia Bugeja, Dept of Biosciences, University of Hertfordshire, College Lane, Hatfield, Herts AL10 9AB (Tel. 01707 284590; Fax 01707 286137; email v.bugeja@herts.ac.uk; http://www.herts.ac.uk/natsci/STC)

PROTEIN TECHNIQUES – A TWO-DAY LABORATORY COURSE

Hatfield, Herts
4–5 or 11–12 September 2000

CONTACT: Prof. John Walker, Dept of Biosciences, University of Hertfordshire, College Lane, Hatfield, Herts AL10 9AB (Tel. 01707 284546; Fax 01707 284510; email j.m.walker@herts.ac.uk; http://www.herts.ac.uk/natsci/STC)

NUCLEIC ACID TECHNIQUES – A THREE-DAY LABORATORY COURSE

Hatfield, Herts
6–8 or 13–15 September 2000

CONTACT: Dr Virginia Bugeja (as above)

ISOLATION AND IDENTIFICATION OF FUNGI FROM NATURAL HABITATS

CABI Bioscience UK Centre, Egham, 11–15 September 2000

CONTACT: Mrs Stephanie Groundwater (as above)

UNDERSTANDING THE USE OF MASS SPECTROMETRY IN PROTEOMICS – A ONE-DAY LECTURE WORKSHOP COURSE. IN CONJUNCTION WITH PROTEIN WORKS.

Hatfield, Herts
20 September 2000

CONTACT: Mrs Vera Jones, Science Training Centre, University of Hertfordshire, College Lane, Hatfield, Herts AL10 9AB (Tel. 01707 284590; Fax 01707 286137; email v.g.jones@herts.ac.uk; http://www.herts.ac.uk/natsci/STC)

40TH ICAAC

Toronto, Canada
17–20 September 2000

CONTACT: ASM Meetings (as above)

INTERNATIONAL CONFERENCE ON MEASUREMENT, ANALYSIS AND CONTROL IN BIOPROCESS TECHNOLOGIES: CURRENT STATUS AND FUTURE PROSPECTS

Robinson College, Cambridge
24–26 September 2000

CONTACT: Society of Chemical Industry, 14/15 Belgrave Square, London SW1X 8PS (Tel. 020 7598 1500; Fax 020 7235 7743; email jacquim@chemind.demon.co.uk; http://sci.mond.org)

INTERNATIONAL CONFERENCE ON BACTERIAL AND VIRAL VIRULENCE FACTORS (ICBVVF)

Smolenice Castle, near Bratislava, Slovakia
24–28 September 2000

CONTACT: email uzaelabu@savba.sk; http://nic.savba.sk/sav/inst/uzae/ICBVVF_Site/intro_01.html

october 2000

BIOTEC' 2000.
V IBERIAN CONGRESS ON BIOTECHNOLOGY.
II IBERO-AMERICAN MEETING ON BIOTECHNOLOGY
I BRAZILIAN CONGRESS ON BIOTECHNOLOGY

Recife, Brazil, 1–4 October 2000

CONTACT: Professor José Luiz de Lima Filho, BIOTEC' 2000 Secretariat, Universidade Federal de Pernambuco, Av. Professor Moraes Rego, S/N, Cidade Universitária CEP 50761-901, Recife, Pernambuco, Brazil (Tel. +55 81 2718484; Fax +55 81 2718485; email biotec2000@lika.ufpe.br; http://www.lika.ufpe.br/BIOTEC2000)

CHARACTERISATION OF PLANT PATHOGENIC BACTERIA

CABI Bioscience UK Centre, Egham, 9–20 October 2000

CONTACT: Mrs Stephanie Groundwater (as above)

may 2001

10TH INTERNATIONAL CONGRESS OF HUMAN GENETICS

Vienna, Austria
15–19 May 2001

CONTACT: ICHG Office, c/o Vienna Medical Academy, Alser Strasse 4, A-1090 Vienna, Austria (Tel. +43 1 405 13 83 33; Fax +43 1 407 82 74; email office@ichg2001.org)

september 2001

ESCV '01 PROGRESS IN CLINICAL VIROLOGY VII

Lahti, Finland
2–5 September 2001

CONTACT: Organizing Secretariat & Congress Office, University of Helsinki, Lahti Research and Training Centre, Kirkkokatu 16, FIN-15140 Lahti, Finland (Tel. +358 3 892 20514; Fax +358 3 892 20219; email irmeli.paasikivi@helsinki.fi; antti.vaheri@helsinki.fi; virpi.tiilikainen@helsinki.fi)

Comment

Hygiene in the home – a shared responsibility

The last decade has seen growing awareness of the importance of the domestic setting in the chain of infection transmission through the community. Although these infections are often self-limiting intestinal and respiratory infections, they represent a significant economic burden. Socio-demographic trends also now mean that increasing numbers of people are cared for at home who have reduced immunity to infection (the elderly and those discharged from hospital) and for whom the consequences of infection are more serious. Changing infectious disease patterns, treatment costs and the problem of antibiotic resistance all add up to a need for better infection prevention through hygiene. To be effective, however, the responsibility must be shared equally between government, industry and the public. The public can only play their part if they are properly informed with messages which make rational sense.

Although we must be concerned about the current 'antibacterial' trend in consumer products, there is a danger that press articles whose appeal lies in saying '*all you need is soap and water and common sense hygiene*' only serve to mislead. To begin making sense, the central point to clarify is not the relative merits of '*antibacterials*' and '*soap and water*' but what we mean by '*common sense hygiene*' and what it seeks to achieve. Behavioural studies suggest that people largely see hygiene as '*getting rid of household germs*' – obliterating them wherever they lurk – so as to create a healthy, i.e. germ-free, home. Such studies suggest that this is largely an innate approach motivated by disgust and fear of germs rather than concern about infection. While this attitude prevails, articles urging '*only soap and water*' and '*a common sense approach*' are merely interpreted as '*use soap and water to get rid of household germs*'.

To motivate improved hygiene we must first gain acceptance that homes will always contain potentially harmful microbes (from people, pets, food, etc.) and that good hygiene is not about eradication, but rather it is about targeting measures in the places and at the times that matter, to limit risks associated with human exposure. HACCP (hazard analysis critical control point) methodology, now fundamental to institutional hygiene, can help derive a rational approach for the home. This approach could also in turn resolve another confusion – the concept of focussed hygiene is compatible with press features which reinforce the need for challenge to the immune system and urge us '*not to be hygiene-obsessed*'.

Given the concept of targeted hygiene, the pros and cons of hygiene products can then be approached rationally. We must, however, remember that homes aren't like institutions where hygiene is a duty, training mandated and hygienic layouts designed in. Recent studies by Humphrey and co-workers, for example, show that a typical consumer cleaning routine using soap and water may be ineffective in preventing the significant spread of contamination around the domestic kitchen that occurs during preparation of raw chickens contaminated with *Salmonella* and *Campylobacter*. UK surveillance data, which now suggest that a significant amount of gastrointestinal tract infection in the community arises from food handling and person to person transmission, further highlight the need for effective targeted hygiene in the home.

Growing interest about home hygiene has led an international group of experts to form the International Scientific Forum on Home Hygiene (IFH). This non-commercial organization aims to raise awareness of the role of home hygiene in preventing infectious disease and to promote understanding of good practice. As part of this work the IFH has reviewed the evidence base for developing effective home hygiene practice. These data, together with information about the IFH, are available from www.ifh-homehygiene.org

● ***Professor Sally F. Bloomfield, Unilever Research, is a Visiting Professor in Environmental Health, Kings College London, and a Member of the Scientific Advisory Board of IFH.***

Further reading

Cogan, T.A., Bloomfield, S.F. & Humphrey, T.J. (1999). The effectiveness of hygiene procedures for prevention of cross-contamination from chicken carcasses in the domestic kitchen. *Lett Appl Microbiol* 29, 354–358.

Curtis, V. & Biran, A. (2000). Dirt, disgust and disease: is hygiene in our genes? *Perspect Biol Med* in press.

Evans, H.S., Madden, P., Douglas, C., Adak, G.K., O'Brien, S.J. & Djuretic, T. (1998). General outbreaks of infectious intestinal disease in England and Wales: 1995 and 1996. *Commun Dis Public Health* 1, 165–171.

Wheeler, J.G., Sethi, D., Cowden, J.M., Wall, P.G., Rodrigues, L.C., Tompkins, D.S., Hudson, M.J. & Roderick, P.J. (1999). Study of infectious intestinal disease in England: rates in the community, presenting to general practice, and reported to national surveillance. *Br Med J* 318, 1046–1050.

● Please note that views expressed in *Comment* do not necessarily reflect official policy of the SGM Council.