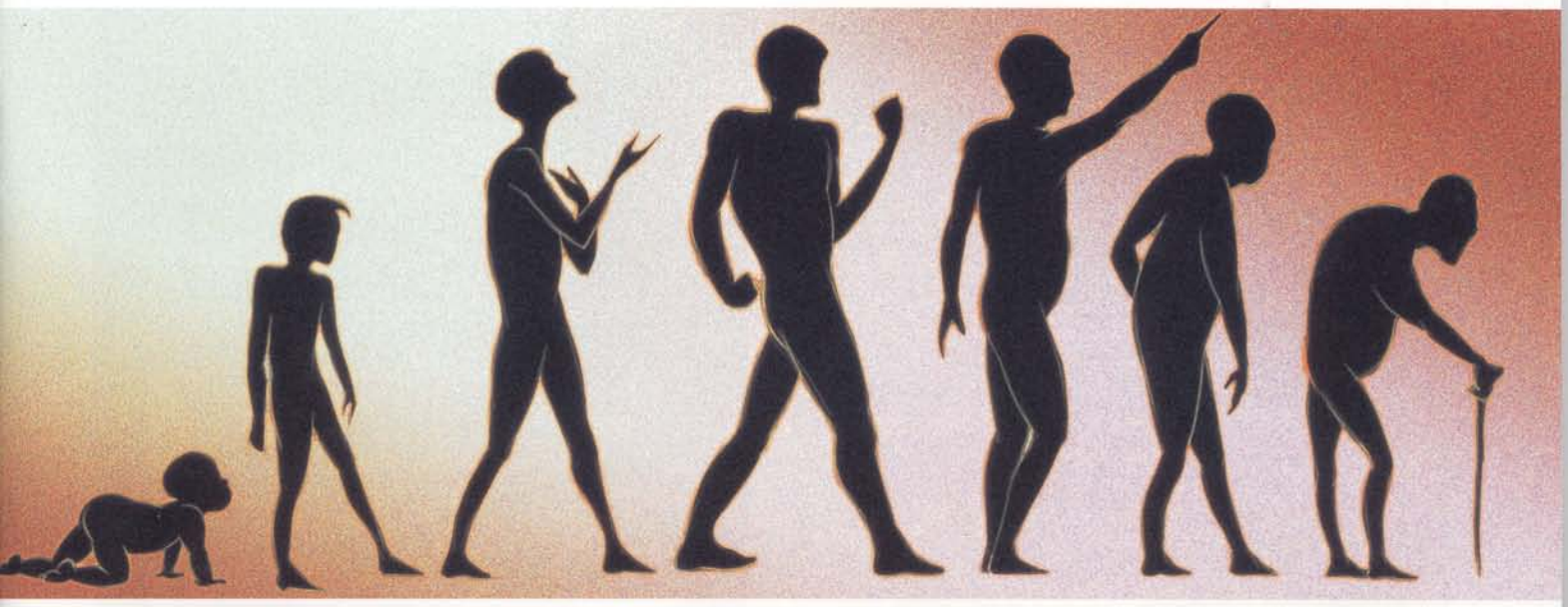


MICROBIOLOGY TODAY

QUARTERLY MAGAZINE OF THE SOCIETY FOR GENERAL MICROBIOLOGY VOLUME 28 NOVEMBER 2001

Contents

SGM Headquarters
Marlborough House,
Basingstoke Road, Spencers
Wood, Reading RG7 1AG
Tel. 0118 988 1800
Fax 0118 988 5656
email mtoday@sgm.ac.uk

SGM Website
http://www.sgm.ac.uk

Editor
Dr Meriel Jones

Editorial Board
Professor Dave Kelly
Dr Lynne Macaskie

Managing Editor
Janet Hurst

Production Editor
Ian Atherton

Assistant Editor and Book Review Manager
Janice Meekings

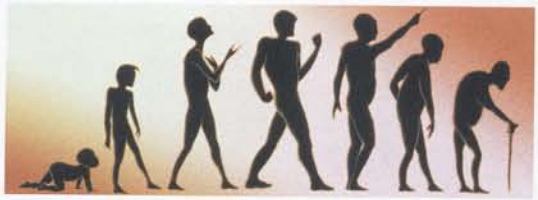
Contributions
These are always welcome and should be addressed to the Editor (c/o SGM Headquarters).

Copy Dates
Last dates for receipt of copy at Marlborough House are:
General Copy
February 2002 issue 10 December
May 2002 issue 25 March
Advertisements (CRC)
February 2002 issue 21 January
May 2002 issue 29 April

Advertisements
All enquiries should be sent to:
Helen Sapsford, NWH Sales Ltd,
The Arcade Chambers,
The Arcade, Aldershot,
Hampshire, GU11 1EE
Tel. 01252 357000
Fax 01252 357001
email helen@nwh.co.uk

Subscriptions 2002
NON-MEMBERS
Microbiology Today £50.00 (US$85.00)
MEMBERS
All members receive *Microbiology Today*. In addition they may take any of the Society's journals.
Ordinary Member
Membership Subscription (inc. *Microbiology Today*) £42.00 (US$72.00)
Microbiology/JGV/IJSEM £75.00 (US$140.00)
Student or Retired Member
Membership Subscription (inc. *Microbiology Today*) £20.00 (US$35.00)
Microbiology/JGV £37.00 (US$70.00)
IJSEM £75.00 (US$140.00)
Undergraduate or School Member
Membership Subscription (inc. *Microbiology Today*) £10.00
Corporate Member
Membership Subscription (inc. *Microbiology Today*) £500.00

Design: Graphics International



Above: Shakespeare's Seven Ages of Man.
Illustration David Gifford/Science Photo Library

Vol. 28, Part 4, Nov 2001

From the cradle to the grave, the human body interacts closely with micro-organisms. In this issue of your award-winning magazine we explore some of the relationships encountered at different stages in our lives.

By way of introduction, Roger Finch describes the variety of challenges we face from pathogens from birth to old age (pp. 171–172). Herpesviruses can affect us throughout life – the details are set out by Paul Griffiths on pp. 182–184.

One particularly distressing condition affecting the teenage years is acne – Anne Eady and Richard Bojar take a look at our current state of knowledge on pp. 178–181. Staying on a skin theme, Brian Perry reveals the battle waged by manufacturers to keep cosmetics and toiletries safe for daily use (pp. 185–187).

Childbed fever caused high maternal mortality in the past. On pp. 173–174 Milton Wainwright shows how the discovery of simple measures like handwashing helped to solve the problem. But is it possible to be too clean? There may be a link between hygiene and allergic disorders as Sundeep Salvi and Stephen Holgate describe (pp. 175–177).

Ulcers were once blamed on stress, but a microbe is now known to be the cause. Dave Kelly explores the role of *Helicobacter pylori* in stomach complaints (pp. 188–189).

And finally, when the grim reaper gets us, microbes make sure that we disappear altogether. Human decomposition expert Arpad Vass describes how bodies rot (pp. 190–192).

Comment focuses on the current situation with BSE and vCJD (p. 228); TSEs are also featured in Hot Off the Press (pp. 209–210). Gradline reports on two events for postgraduates (pp. 204–206) and there is an account of *The Alphabet of Science* in Wales (pp. 200–201). *Schoolzone* is a new feature aimed at meeting the needs of our school corporate members.

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

Articles

Regular Features

Other Items

Microbiology Today wins award

Microbiology Today has been judged Highly Commended in the Association of Learned and Professional Society Publishers/ Charlesworth Award category for House/ Membership Journals.

The results were announced at the first Annual Dinner of the ALPSP, held at the Institute of Physics on 12 September. Janet Hurst, Managing Editor of *Microbiology Today*, was delighted to be presented with a framed certificate by Neil Charlesworth of the well known journals house. Awards were also made in five other categories, each category recognizing significant achievement in the field of learned and professional publishing.

The *Microbiology Today* team is very proud to have received this recognition of their achievement and hard work. Members who peruse the pages of the magazine may never have considered how it is produced. As this is a special occasion, we hope we will be forgiven for illuminating our readers.

'*A highly professional membership journal boasting modern and innovative design.*'

Judges comments

The Editor, Meriel Jones (Liverpool University), is a member of SGM Council and presides over an editorial board made up of two fellow Council members (Dave Kelly, Sheffield, and Lynne Macaskie, Birmingham) and SGM staffers Ron Fraser, Janet Hurst, Ian Atherton, Janice Meekings and Tracey Duncombe. An 'editorial board' sounds very grand, but what we actually do is decide on topics to cover in future issues and come up with ideas for the articles that fit the theme. Then it's thinking caps on for the names of suitable authors. Writing articles for a magazine is very different from authoring a scientific paper, both in style and content. Meriel, Dave and Lynne usually approach the authors; once they've agreed to put pen to paper the team at Marlborough House take over.

Janice Meekings is the kingpin of the operation, handling all the administration of the articles and regular features. Letters are sent out to authors setting out the remit of their piece and the all-important deadline for its receipt, accompanied by guidelines on style, illustrations, etc. and a copyright form. Once the articles are in (usually after several chase-ups by Janice) Janet Hurst copy-edits them, forwards the text to Janice for amendments and further scrutiny by her eagle eyes for errors of spacing, punctuation, etc., before they are checked yet again and set by Ian Atherton in QuarkXpress. Proofs are then printed off and circulated to authors, as well as being checked by Janet and Janice in-house. No matter how hard we try, the occasional error does still get through this screening process.

In the meantime Janet, aided by Janice and Tracey, is also busy compiling regular items such as *Society News* and the *Meetings* page and asking other staff for copy on educational and careers activities, *Public Affairs*, *Gradline* and *Going Public*, etc. She collates and edits this material, along with that submitted by members, and passes it on to Ian and Janice.

Ian is in charge of *Hot off the Press*, nagging the journals staff to come up with papers to feature. These are sent off to Meriel who writes them up in a journalistic style and returns her copy to Ian who in turn forwards it to the journals for accuracy checks before it is set and proofed.

Book Reviews are Janice's province – she handles the whole process (new reviewers are always welcome for adding to her database!) – and she also compiles the *Diary* page from information submitted by readers and the public, checks that the *Address Book* information is up to date and gets new Council members, Officers, Conveners and Prize Lecturers to supply biographical information for publication.

Following the rough running order determined earlier, all the pieces are collated and the gaps and spaces identified. Some are filled with advertisements obtained via our agency, NWH Sales at Aldershot, but the rest are plugged by Janet who collects a file of press releases and other material just for this purpose. We may also be desperately searching round for illustrations at this stage, if some of the text needs to be broken up. The cover is put together by Ian, usually after some spirited discussion by the team about the best photograph to use.

Then it's the final run through. The contents page is compiled, 'in this issue' is hurriedly written, Ian prepares the computer files of DTP'd text and illustrations and Janet gives the whole thing one last read through. Meriel also receives a copy of the complete magazine. The discs are sent off to the friendly and efficient firm of family printers that we use – Warwick Printing Company Ltd – and we sit back and wait for the colour proofs to arrive. Once these have been checked and returned, the new magazine is soon printed and delivered to Marlborough House for distribution by Chris Rowland and his team, using labels produced in the membership office by Christine Pickett. The web pages are compiled by Janet and Ian, and put up on the day the magazine is distributed.

Apart from the printing, everything is done in-house, which means we have total control over the content and through close attention to detail and good teamwork, a high quality product. Not bad for one full time member of staff (Janice) and the others who fit in *Micro Today* with their other duties. Ian is self-taught in QuarkXpress and Photoshop; and although we paid a professional to design the basic layout of the magazine and provide templates, he is responsible for the design and layout of each issue.

Of course it is your magazine, so don't hesitate to give us feedback or request features on any particular topic. You might even want to volunteer to be an author. We look forward to hearing from you.

● *Janet Hurst, Managing Editor*

● *ALPSP represents the community of not-for-profit publishers and those who work with them to disseminate academic and professional information. It has an informative website at* ***www.alpsp.org*** *and publishes a journal, Learned Publishing.*

The microbiological ages of man

Roger Finch

Throughout our lives, microbes pose a threat to our health and well-being. Roger Finch charts the microbiological ages of man.

The lot of man is characterized by nine months *in utero* followed by 'three-score years and ten'. Throughout this period there is the ever present challenge from endogenous micro-organisms making up the normal flora of the skin or mucous membranes, or from exogenous agents acquired through inhalation, droplet spread, ingestion, sexual contact or from behavioural activity such as intravenous drug use. Susceptibility to infectious diseases occurs despite an impressive array of defences which include an enveloping integument, fixed and circulating phagocytic cells, the ability to respond to infectious challenges with specific and non-specific antibodies, augmented by a sophisticated cellular immune system able to process and express a vast repertoire of microbe-inactivating molecules. However, inherited genetic defects, circumstances of birth, nutrition, geography, travel, occupation, animal exposure and social behaviour all impact on our vulnerability to infectious disease which may sometimes threaten survival. There are many parallels between Shakespeare's description of the seven ages of man and the microbiological challenges of life.

Life *in utero*

The period from conception to delivery is relatively safe. However, maternal infections can have an adverse effect, despite the relatively short duration of pregnancy. Hepatitis A, B and E, and pneumococcal pneumonia are often more severe in pregnancy and may induce abortion or premature labour. Furthermore, the combined effects of a gravid uterus and elevated progestogens increase the risk of bacterial infection of the urinary tract which may ascend to involve the kidneys and sometimes spills over into the bloodstream.

The placenta provides an efficient protective barrier to many common infections. However, some micro-organisms can induce an active placentitis, thereby infecting the fetus, giving rise to diseases such as syphilis, cytomegalovirus (CMV), toxoplasmosis and rubella. Fetal death and congenital defects are well recognized complications of maternal syphilis and rubella, although influenced by the duration and timing of infection, respectively. Both diseases are routinely tested for as part of antenatal care in developed countries. Toxoplasmosis, rubella, CMV and herpes simplex in the pregnant woman can all result in minor to life-threatening infection in the newborn. Worldwide, the most important transmissible infection resulting from pregnancy is hepatitis B, which is particularly prevalent in developing countries. Infection acquired at birth results in a chronic carrier state in some 90% of newborns, compared with 10% when infection occurs in adult life. The legacy of chronic hepatitis B infection includes chronic liver disease, cirrhosis and liver cell cancer.

Parturition

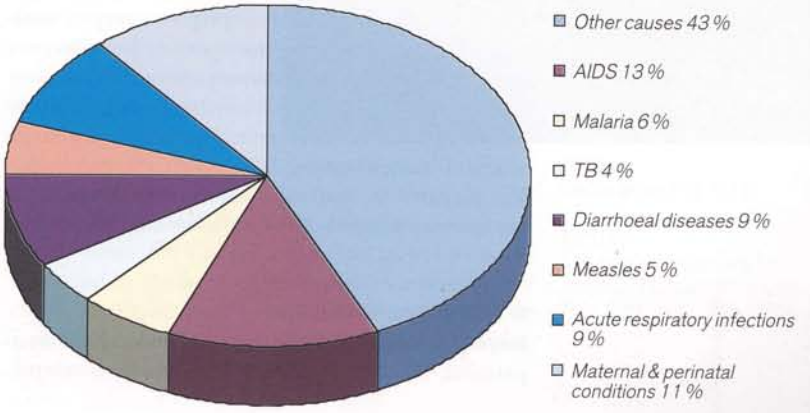
From the moment the maternal membranes rupture and delivery commences, the newborn child passes from the sterile environment of the womb to a world in which micro-organisms abound. Its skin and mucous membranes rapidly acquire a microbial flora, largely derived from its mother's birth canal and skin through contact and handling. This flora is largely harmless and offers some protection against potentially pathogenic organisms, but on occasions, virulent micro-organisms such as *Escherichia coli*, *Streptococcus agalactiae* and *Listeria monocytogenes* or herpes simplex virus may invade to produce generalized sepsis and meningitis. Mortality is still high despite prompt recognition and treatment, especially from *E. coli* meningitis.

Hospital delivery is the norm in many developed countries. It exposes the young to the potential for hospital-acquired infections at a stage when their immune defences are immature and passively acquired maternal IgG antibodies provide variable protection. Virulent pathogens, such as methicillin-resistant *Staphylococcus aureus*, multi-resistant *Enterobacteriaceae* and *Pseudomonas aeruginosa* are intermittently present in neonatal units and occasionally cause sporadic and epidemic illness, sometimes with fatal results.

Childhood

For the majority of the world's children, the tragedy of gastrointestinal infections and vaccine-preventable diseases continues to wreak a heavy toll. Fig. 1 highlights the causes of death in children and young adults in developing areas of the world. Poor nutrition, primitive or non-existent sanitation and the absence of a clean water supply are largely to blame. Measles carries mortality rates of up to 50% in some developing countries, while diphtheria has re-emerged in countries of the former Soviet Union with disastrous consequences.

Breastfeeding protects against diarrhoeal diseases, largely through the presence of secretory IgA in maternal colostrum. The decline in breastfeeding in developing countries as a result of commercial pressures promoting



BELOW:
Fig. 1. Deaths in developing countries. Two out of three deaths among children and young adults in Africa and Southeast Asia are due to seven causes (ages 0–44)
SOURCE: WORLD HEALTH ORGANIZATION/CDS

baby foods or from personal preference, has been highlighted by the WHO, UNESCO and other child welfare agencies.

Multiple upper respiratory tract viral infections are common in early childhood. In the West they are increasingly spread by attendance at day-care centres, nurseries and kindergartens as more parents select these facilities for reasons of personal choice, education and employment. Occasionally, more serious infections, such as meningococcal sepsis, may arise.

Antibiotics are frequently prescribed in early childhood and this has recently been highlighted as an area for more prudent use, since most childhood infections are viral in nature. Antibiotic resistance among community and hospital pathogens is increasing. Of considerable concern is the global prevalence of penicillin-resistant pneumococci which are an important cause of bacterial middle ear infection. Pre-school children experience, on average, an attack of acute otitis media every year. In the USA, there are increasing reports of failure to respond to conventional oral antibiotics, such as amoxycillin and erythromycin. Hospital admission and the use of injectable cephalosporins is now necessary to cure some children.

Adolescence and young adulthood

The infectious hazards of the years between childhood and adulthood often have life-long consequences. Sexually transmitted diseases, such as syphilis and gonorrhoea, are readily treated if recognized and diagnosed promptly. On the other hand, *Chlamydia trachomatis*, now the commonest sexually transmitted infection, has a legacy of infertility as a result of complicating pelvic inflammatory disease. Genital virus infections, such as herpes simplex, can recur throughout life, while the link between papillomavirus as a cause of genital warts and cervical carcinoma is becoming clearer. The emergence of HIV and AIDS in 1981 has led to the global pandemic which has the greatest impact on persons of reproductive age. Safe sex contributes to its control, but is clearly not the solution to containing this disease which continues to claim the lives of millions. Likewise, despite an ever impressive array of anti-retroviral therapies, drug management provides only temporary interruption in the progression to death.

The escalating use of prohibited drugs largely affects the young. The use of intravenous drugs is the major source of the newly recognized hepatitis C virus, which like hepatitis B, frequently causes chronic hepatitis, sometimes leading to cirrhosis, failure and cancer of the liver.

Maturity and old age

International travel is booming. This may be occupational, but is increasingly recreational in nature. The reality of the global village has resulted in an increase in travel-associated infectious disease. Malaria, schistosomiasis, tuberculosis, rickettsioses, salmonellosis and, less commonly, more exotic conditions, including Leishmaniasis and ectoparasitic diseases, such as jiggers (*Tunga penetrans*), are a sample of the recent problems dealt with in the infectious disease clinics and ward in Nottingham.

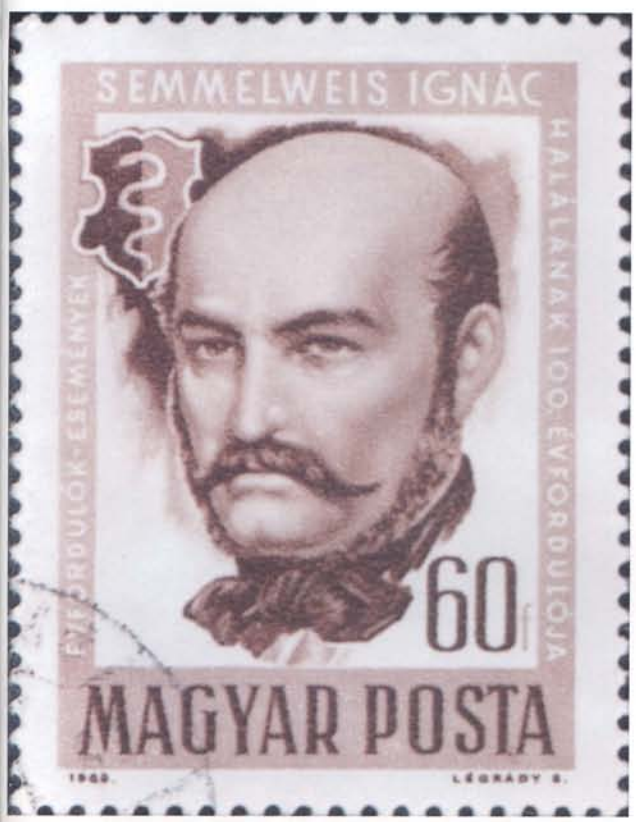
Malignant disease becomes increasingly common through adult life to old age. Current therapeutic approaches include oncolytics, radiotherapy and immunosuppressives. The latter, especially corticosteroids, are used to control a wide variety of other conditions, including those with an autoimmune basis. Similar approaches are adopted to prevent rejection in organ transplantation recipients. The therapeutic benefits unfortunately bring in their wake a repertoire of potential infectious complications across the whole range of micro-organisms, including viruses, bacteria, fungi and protozoa. Some reflect past infection with reactivation complicating the state of immunosuppression. These include varicella-zoster and cytomegalovirus, *Mycobacterium tuberculosis*, *Candida* spp., *Pneumocystis carinii* and occasionally *Strongyloides stercoralis* infections. Other challenges originate from the normal flora and hospital environ-ment. A successful bone marrow transplant can still be frustrated by severe and life-threatening infectious complications. This has resulted in a variety of management strategies, such as isolation care, anti-bacterial chemoprophylaxis, and granulocyte and macrophage colony stimulating factors, all comple-mented by strict hygiene measures.

Survival into old age and the involution of the immune system and other defence mechanisms leads to increasing vulnerability to infectious disease. These mainly affect the respiratory tract, so that pneumonia is a frequent complication of other diseases, such as stroke, influenza and post-operative states. Pneumonia has been described as 'Captain of the men of death'. It can sometimes be viewed as nature's way of relieving suffering from more serious underlying afflictions, as man enters his final state '*sans teeth, sans eyes, sans taste, sans everything*'.

● *Roger Finch is Professor of Infectious Diseases, The City Hospital and University of Nottingham, Nottingham NG5 1PB, UK.*
email: r.finch@nottingham.ac.uk

Childbed fever – the Semmelweis myth

Milton Wainwright



Was Ignaz Semmelweis really the first to show that puerperal fever is contagious, or is the famous story just a satisfying myth? Milton Wainwright investigates.

Before the introduction of prontosil and then penicillin, childbed, or puerperal, fever was the scourge of childbirth, leaving many babies without mothers. Even today, puerperal sepsis kills some 100,000 women a year worldwide. The disease is now known to be caused by haemolytic streptococci, but long before the microbial theory of infection was discovered, Ignaz Philipp Semmelweis (1818–1865), a Hungarian gynaecologist who practised in Vienna, showed that the incidence of puerperal fever could be reduced by antiseptic techniques such as rigorous handwashing. Semmelweis was largely ignored or ridiculed by his contemporaries and died of a staphylococcal infection in an asylum for the insane. But was he really the first to show that childbed fever is contagious, as is commonly believed?

As long ago as 1905, C. J. Cullingworth had his doubts when he stated that, '*We English-speaking people on both sides of the Atlantic, while giving abundant honour to Semmelweis, have been in danger of forgetting the earlier and equally remarkable contributions to our knowledge of puerperal fever.*' J. P. Greenhill also pointed out in 1936 that the contagiousness of puerperal fever had been recognized long before Semmelweis even thought about the disease.

One such pioneer in this field was the Manchester-based physician Charles White, who as early as the late 1700s, showed that the occurrence of childbed fever could be drastically cut down by isolating victims and insisting on cleanliness. By 1795, Alexander Gordon, of Aberdeen, had come to the radical conclusion that, like many other doctors, he had accidentally spread the disease and had caused the death of many women in his care.

Semmelweis

Semmelweis began his work on puerperal fever in 1846 and it was first published in 1847. He became aware of the disease following a change in hospital practice. The Vienna hospitals had originally followed the methods of Charles White. These had produced a very low death rate from puerperal fever, but when they were abandoned and cadavers were once again used to demonstrate midwifery techniques, a dramatic increase in mortality resulted. Semmelweis concluded that childbed fever was spread by a poison found in dead flesh (the so-called 'cadaveric principle'), although the germ theory is mentioned in his book published in 1861 which treated the topic in detail. He boldly stated that, '*Puerperal fever is not a contagious disease, but it is conveyable from a sick to a sound puerpera by means of decomposed organic matter.*'

By insisting that the cadaveric principle alone caused childbed fever, Semmelweis invoked the wrath of his critics. The Dublin-based physician, John Denham, for example, pointed out (in 1862) that Semmelweis overlooked the fact that childbed fever frequently appeared in towns where there were no lying-in hospitals or dissecting rooms, and in rural districts where medical practitioners were seldom called upon. Many of Semmelweis' forebears and contemporary critics were also aware of the link between puerperal fever and both erysipelas and scarlet fever. Such observations can now be readily explained by the fact that puerperal fever is caused by the haemolytic streptococci which are spread on unwashed hands and on the breath of anyone carrying *Streptococcus pyogenes*.

ABOVE:
Charles White (1728–1813).

TOP LEFT:
A centenary postage stamp from Hungary (1965) celebrating Ignaz Philip Semmelweis (1818–1865).

RIGHT:
Oliver Wendell Holmes (1809–1894).

'Elementary My Dear Holmes'

To an American reader the name of Oliver Wendell Holmes is more usually associated with belle-lettres and poetry than with medicine. In 1843, however, Holmes wrote an article which appeared in the *New England Journal of Medicine and Surgery* entitled 'The Contagiousness of Puerperal Fever'. In this he agreed with White and Gordon that the disease was both contagious and was often transmitted, via an unknown agent, by both physicians and nurses. He also described how, in 1835, an un-named doctor had the *'good sense to change his clothes after each maternity-related visit and wash his hands in chloride of lime'* – a practice usually credited to Semmelweis (in 1848). Holmes also referred to the fact that in 1821, an Edinburgh doctor called Campbell assisted in a post mortem and then spread the disease to a woman whilst attending a delivery. The same doctor attended an autopsy in June 1823 and, because he was unable to wash his hands, transmitted puerperal fever to two pregnant women. On the basis of his observations, Holmes recommended that physicians should:

- never attend autopsies prior to examining a pregnant woman,
- always change every article of dress after attending a delivery and allow 24 hours or more to elapse before conducting any further midwifery,
- always leave a period of at least a month between attending a case of puerperal fever and any uninfected patients,
- on finding three or more closely connected cases of puerperal fever in the practice (with no others existing in the neighbourhood) assume that they are the prima facie vehicle of the infection; and finally,
- regard it as their duty to pass on these warnings to nurses and assistants.

Like Semmelweis, Holmes was ridiculed for such views, which, it should be emphasized, were published in 1843, some 3 years before Semmelweis began his work.

Conclusion

Historians place great emphasis on the fact that Semmelweis used an essentially modern statistical approach to demonstrate the contagiousness of puerperal fever; however, it is not for such subtleties that he is generally eulogized. Instead, we are told that he alone realized that puerperal fever was spread by doctors and could be prevented by antiseptic hand washing. As we have seen, this is simply not the case. It is noteworthy that when Semmelweis' work first became known the famous Edinburgh surgeon, James Young Simpson, fired off vitriolic letters to the medical journals refuting the idea that the Hungarian doctor should receive any priority on his ideas. Despite this intervention, the Semmelweis myth grew, and continues to be uncritically propagated – essentially because it is too good a story to miss. It satisfies our need to elevate the underdog to near mythical status. In so doing, we ignore the many pioneers who went before Semmelweis and miss out on a more complex and far more fascinating story.

Dr Milton Wainwright is Senior Lecturer in Microbiology in the Department of Molecular Biology and Biotechnology, University of Sheffield, Sheffield S10 2TN, UK.
Tel. 01142224410; Fax 01142728697
email m.wainwright@sheffield.ac.uk

Further reading

Burgess, A. H. (1941). Charles White of Manchester. *Lancet* 1941(i), 235–240.

Codell Carter, K. (1981). Semmelweis and his predecessors. *Med Hist* 25, 57–72.

Cullingworth, C. J. (1905). Oliver Wendell Holmes and the contagiousness of puerperal fever. *Br Med J* ii 1161–1167.

Greenhall, J. P. (1936). Oliver Wendell Holmes and puerperal fever. *Surg Gyn Obstetr* 62, 772–774.

Holmes, O. W. (1843). The contagiousness of puerperal fever. Reprinted in *Medical Classics 1* (1936), pp. 195–268.

Is there a link between hygiene and allergic disorders?

Sundeep S. Salvi & Stephen T. Holgate

Allergic diseases are increasing rapidly. Is this linked to our rising standards of hygiene? Sundeep Salvi and Stephen Holgate explore the pros and cons of the 'Hygiene Hypothesis'.

The human fetus develops in a sterile maternal environment. Soon after birth, it is exposed to a large number of environmental stimuli, including microbes that rapidly colonize the gastrointestinal and respiratory tracts, as well as the epidermal layer of the skin. It has been estimated that within a few years the viable cells of the gut, respiratory and skin microflora outnumber the human host by a factor of ten. In most cases, this microbial flora is beneficial since it helps in the maturation of the intestinal tract. Constant microbial stimulus from the developing gastrointestinal and respiratory microflora is also required for the successful maturation of the gut and respiratory mucosal immune system. Numerous experimental studies have shown that the lack of such a stimulus results in decreased intestinal surface area, altered mucosal enzyme patterns, defects in the non-immunologic barrier of the intestine, reduced capacity for inflammatory responses and a defective mucosal IgA system.

Improved sanitation and a boost in hygiene have led to the end of many parasitic and microbial diseases. News about the germs lurking in mattresses and salmonella-yielding chopping boards has nearly everyone reaching for soaps, lotions, disinfectants and antibacterial hand gels. Between 1992 and 1998 nearly 700 new antibacterial products came on to the market. However, experts suspect that our widespread obsession with cleanliness and all things antibacterial may actually be harming our immune systems. Modern vaccinations, fear of germs and obsession with hygiene are depriving the immune system of the information input on which it depends for maturation and development. This fails to maintain the corrective cytokine balance and fine tune T-cell regulation, and some scientists believe that this may, at least in part, explain the increasing incidence of some immune disorders over recent years.

The prevalence of allergic diseases such as asthma, allergic rhinitis and allergic dermatitis have more than doubled over the past two generations. Interestingly, this increase appears restricted to first-world countries, particularly amongst the high socio-economic groups. Frequency of atopy (hypersensitivity to allergens) and asthma symptoms in children have been shown to vary from 2 to 4 % in China, India and Africa to 20–30 % in Britain, USA and Australia. Although there is a clear inherited predisposition to atopic diseases, the rapid recent increase and the 15-fold disparity in reported allergic disorders among countries probably reflect the influence of environmental factors. Some scientists have suggested that the rise in allergic disorders is linked to our ever greater preoccupation with cleanliness.

The 'Hygiene Hypothesis'

The 'Hygiene Hypothesis' for allergic disorders was first proposed in 1989 by David Strachan based on his observation that hay fever, skin prick positivity and specific IgE in children correlated inversely with family size. He stated that higher standards of personal cleanliness over recent years have reduced opportunities for cross-infection in young families, and that this may have resulted in more widespread clinical expression of atopic disease. He also indicated that the development of allergic diseases could be prevented by infections during early childhood, transmitted by unhygienic contact with older siblings or acquired prenatally. Since then, several other epidemiological studies from different parts of the world have reported similar observations.

Epidemiological link between hygiene and allergic diseases

The earliest association between hygiene standards and allergic disorders was observed by John Brostock, who first described hay fever in 1828 and was puzzled to find that this condition occurred mainly in the urban educated classes rather than those who lived on farms, despite their lower levels of exposure to pollen. More recently, the opening of former socialist countries of Eastern Europe to western investigators during the early 1990s brought important insights into the epidemiology of atopic disease. Before the Berlin wall came down, the incidence of allergies in East Germany was 5 %. Children were born in less-than optimal living conditions, ate less sterile food and lived in apartments that were not clean. In West Germany, at the same time the incidence of allergies was 25 %. Ten years after the unification the incidence of allergies in the old eastern Germany equalled that of western Germany, and some scientists have suggested that this has been mainly due to embracing the Western ideal of cleanliness.

Significant differences in the prevalence of allergic diseases have also been reported between urban and rural areas. An analysis of the prevalence of asthma in 1,375 children from the Xhosa tribe in South Africa showed that more than 3 % of the city-dwelling Xhosa children had asthma, compared with 0·14 % of rural children. A study in Basel, Switzerland showed that children of part-time farmers had a 76 % higher risk of hay fever and allergy than those of full-time farmers, suggesting that the greater exposure to livestock and the farm environment was protective for the development of allergic disorders. More recent studies have also shown a protective effect from living on a farm, particularly if there is contact with poultry, livestock or domestic animals. Of 500 children tested by the Medical College of Georgia, Detroit, those living with two or more pets (dogs or cats) were significantly less likely to have a positive skin test to allergens or allergen-specific IgE antibodies in the serum.

Some studies have shown that the use of antibiotics in early years leads to some children developing asthma and other allergic diseases later on. It has been argued that early childhood infections have a protective effect on

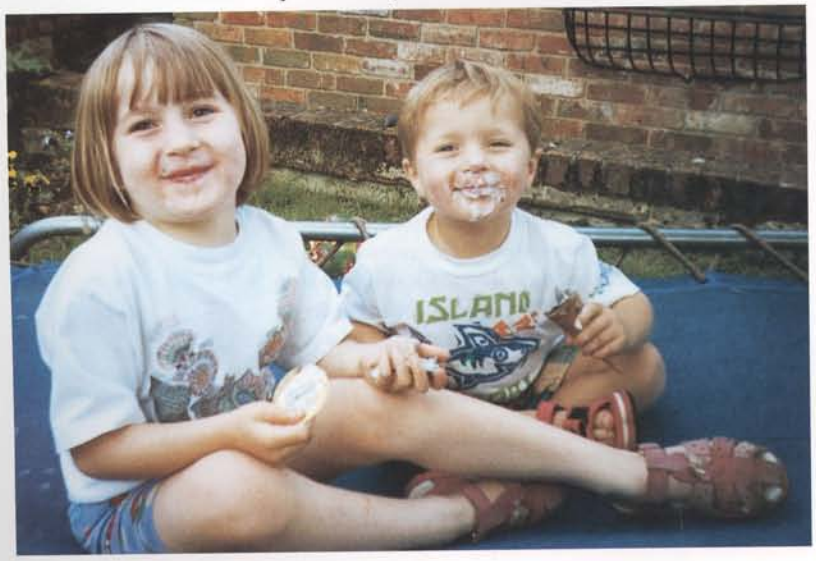
RIGHT:
Owning a pet, like 'Bertie Hogg', may be a mixed blessing for children.
PHOTO AIDAN PARTE, SGM

BELOW:
Allowing children to be exposed to the world around them and each other may be of benefit to their immune system.
PHOTO DARIEL BURDASS, SGM

the development of asthma. An ecological analysis conducted in 85 centres from 23 different countries showed that those with higher notification rates for TB had lower prevalences for asthma, allergic rhinoconjunctivitis and atopic eczema and it has been suggested that exposure to *Mycobacterium tuberculosis* may reduce the risk of developing asthma.

In 1,659 Italian military cadets aged 17–24 infections transmitted by contaminated food and the orofecal route, such as hepatitis A, were inversely related in a dose-dependent manner to atopy and respiratory allergies. Cadets who lacked antibodies to hepatitis A virus, *T. gondii* and *H. pylori* were 2·7 times more likely to he highly atopic than those with antibodies to two or three of these microbes (20·1 vs 7·8 %). Furthermore the researchers detected asthma in 0·4 % and allergic rhinitis in 7 % of the cadets exposed to at least two of the three microbes, in contrast to 5 and 16 %, respectively, in the group with no exposure to these microbes.

Bacterial endotoxins are found ubiquitously. The levels are particularly high in farms, being 18 times greater than those found in average homes. A recent study from the National Jewish Medical Centre, Denver, has demonstrated that exposure to bacterial endotoxin early in life may protect against the development of allergen sensitization, such as asthma. The researchers found that the homes of children who were most sensitive to allergens had significantly lower concentrations of bacterial endotoxin than those of children who were not sensitized to any allergens. It has been suggested that endotoxin drives the immune system to produce the cytokines that inhibit certain processes in the body which may lead to asthma. More recently, it has been observed that in some populations, polymorphisms that increase the expression of CD14 (receptor for endotoxin) may be associated with lower levels of IgE, and a potential explanation is that increased CD14 signalling enhances Th1-predominant responses and thereby less likelihood of developing IgE-mediated immunity.



Evidence for the Hygiene Hypothesis

Although the Hygiene Hypothesis was initially based on epidemiological evidence, a plausible underlying biological mechanism was suggested only when Tim Mosmann discovered the two polarized arms of the T-helper immune system, and the observation that allergic disorders were associated with overactivity of one arm. Th1- and Th2-helper cells are two polarized arms of the $CD4^+$ T-helper immune cell system which reciprocally inhibit each other. Th1 cells produce IFNγ, IL-2 and TGFβ, which have effects on the production of opsonizing and complement-fixing antibodies by B cells, activation of macrophages, cell cytotoxicity and induction of cell-mediated immunity. On the other hand Th2-helper cells produce cytokines IL-4, -5, -10 and -13, which evoke strong antibody responses, including IgE, and favour eosinophil differentiation and activation. Because cytokines released by Th2 cells mainly regulate IgE production as well as mast cell and eosinophil function, cells that are believed to drive the allergic responses, the Th2 system is believed to drive allergic responses to foreign organisms.

Pregnancy is associated with a strong skewing towards Th2-type immunity and if this does not occur at the correct time in gestation, there is an increased risk of abortion. As a consequence, neonatal immunity is Th2-skewed and allergen-specific T cell responses are already common at birth. The development of a counter-balancing Th1 immune response depends upon encounters with harmless microbes or through fighting microbial infections. According to the Hygiene Hypothesis, lack of microbial infections or contact with microbes causes the Th1 system to develop poorly, and as a consequence the Th2 system flourishes, which then favours the development of allergic diseases.

It has been suggested that the intestinal microflora is the most likely source of microbial pressure to enhance Th1-type responses. Experiments have shown that germ-free pups have a prolonged period of Th2 immune responses and a delayed development of oral tolerance. When the animals are colonized with bacteria of the normal commensal intestinal flora, oral tolerance and immune deviation toward Th1 responses rapidly develop. Also, treatment of mice with bacterial DNA products has been shown to inhibit the development of allergic airway inflammation.

One approach being explored is to expose children to dead bacteria or snippets of bacterial DNA to prompt a predominant Th1 immune response and thereby prevent the onset of allergies. A recent study showed that infants exposed to bacteria found in common yoghurt were half as likely to develop eczema as those who had not been given the bacteria. It has also been demonstrated that

RIGHT:
Owning a pet, like 'Bertie Hogg', may be a mixed blessing for children.
PHOTO AIDAN PARTE, SGM

BELOW:
Allowing children to be exposed to the world around them and each other may be of benefit to their immune system.
PHOTO DARIEL BURDASS, SGM

the development of asthma. An ecological analysis conducted in 85 centres from 23 different countries showed that those with higher notification rates for TB had lower prevalences for asthma, allergic rhinoconjunctivitis and atopic eczema and it has been suggested that exposure to *Mycobacterium tuberculosis* may reduce the risk of developing asthma.

In 1,659 Italian military cadets aged 17–24 infections transmitted by contaminated food and the orofecal route, such as hepatitis A, were inversely related in a dose-dependent manner to atopy and respiratory allergies. Cadets who lacked antibodies to hepatitis A virus, *T. gondii* and *H. pylori* were 2·7 times more likely to he highly atopic than those with antibodies to two or three of these microbes (20·1 vs 7·8 %). Furthermore the researchers detected asthma in 0·4 % and allergic rhinitis in 7 % of the cadets exposed to at least two of the three microbes, in contrast to 5 and 16 %, respectively, in the group with no exposure to these microbes.

Bacterial endotoxins are found ubiquitously. The levels are particularly high in farms, being 18 times greater than those found in average homes. A recent study from the National Jewish Medical Centre, Denver, has demonstrated that exposure to bacterial endotoxin early in life may protect against the development of allergen sensitization, such as asthma. The researchers found that the homes of children who were most sensitive to allergens had significantly lower concentrations of bacterial endotoxin than those of children who were not sensitized to any allergens. It has been suggested that endotoxin drives the immune system to produce the cytokines that inhibit certain processes in the body which may lead to asthma. More recently, it has been observed that in some populations, polymorphisms that increase the expression of CD14 (receptor for endotoxin) may be associated with lower levels of IgE, and a potential explanation is that increased CD14 signalling enhances Th1-predominant responses and thereby less likelihood of developing IgE-mediated immunity.

Evidence for the Hygiene Hypothesis

Although the Hygiene Hypothesis was initially based on epidemiological evidence, a plausible underlying biological mechanism was suggested only when Tim Mosmann discovered the two polarized arms of the T-helper immune system, and the observation that allergic disorders were associated with overactivity of one arm. Th1- and Th2-helper cells are two polarized arms of the $CD4^+$ T-helper immune cell system which reciprocally inhibit each other. Th1 cells produce IFNγ, IL-2 and TGFβ, which have effects on the production of opsonizing and complement-fixing antibodies by B cells, activation of macrophages, cell cytotoxicity and induction of cell-mediated immunity. On the other hand Th2-helper cells produce cytokines IL-4, -5, -10 and -13, which evoke strong antibody responses, including IgE, and favour eosinophil differentiation and activation. Because cytokines released by Th2 cells mainly regulate IgE production as well as mast cell and eosinophil function, cells that are believed to drive the allergic responses, the Th2 system is believed to drive allergic responses to foreign organisms.

Pregnancy is associated with a strong skewing towards Th2-type immunity and if this does not occur at the correct time in gestation, there is an increased risk of abortion. As a consequence, neonatal immunity is Th2-skewed and allergen-specific T cell responses are already common at birth. The development of a counter-balancing Th1 immune response depends upon encounters with harmless microbes or through fighting microbial infections. According to the Hygiene Hypothesis, lack of microbial infections or contact with microbes causes the Th1 system to develop poorly, and as a consequence the Th2 system flourishes, which then favours the development of allergic diseases.

It has been suggested that the intestinal microflora is the most likely source of microbial pressure to enhance Th1-type responses. Experiments have shown that germ-free pups have a prolonged period of Th2 immune responses and a delayed development of oral tolerance. When the animals are colonized with bacteria of the normal commensal intestinal flora, oral tolerance and immune deviation toward Th1 responses rapidly develop. Also, treatment of mice with bacterial DNA products has been shown to inhibit the development of allergic airway inflammation.

One approach being explored is to expose children to dead bacteria or snippets of bacterial DNA to prompt a predominant Th1 immune response and thereby prevent the onset of allergies. A recent study showed that infants exposed to bacteria found in common yoghurt were half as likely to develop eczema as those who had not been given the bacteria. It has also been demonstrated that

Mycobacterium bovis BCG infection can suppress the development of allergen-induced airway eosinophilia and airway hyper-responsiveness in mice.

Evidence against the Hygiene Hypothesis

Ever since the Hygiene Hypothesis was described in 1989, it has been faced with scepticism and remains an area for hot debate. Although more than 6,000 research reports have been published over the past 3 years examining the links between civilized living and allergies and asthma, not all of them support this link as causal. Some critics say that the disproportionate rise in asthma in most urban environments simply doesn't fit comfortably with the Hygiene Hypothesis. It has been argued that the evidence for a relationship between respiratory tract infections and protection against allergy is circumstantial, inconsistent and inconclusive, and is not supported by comparisons of risk factors and allergy prevalence in different regions.

Studies on the relationship between atopic sensitization and severe respiratory illness in early life have yielded contradictory and inconsistent results. Of particular interest are the findings that the social class bias towards asthma prevalence characteristic of the developed world appears to be reversed among low-income groups in the inner cities of the US, thereby challenging the hypothesis. Some respiratory infections account for around 80 % of acute asthma episodes during infancy and childhood. This association persists for 8–13 years, while histamine hyper-responsiveness is evident for at least 10 years after bronchiolitis. Viral infections are also present in up to 80 % of adults with asthma, whereas experimental rhinovirus inoculation in adults with allergic rhinitis have been shown to alter the response to allergen bronchoprovocation, favouring development of the late-phase allergic response. Virally infected patients with asthma have been shown to have enhanced cytokine responses, apparently leading to prolonged lymphocyte and eosinophil accumulation in the lungs. Similarly, contrary to earlier observations, a recent Finnish study involving 500,000 children has found that those who get measles are 67 % more likely to develop asthma and other allergy-based ailments. This association between measles and atopy was evident at all ages, in both urban and rural dwellers, and among subjects with many or few contacts at home or in day care.

A protective effect of siblings on atopy appears to be evident only in the group with no parental allergy, suggesting that environmental influences on allergic sensitization may be overwhelmed by genetic predisposition to atopy. Although earlier studies showed that pet ownership was protective against the development of allergic disorders, a recent US study found that there was a 45 % increase in asthma rates among children aged 6–17 years who had pets at home. The earlier observation that pets protected against the development of allergies was curiously demonstrated only in boys and not in girls. While some studies looking at measles or hepatitis A virus infections have supported the conclusion that infections protect against atopy, others have shown an association between asthma and allergic diseases and *Mycobacterium tuberculosis* infections only in women and not men, and yet others have failed to show similar associations between atopy and measles or BCG vaccination. Some scientists have even suggested an alternative explanation for the earlier observation that mycobacteria do not lower the risk of atopy, but that atopics have an impaired ability to make a Th1 response to mycobacteria.

Conclusion

Constant microbial stimuli appear to be necessary for the maturation and development of the immune system, at least during the early years. Some scientists have argued that improved sanitation and increased use of antimicrobial agents have driven the immune system to mount an abnormal response to innocuous external environmental agents and have thereby contributed to the increase in prevalence of allergic disorders. In broad terms the Hygiene Hypothesis envisages that the increasing efficiency of public health and hygiene measures in the developed world, when combined with lower family sizes, has reduced contact with respiratory infections in early life – such contact is believed to exert protective 'bystander' effects on developing Th1 responses to environmental allergens, promoting immune deviation towards the Th2-polarized responses that are characteristic of atopics. Although the Hygiene Hypothesis seems to be an attractive explanation for the recent increase in allergic disorders in the West, it is not clear which infections protect and whether there is a crucial period during which they are most effective. Further work is needed relating early infection to later atopic outcomes, but this is a demanding research agenda requiring longitudinal studies with follow up over several years. More rapid progress might be made by examining the epidemiology of a wide range of infections by age at onset, in relation to sibship size and socio-economic status. In spite of its popularity, the Hygiene Hypothesis remains a highly controversial topic, and there is evolving epidemiological and laboratory evidence to argue against it. Other possibilities for the increase in allergic disorders remain. Some have argued that this increase is due to changes in diet, while others have suggested changes in lifestyles or exposure to air pollutants. As is stands today, the Hygiene Hypothesis for the development of allergic disorders remains just that, a hypothesis, still to be proven or disproven.

Dr Sundeep Salvi MD PhD is Clinical Research Fellow and Stephen Holgate MD DSc FRCP is MRC Clinical Professor of Immunopharmacology in the Department of Respiratory Cell and Molecular Biology, University of Southampton, Southampton SO16 6YD, UK. email sundeepsalvi@hotmail.com or sth@soton.ac.uk

Spotting the onset of puberty – the secret's in the skin

Anne Eady and Richard Bojar

Alice returned home from her first day at Grammar School in tears. Mum sat beside her and tried to coax out of the sobbing youngster the cause of her immense distress. After a few minutes, Alice shouted, 'I hate you. No one will make friends with me because I've got spots. Why didn't you take me to the doctors when I asked you to?'

The onset of puberty marks the transition from childhood to adulthood, through increasing self-awareness and a turmoil of emotions in which feelings and actions are driven by the rising concentrations of sex hormones derived initially from the adrenal glands and then from the developing gonads. The first signs of physical maturation may not be those we normally associate with puberty, but rather more subtle changes in the skin, which lead to oiliness and spots (Fig. 1).

Spots are amongst every teenager's worst nightmares. Just when physical attractiveness really starts to matter, fate has decreed that many youngsters will find their skin rebelling with a colourful display of volcanic eruptions (Fig. 2). Spots can be big or small, inflamed or non-inflamed, superficial or deep, and have the ability to reduce self esteem to rock bottom. One of us well remembers how a handful of spots severely dented her own self-confidence and the habit of avoiding mirrors lingers to this day!

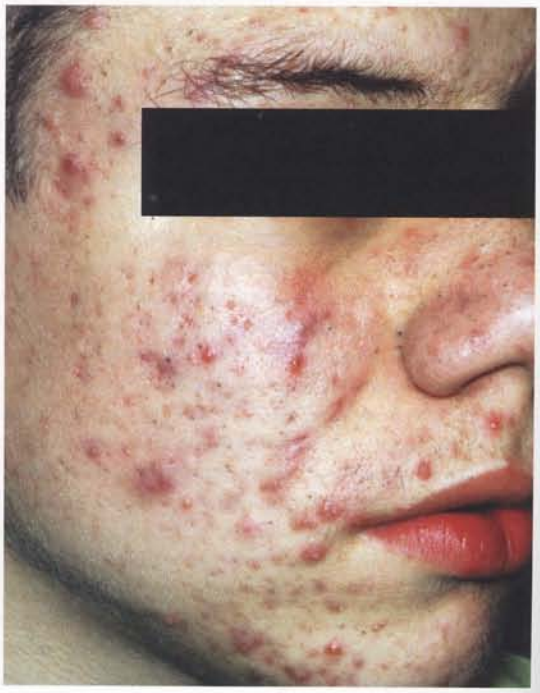
What is acne?

Acne is a multifactorial disease of the sebaceous (grease-producing) glands of the face and upper trunk. Although acne tends to run in families, patterns of inheritance are complex. Under androgenic control, sebum is produced as a holocrine secretion. In humans it has no known function, although there is speculation that it may contain sex steroid-derived pheromones. For reasons that are not well understood, some follicles produce too much sebum. These 'gushers' probably represent acne-prone follicles.

Contrary to popular belief, acne begins not at puberty but before puberty, specifically during the adrenarche when the adrenal glands start producing androgens, including testosterone and dehydroepiandrosterone sulphate (DHEAS) in both sexes. The adrenarche occurs between the ages of 6 and 10. Prior to this, sebum is not produced (except for a brief period immediately after birth). Not all follicles turn on at once. We do not yet know whether those that turn on early are the gushers. A special lipid-absorbent tape, 'Sebutape', applied to the skin can reveal different patterns of sebum production (Fig. 3). If the pattern is homogeneous, the subject is unlikely to be acne-prone.

Patterns become increasingly heterogeneous as acne severity increases – with some follicles producing no or very little sebum. These follicles are functionally blocked by a cornified plug which arises via the hyper-proliferation of the keratinocytes (epidermal cells) lining the duct (infundibulum). This is the second step in the formation of an acne spot. At this stage the lesion is called a comedo. Organ culture studies by Terence Kealey and colleagues at the University of Cambridge indicate that comedogenesis may be triggered by keratinocyte-derived interleukin-1 alpha. Alternatively, high sebum excretion rates have been hypothesized to dilute the essential fatty linoleic acid to deficient levels, which can also initiate hyperkeratosis.

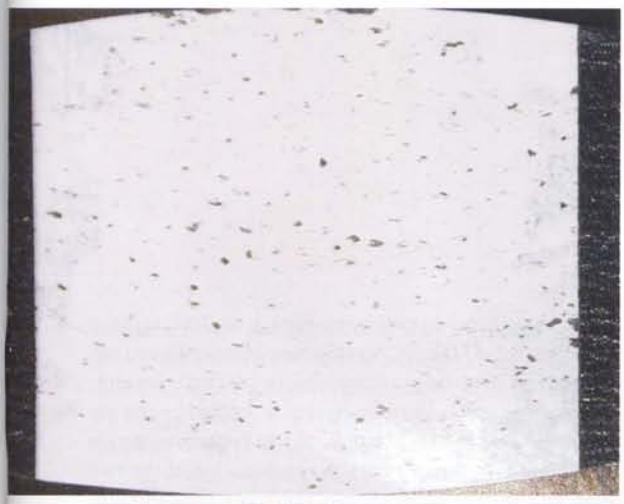
Comedones in which the pore (orifice of the duct) is open and wide are called blackheads (the colour is due to the pigment melanin, not dirt!). Those in which the duct is narrowed and the pore barely visible are called whiteheads (Fig. 4). Tiny whiteheads or microcomedones

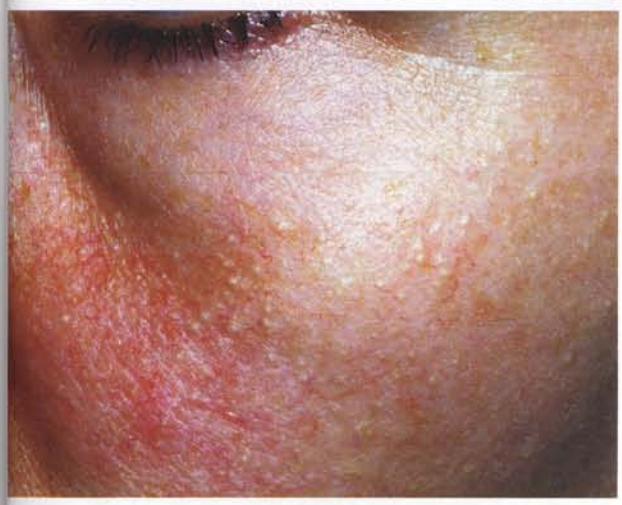


RIGHT:
Fig. 1. Spots can wipe the smile off even a 10-year-old's face. The first signs of acne are often present at this age.

FAR RIGHT:
Fig. 2. Well established acne in an adult male. Note the presence of both inflammatory lesions and blackheads.

PHOTOS COURTESY SKIN RESEARCH CENTRE, LEEDS





TOP LEFT:
Fig. 3. The heterogeneous 'Sebutape' pattern of a 9-year-old girl who already has numerous whiteheads. Each dot represents the sebum output from a single pilosebaceous follicle. Note the presence of 'gushers'. At this stage, propionibacteria are absent.

LOWER LEFT:
Fig. 4. Numerous comedones (whiteheads) on the cheek of a teenager.

BELOW:
Fig. 5. Colonies of all three species of cutaneous propionibacteria (*P. acnes*, *P. granulosum* and *P. avidum*) as obtained from a scrub wash of adult facial skin. The colony colour is due to porphyrins.

PHOTOS COURTESY SKIN RESEARCH CENTRE, LEEDS

are often referred to as acne timebombs. These spots are too small for most people to be aware of, but can rapidly transform into inflamed lesions when the third and final participants in the acne triad, the resident skin microbes *Propionibacterium acnes* and/or *Propionibacterium granulosum* (Fig. 5) trigger a powerful immune response, mediated by CD4+ve T cells. Although the organisms appear to be sebum-dependent *in vivo* (numbers are low where sebaceous glands are sparse), they have no requirement for lipid *in vitro*.

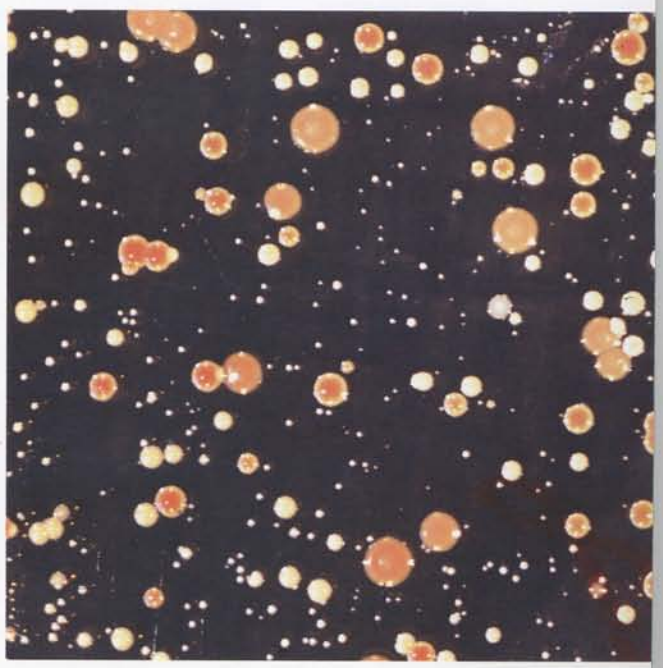
The role of proprionibacteria

What makes harmless skin commensals suddenly turn into bad guys? The truth is that we don't know for sure. In acne-prone individuals, numbers of propionibacteria on the skin surface rise during puberty and reach adult levels by the mid-teens. In non-acne subjects, numbers remain low throughout puberty and rise in the late teens, not reaching adult levels until the age of 20. Sebum output is rising throughout this period. At the follicular level, there is something of a paradox. In mature subjects without acne, most pilosebaceous follicles (Fig. 6) contain viable propionibacteria. In contrast, only a minority of normal follicles in acne patients contain the organisms, although a majority of lesions (both inflamed and non-inflamed) do so.

Cutaneous propionibacteria are slow-growing microaerophiles and may be unable to colonize follicles in which the sebum excretion rate is high. When such follicles become functionally blocked, sebum production (and oxygen tension) is reduced, possibly via a feedback mechanism. This may allow organisms trapped within the follicle to multiply. In normal (unblocked) follicles, end products of bacterial metabolism escape with the outflowing sebum. This is called an open or continuous culture system and is like the intestinal tract in which nutrients enter at one end and bacteria plus their metabolites exit at the other. When a follicle becomes blocked, it behaves as a closed or batch culture system from which bacteria and their end products cannot escape. It is probably the build up of these products to toxic levels that damages the follicle wall and/or initiates the inflammatory response. Bacteria will also die and lyse *in situ*, releasing their intracellular contents and highly antigenic cell wall fragments into the duct.

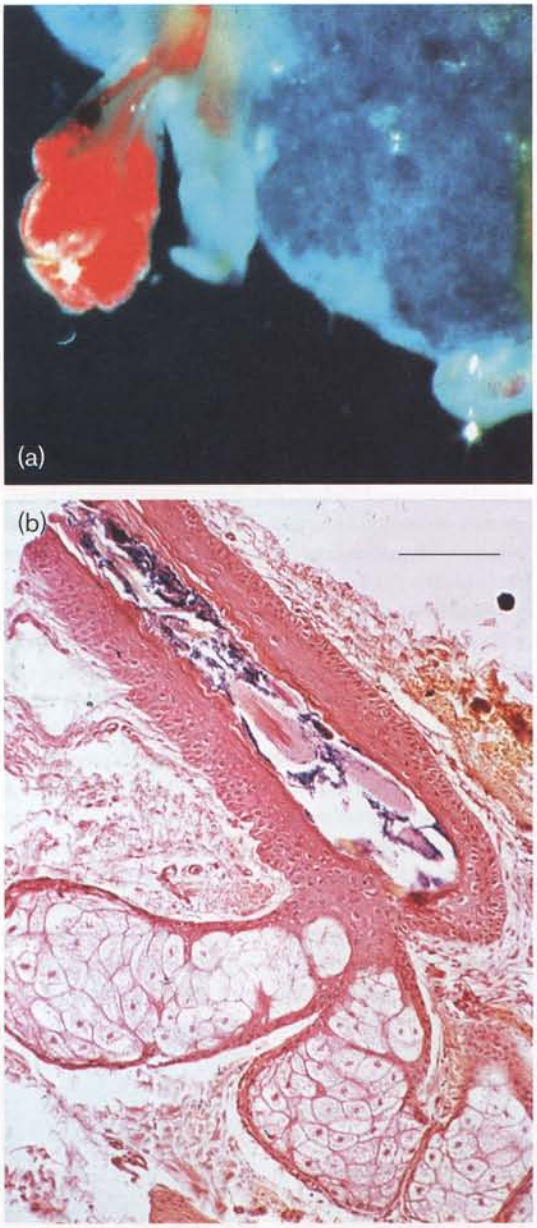
The immune response in acne

The cellular infiltrate around inflamed acne lesions is characteristic of a delayed type hypersensitivity response, presumably to one or more lesional antigens, not necessarily propionibacterial. Damage to the follicle wall will allow non-bacterial antigens to escape into the dermis. The immune response in acne, particularly severe acne (characterized by granulatomous nodular lesions) is similar to that seen in tuberculosis. Like mycobacteria, *P. acnes* and *P. granulosum* exhibit potent adjuvant activity and non-specifically up-regulate macrophage functions, including recruitment of Th1 cells which recognize not only propionibacterial, but also co-antigen-specific proteins displayed on the surface of the macrophages themselves or on Langerhans (antigen-presenting) cells. Such co-antigens may be keratinocyte-derived. Adjuvant activity is strain-variable and correlates with the ability to persist within macrophages. *P. acnes* has been implicated in a number of other chronic inflammatory diseases, including sarcoidosis, periodontitis, the SAPHO syndrome (characterized by sterno-clavicular osteoarthritis and isolation of the organism from bone biopsies) and, most recently, sciatica.



Prediction and prevention

Research over the last 30 years has done much to increase our understanding of what causes spots and we have now reached a point where predicting and preventing



LEFT:
Fig. 6. Single pilosebaceous follicles. (a) Fresh biopsy specimen stained with Oil Red O to visualize lipid and (b) lateral section to show the multilobular sebaceous gland and the pilosebaceous duct (bar, 100 μm).
PHOTOS COURTESY SKIN RESEARCH CENTRE, LEEDS

acne (or at least reducing its severity) are no longer unrealistic possibilities.

As already noted, acne spots, particularly whiteheads, start to appear during the adrenarche and prior to puberty. The earlier the appearance of such lesions, the worse the acne is likely to be. Here in Leeds, 'Sebutapes' are being used to assess sebum production at 6-monthly intervals in a cohort of primary schoolchildren. A simple biopsy method using cyanoacrylate glue on a glass slide is being used in parallel to detect and enumerate follicular casts. Casts are the plugs which block some follicles. Colonization by, and population densities of, cutaneous propionibacteria are being monitored using a surface scrub wash method followed by viable counting on selective medium. The presence and number of inflamed and non-inflamed lesions on the face and trunk is recorded at each visit. Developmental stage is determined by the estimation of DHEAS in saliva and by recording physical signs (Tanner stage). The aim is to follow each child through puberty to see whether any of the tests will accurately detect acne proneness. If we identify a reliable predictive test, then we may be able to offer at risk children early intervention to either prevent the spots forming or reduce the severity of disease.

We can do this in two ways. First, a topical retinoid (a derivative of vitamin A available on prescription) can be used to prevent pores becoming blocked. Second, propionibacterial colonization can be delayed by the use of a topical antibacterial agent such as benzoyl peroxide (available over the counter). A combination of the two may be the best strategy, but there is a fundamental problem. Both types of product have low cosmetic acceptability and getting children without spots to use such products regularly for several years is a tall order for any parent. Their use would have to become a ritual just like brushing teeth morning and evening. What about those children who will get acne on their trunk? It is very difficult to apply topical products to these areas and preventative strategies based on existing topical products are unlikely to be successful.

For the vast majority of children prevention is not yet a realistic option and the spots will appear anyway. Acne should always be treated early and aggressively to minimize the risk of physical and emotional scarring. A wide range of safe and effective therapies is available on prescription. Boys are more reluctant to seek medical help than girls, despite the fact that they tend to suffer from more severe disease. Young Alice was right – any child with inflamed spots or lots of whiteheads should be taken to see their family doctor at the earliest opportunity.

Is acne all bad news?

Many experts have theorized as to why humans get acne. If the biological role of acne is to modulate physical attractiveness, with the more spotty males and females less likely to find a mate, then one might assume some kind of genetic linkage between spottiness and at least one other deleterious trait.

Some light may come from an unexpected source. In 1991/2, over 14,000 mothers-to-be were enrolled to the Avon Longitudinal Study of Parents and Children (http://www.ich.bris.ac.uk/ALSPAC). Every detail of these pregnancies was meticulously documented by Professor Jean Golding and her team at the University of Bristol. Live births have been followed up annually with detailed questionnaires and regular physical examinations. The children are now approaching puberty and will provide an invaluable resource for examining the effects of nature versus nurture on acne proneness and to uncover any linkages between acne and other heritable traits. There is already evidence that multiple genetic loci are involved in modulating sebum excretion.

The natural assumption is that spots are bad news, but what if there were advantages to having acne? Because propionibacteria are potent adjuvants, their presence on human skin may constitute a first line immune defence system against microbial infection and cancer. Acne, by enhancing systemic exposure to immunostimulatory

Further reading

Eady, E. A. & Cove, J. H. (2000). Is acne an infection of blocked pilosebaceous follicles? *Am J Clin Dermatol* 1, 201–209.

Ingham, E. (1999). The immunology of *Propionibacterium acnes* and acne. *Curr Opin Infect Dis* 12, 191–197.

Lucky, A. W., Biro, F. M., Huster, G. A., Leach, A. D., Morrison, J. A. & Ratterman, J. (1994). Acne vulgaris in premenarchal girls. An early sign of puberty associated with rising levels of dehydroepiandrosterone. *Arch Dermatol* 130, 308–314.

Pierard, G. & Pierard-Franchimont, C. (1992). The Sebutape technique for monitoring androgen dependent disorders. *Eur J Med* 1, 109–112.

Vlajinac, H. D., Adanja, B. J., Lazar, Z. F., Bogavac, A. N., Bjekic, M. D., Marinovic, J. M. & Kovec, N. I. (2000). Risk factors for basal cell carcinoma. *Acta Oncol* 39, 611–616.

components of the organisms, may upregulate their protective effect and extend it beyond the skin. Studies in animal models have revealed that *P. acnes* promotes a Th1-type response to tumours, viruses, parasites and facultative intracellular bacterial infections. There is already evidence that two skin tumours, basal cell carcinoma and malignant melanoma, are less common amongst past acne sufferers than age- and sex-matched non-acne subjects. The organisms have been successfully used to treat certain advanced cancers, especially of the bladder. Acne may simply be the price we pay for the optimum performance of a natural defence mechanism. If acne is slowly but surely eliminated, we may begin to pay a much higher price as the incidence of certain cancers starts to rise. One day we may all be popping pills of *P. acnes* in a bid to stay healthy.

Help for acne sufferers

Concerned teenagers or parents may wish to know how to contact the Acne Support Group. Their address is PO Box 230, Hayes, Middlesex UB4 0UT (Tel/Fax: 0181 561 6868).

● *Dr E. Anne Eady is Principal Research Fellow and Dr Richard A. Bojar is Senior Research Fellow at The Skin Research Centre, Division of Microbiology, School of Biochemistry and Molecular Biology, University of Leeds, Leeds LS2 9JT, UK.*
Tel. 0113 233 5581 (Dr Eady) or 5615 (Dr Bojar)
Fax 0113 233 5638
email miceae@leeds.ac.uk or micrab@leeds.ac.uk
website http://www.leeds.ac.uk/src

Letter from the President – 'Local Representatives' for SGM

Dear Member

Since becoming President of the SGM a year ago I have been increasingly impressed by the range of services that the Society provides to microbiologists and microbiology, especially in the UK, but also internationally. During my term of office I aim to help increase the Society's impact even further, building, of course, on the efforts of my predecessor, Howard Dalton, and the huge energies and experience of the Officers, Council and Staff.

There have been a number of recent initiatives.

- The Society has started several new **grant and fellowship schemes** for members, especially, but not exclusively, younger microbiologists at an early stage in their careers.
- We have increased the number of **Groups** in the Society to cover different areas of microbiology, adding Clinical Microbiology, Food and Beverages, and Eukaryotic Microbes to the set of ten already in existence. This means that our two **meetings** each year are becoming increasingly busy and exciting.
- We are fostering **education** in microbiology, right through from primary school to university level, by producing teaching materials, providing a category of schools membership, and in many other ways.
- We are now better equipped to make representations on microbiological matters to government, the public, and indeed anyone who will listen, with a full-time staff member dealing with **public affairs**.
- We will soon be publishing four **journals** covering a very wide range of microbiological fields. Our taking over of the *International Journal of Systematic Bacteriology* (formerly the published by the American Society for Microbiology and now the *International Journal of Systematic and Evolutionary Microbiology*), is to be followed by the *Journal of Medical Microbiology*, a gift from the Pathological Society.
- And of course we also publish *Microbiology Today*, the award-winning quarterly **magazine** of the Society.

One way in which we can pursue the SGM aim of becoming even more visible and relevant is to identify a Local Representative in every university or college department, or research institute, hospital or company, which teaches or uses microbiology. Such a person could act as a two-way conduit between the Council, Officers and Staff on the one hand and every member or, more importantly, potential member on the other. I do not envisage a rigid and precisely defined role for the Local Representatives. It will be a chance to be imaginative and pro-active, according to local circumstances. However, one important function will be to make sure that as many as possible of the eligible microbiologists in each institution are aware of the advantages of membership of the SGM, realize what good value for money membership can provide, and join the Society.

This is why I am writing to you now. Even if you do not wish to volunteer personally, I hope you will be able to think about who in your organization might be really suited to the task, and to persuade them to get in touch with Janet Hurst, our Deputy Executive Secretary at Marlborough House (Tel. 0118 988 1809; email j.hurst@sgm.ac.uk), who will co-ordinate the activities of the Local Representatives.

Further information about the Society, listing its many activities and benefits of membership, is on our website at **www.sgm.ac.uk**

Thank you for reading this letter. We look forward very much to hearing from your institution.

Collegiate regards

● ***David Hopwood***

Please note that this letter has also been sent individually to possible representatives in a number of institutions but we are seeking volunteers to make the coverage as complete as possible.

Herpesviruses: from the cradle to the grave

Paul D. Griffiths

Herpesviruses are prime contenders for inclusion in the microbiological ages of man since they infect humans at all life stages.

How many herpesviruses are there?

We now have eight human members of the herpesvirus family, grouped into three subfamilies (Table 1), which tend to share biological characteristics. The more recently described viruses are numbered systematically, while the older ones retain their colloquial names.

How do we know that they are herpesviruses?

The characteristics which define members of the herpesvirus family are listed in Table 2. An important common feature is that they can all establish latency so that they are not eradicated from the host following initial infection. Hence, the aphorism, '*What is the difference between love and herpes? Answer: herpes is forever!*' Periodic reactivations from the latent state allow these viruses to transmit to other individuals, e.g. VZV is infectious both when it causes chickenpox and when it reactivates decades later to cause zoster (shingles).

At what age do we acquire them?

Table 3 relates appearance of herpesviruses according to the 'Seven Ages of Man' (with apologies to W. Shakespeare). Some can infect a fetus *in utero* and many transmit to neonates/toddlers. Individuals not infected during childhood become exposed as adolescents and/or adults through salivary and/or sexual contact. Indeed, changing sexual practices mean that most first episodes of genital herpes are now caused by HSV 1 (Clinton–Lewinsky syndrome).

Most adults are infected with several herpesviruses (Fig. 1). Remarkably, most of these infections do not cause symptoms. They are either entirely asymptomatic or produce only mild, self-limiting discomfort which is not brought to medical attention. The only exception to this rule is VZV, which regularly produces symptoms in the form of the familiar chickenpox in the majority of children who acquire it (see Fig. 2).

How do herpesviruses make us sick?

Herpesviruses are normally kept in check by the immune system and so they have evolved a series of mechanisms to evade such responses. The net result is a balance between the virus and its host immune system leading to transmission of virus without (usually) producing disease. When diseases do develop, they are caused by a variety of mechanisms (Table 4).

In those with normal immunity

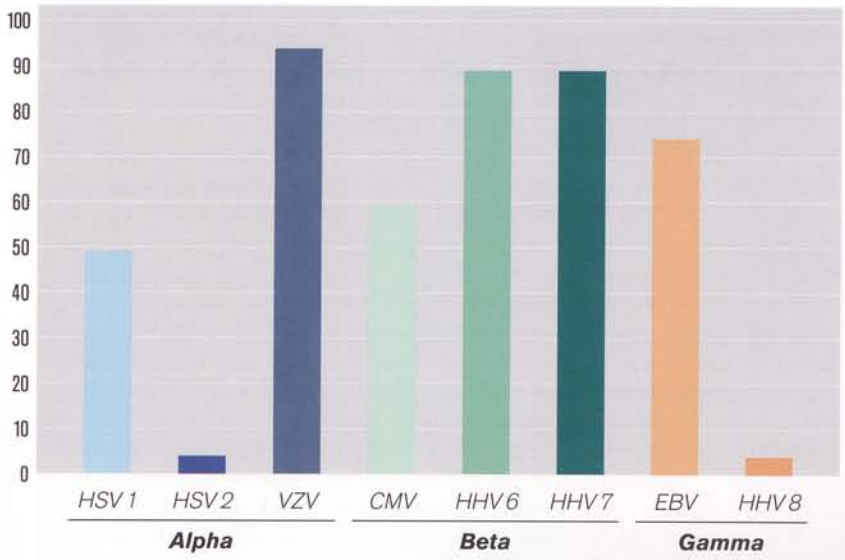
Herpesviruses are very important medically because they are common and produce disease in a substantial minority of cases. Some individuals develop overt disease, such as glandular fever following EBV, probably because they acquire large amounts of virus through the salivary–salivary route (kissing). Some unlucky people develop HSV encephalitis for reasons which are not understood. In the case of genital herpes, many reactivations are clinically silent, but others cause local ulceration which is painful and affects psychosexual well-being. The ulcers (even those which do not produce symptoms) reduce an important barrier of

Table 1. The human herpesviruses

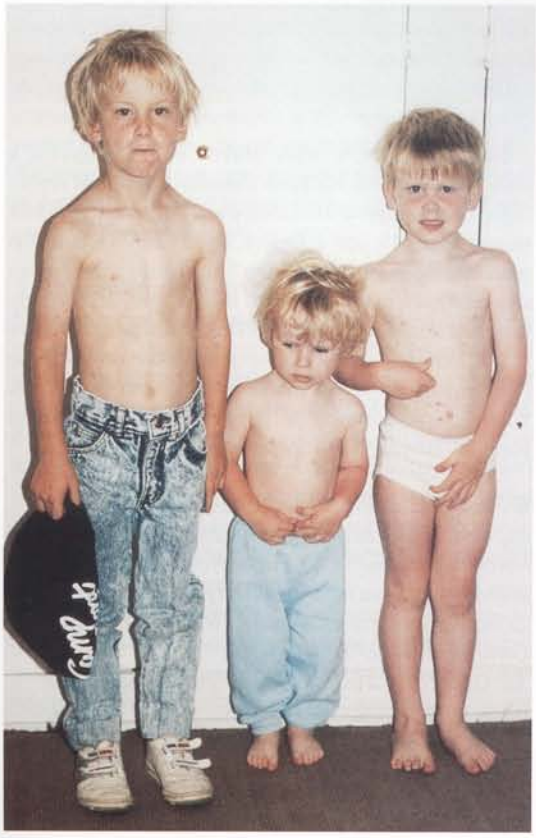
Subfamilies	Common names	Systematic nomenclature	Major diseases
Alphaherpesviruses			
	Herpes simplex virus type 1 (HSV 1)	HHV 1	Cold sores, encephalitis
	Herpes simplex virus type 2 (HSV 2)	HHV 2	Genital infection, *erythema multiforme*
	Varicella zoster virus (VZV)	HHV 3	Chickenpox, zoster
Betaherpesviruses			
	Human cytomegalovirus (CMV)	HHV 5	Hearing loss, retinitis
	Human herpesvirus type 6 (HHV 6)	HHV 6	*Exanthem subitum*, febrile fits
	Human herpesvirus type 7 (HHV 7)	HHV 7	*Exanthem subitum*
Gammaherpesviruses			
	Epstein–Barr virus (EBV)	HHV 4	Glandular fever, Burkitt's lymphoma
	Human herpesvirus type 8 (HHV 8)	HHV 8	Kaposi's sarcoma

Table 2. Characteristics of herpesviruses

- Look similar by electron microscopy
- Initial infection usually gives no symptoms
- Establish latency, persist for life of individual
- Reactivate from latency, so transmitting to others
- Most of these reactivations also give no symptoms
- Re-infections with other strains also occur
- Each herpesvirus causes more than one disease
- Interfere with immune responses
- Important component of multi-factorial complex diseases



LEFT (TOP):
Fig. 1. Proportion of adults in the UK infected with each of the eight herpesviruses. Data are from multiple papers providing estimates of the proportion of adults aged 30–40 years who have IgG antibodies specific for each virus.



LEFT (BOTTOM):
Fig. 2. Chickenpox in the author's children. Number two son (aged 4) acquired chickenpox from school. Fourteen days later, number one son (age 6) acquired it from his brother, prompting this photograph which uses number three son (age 2) as an uninfected control. (He developed chickenpox 14 days after the photograph was taken.) All recovered without treatment or complications.
PHOTO PAUL GRIFFITHS

protection against acquiring HIV infection. CMV and HHV 6 also play a role by activating HIV replication, so increasing the risk of HIV trans-mission to sexual partners.

It is now known that herpesviruses also play a role in complex medical conditions which were not previously thought to have an infectious component. Thus, HSV is the cause of Bell's palsy (paralysis of the nerve on one side of the face) and is also the cause of *erythema multiforme*, a recurrent, painful, nodular rash caused by an immune response to reactivations of HSV.

In those who are immunocompromised

If the immune system is immature (fetus), or is compromised by immuno-suppressive drugs required to prevent graft rejection (transplant) or by HIV infection (AIDS), the delicate balance between virus and host is lost. Uncontrolled herpesvirus replication leads to local disease and/or widespread dissemination of virus, with life-threatening consequences. HSV and VZV cause extensive skin vesiculation; HSV, VZV and CMV cause pneumonitis, hepatitis or encephalitis; CMV frequently causes gut ulceration or retinitis. Furthermore, CMV triggers the immune system of transplant patients to cause rejection of the transplanted organ. Meanwhile, the oncogenic potential of the gammaherpesviruses is increased where EBV induces B-cell lymphomas and HHV 8 induces Kaposi's sarcoma or multi-centric Castleman's disease. In the fetus, the main pathogen is CMV, which causes mental retardation and/or hearing loss.

What can be done about herpesvirus diseases?

Treatment

Fortunately, antiviral agents able to control the worst ravages of herpesviruses have been developed over the last 20 years.

The symptoms of initial genital herpes resolve more rapidly and are less severe when patients are given acyclovir, valaciclovir or famciclovir. Patients with frequently recurring genital herpes have dramatic benefit from long-term prophylaxis, usually with acyclovir or valaciclovir. The chronic pain which follows shingles is also reduced significantly if treatment is begun in the acute phase.

The effects of HSV in transplant patients are routinely prevented by acyclovir prophylaxis given from the time of transplant onwards. Extension of prophylaxis to 6 months also protects against zoster. High-dose acyclovir reduces CMV disease in bone marrow transplant patients. Valaciclovir is potent enough to prevent CMV disease in renal transplant patients and also significantly reduces the graft

Table 3. Infection with herpesviruses during the 'seven ages of man'

Age	Source of virus	HSV	VZV	CMV	HHV 6	HHV 7	EBV	HHV 8
Fetus	Mother		+	+	+			
Newborn baby	Mother/family	+	+	+				
Toddler	Other toddlers	+	+	+	+	+		
Child	Other children	+	+	+			+	+
Adolescent	Kissing	+		+			+	+
Adult	Sex	+		+			+	+
Elderly	Self		+					

Table 4. How herpes viruses make us sick

Mechanism	HSV	VZV	CMV	HHV 6	EBV	HHV 8
Destroy cells	+	+	+			
Cause the immune system to over-react			+		+	
Act as component of complex disease	+		+			
Interact with HIV	+		+	+		+
Cause cancer					+	+

rejection caused by this virus. Ganciclovir prophylaxis reduces CMV disease in liver, cardiac and bone marrow transplant patients, but its marrow toxicity limits its overall benefit in the latter group. A recent report shows that the hearing loss caused by CMV can be reduced significantly if babies with symptoms at birth are treated with ganciclovir.

Even after 20 years of use, HSV resistance to acyclovir has not become a clinical problem in the general population because the viruses which escape from control of this drug are profoundly debilitated. Nevertheless, these 'puny' viruses can still cause diseases in patients with damaged immune systems. Thus, resistance is a small but significant management problem in transplant and AIDS patients, and the number of treatment options is severely limited.

Although these are examples of success, we need to do more. Drugs with better safety profiles, improved potency and the ability to treat resistant strains are required, particularly for CMV, and we need treatments able to control EBV.

Vaccines

A live, attenuated vaccine is being used in the USA to prevent chickenpox. Trial results show that a recombinant HSV vaccine can reduce (but not abolish) acquisition of genital herpes in women, although it has no effect in men. This result is disappointing because as much as one-third of HIV transmission in Africa might be reduced if the ulceration caused by genital herpes could be eliminated.

No other vaccine with proven efficacy against a human herpesvirus has been identified. A recent report from the Institute of Medicine shows that such vaccines should be highly cost-effective, and a CMV vaccine was put in its top priority category. This should stimulate an area held back more by neglect than by overwhelmingly complex scientific problems. Thus, once people realize the full clinical impact of herpesviruses, they will be more willing to invest in the development of vaccines with the eradication of herpesviruses from the human population being the ultimate target.

● *Paul D. Griffiths researches quantitative aspects of the natural history and pathogenesis of herpesvirus infections. He is Professor of Virology at the Royal Free and University College Medical School, Royal Free Campus, Rowland Hill Street, London NW3 2PF, UK.*
Tel. 020 7830 2997; Fax 020 7830 2854
email p.griffiths@rfc.ucl.ac.uk

Further reading

Griffiths, P. D. (2000). Herpesviruses as unrecognized components of the pathogenesis of chronic diseases. *Rev Med Virol* 10, 281–283.

McGeoch, D. J., Dolan, A., Ralph, A. C. (2000). Toward a comprehensive phylogeny for mammalian and avian herpesviruses. *J Virol* 74, 10401–10406.

Roizman, R. (1996). Herpesviridae. In *Fields Virology*, pp. 2221–2230. Edited by B. N. Fields, D. M. Knipe, P. M. Howley & others. Philadelphia: Lippincott-Raven.

Stratton, K. R., Durch, J. S., Lawrence, R. S. (2001). Vaccines for the 21st Century: a tool for decision-making setting priorities. *National Academy Press* p. 476.

Cosmetic microbiology

Brian Perry

Activities like having a shower, washing our hair or applying deodorant involve the regular use of cosmetics and toiletries. Brian Perry reveals the incessant battle against microbes that has to be waged by manufacturers to make these products safe.

Cosmetics and toiletries are in daily use to cleanse, perfume, beautify or decorate the human body. They are mainly applied to the skin or hair, but some, such as toothpastes and mouthwashes, are also used internally. Cosmetics are not intended to permanently alter the physiology of the target organ, although some 'healthcare' products may contain an active substance or make medicinal claims. These include cosmetics that help with conditions such as dandruff, spots and poor gum health. The microbiology of cosmetics is therefore complex due to the wide range of formulations, manufacturing procedures and conditions of consumer use.

Good Manufacturing Practice (GMP) should ensure that products, whilst not necessarily sterile, contain no harmful organisms and that the benign population is of a low and stable order and/or declines over the product lifetime. However, it is still necessary to add chemical preservatives to cosmetics to suppress the proliferation of the micro-organisms which almost inevitably get into them after manufacture. Since micro-organisms are ever-present in the home, especially in warm, moist areas such as bathrooms and kitchens, cosmetics and toiletries are exposed to contamination with both spoilage and potentially hazardous micro-organisms during their use. Although we live in equilibrium with a wide range of microbes, confirmed reports do exist of contaminated cosmetic products causing infections.

Contamination in use

From the moment the product is opened until the consumer discards it, it is subject to constant and variable microbial contamination from the domestic environment and the consumers' hands and body fluids. For example, micro-organisms are readily introduced when fingers are dipped into products. Spillage of water into shampoos or shower preparations and consumers using saliva to remoisten old mascara or 'swigging' from bottles of mouthwashes are unfortunately common sources of potential contamination.

A family-size shampoo can be over 80% water and may be used by several different people over a prolonged period. In a warm, moist environment such as a shower where it is easily contaminated, micro-organisms are very likely to enter the product.

A sun-tan lotion shared by the same family over a two-week holiday is contaminated daily through multiple use and most probably is left for several hours at optimal growth temperatures in the sun, sand and sea. Unfinished at the end of the holiday, it is re-used the following year and the exercise repeated.

Mascara usage represents the ultimate challenge to a cosmetic. Consumers are not likely to store their shampoo in a car glove box, subjected to extreme temperature changes, but this does happen with mascara. Consumers have also been known to apply mascara whilst driving, poking themselves in the eye with the brush in the process and allowing the introduction of microbes. Even more likely is a mascara being stored in a humid bathroom environment where brushes are dropped on the floor and containers are left open to contamination by harmful micro-organisms.

Spoilage

Micro-organisms in the home are adapted to a wide range of environments and can degrade a host of product ingredients. Whilst mouldiness, colour change, frothing, and packaging that bulges, leaks or explodes as a result of gas production are obvious effects of gross contamination, more subtle changes can occur. Shampoos, which necessarily contain surfactants, are particularly susceptible to contamination by water-borne Gram-negative bacteria which may cause, at the very minimum, a visible loss of lathering activity. Active ingredients may also be rendered ineffective.

Other contamination effects may be unpleasant aromas or tastes (yeasts, actinomycetes) and change of tactile effects. Aesthetically unpleasant viscosity changes can occur in cream formulations which may also diminish the performance of the product.

Manufacture

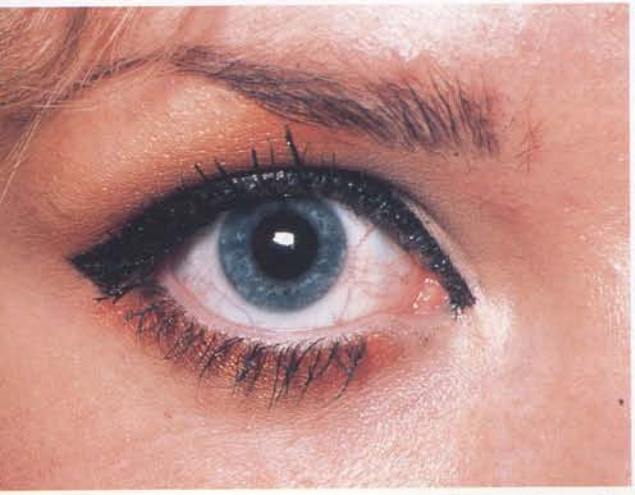
There is widespread exposure to potential contaminants during manufacture, particularly from the raw materials. Water is the most common ingredient and poses obvious problems, but a seemingly innocuous material such as talc can be contaminated with dangerous pathogens. The principles of GMP must always be followed and raw materials, particularly those of natural origin, must be tested for contamination before use and limits of acceptability established. Areas where contamination may be introduced must be identified and controlled. The manufacturing facility offers a unique challenge as no two units are likely to be the same. Adequate Quality Assurance (QA) procedures must be in place to ensure unacceptable levels of contamination are never reached. Effective cleaning and sanitization programmes need to be validated and in place. Finally, people offer an unpredictable challenge. Adequate training must be undertaken and updated as appropriate.

Due to GMP, contamination during actual production is of such a low order that modern cosmetics manufacturing plants can achieve 'absence of micro-organisms'

ABOVE:
A young woman applies her make-up in a bathroom mirror.
PHOTO MARTIN RIEDL/ SCIENCE PHOTO LIBRARY

RIGHT:
A technician at the Christian Dior plant in St Jean de Braye, France, checks the quality of a sample of red lipstick during its manufacture.
PHOTO PASCAL NIETO, JERRICAN/ SCIENCE PHOTO. LIBRARY

BELOW:
The 'made-up' eye of a young woman.
PHOTO ADAM HART-DAVIS/ SCIENCE PHOTO LIBRARY



in almost 100 % of units produced. Manufacturers also aim wherever possible to develop formulations which are incapable of microbial growth.

Once the product is made and packaged the preservative system must be able to withstand the normal microbial challenge. This includes storage and use. Packaging should be designed to minimize the chances of contamination.

Specific organisms in cosmetic products

Organisms commonly isolated from poorly preserved water-based products include *Klebsiella*, *Enterobacter*, *Staphylococcus* and *Bacillus* species, *Pseudomonas*, including *P. aeruginosa*, *Burkholderia cepacia*, *Penicillium* and *Candida albicans*. Gram-negatives are most common and, as they have very diverse metabolic capabilities, can survive in a wide range of environments. They are often introduced through water supplies.

A Japanese study of professional shampoo products in hairdressers found that over 60 % of samples were contaminated with Gram-negatives, including *P. aeruginosa*. This may reflect multiple use, poorly preserved products or the consequences of dilution after purchase. In Denmark 22 % of samples of suncare products in use on a beach contained *Candida* species.

Clinical consequences of contamination

Potential pathogens have been found in cosmetics and toiletries. The more vulnerable members of society – neonates, the elderly, people with debilitating diseases or those undergoing drug therapy – are especially at risk. Contamination of talc with *Clostridium tetani*, infection of neonates with *P. aeruginosa* from contaminated cleansing solution and scalp infection leading to fatality in a granulocytopenic patient from diluted stored shampoo in a hospital beauty salon with *P. aeruginosa* are but three examples. A contaminated hand cream was shown to be the source of septicaemia in an Intensive Therapy Unit.

The eye is particularly vulnerable to infection, especially if it is already damaged or has been injured by the consumer with the cosmetic applicator. Cases of *Pseudomonas*-induced corneal ulceration associated with mascara wand trauma and mascara contamination after multiple use of product have been reported. New mascara is rarely contaminated.

The incidence of such reports has declined in recent years as manufacturing processes have improved and there is better understanding of preservation. Nevertheless, there is still a need for vigilance and good practice.

Principles of product preservation

Product preservation has two functions: one is to inhibit spoilage organisms and the other is to prevent the growth of potential pathogens. None of us would appreciate a cosmetic product with a foul odour, traces of mould or ingredients which had separated/degraded due to microbiological contamination. More importantly, any product which posed a potential health risk would rightly be unacceptable to the public.

Whilst preservatives are selected because they are toxic to micro-organisms, they are also required to be safe for human exposure to the products into which they are incorporated. Whatever the method or ingredient employed, the manufacturer seeks preservation at the lowest level consistent with the inhibition of microbial contamination. This has to maintain product integrity whilst ensuring safety in use for the consumer, repeatedly and for the life of the product.

The preservative efficacy of a formulation cannot be predicted and has to be established by empirical microbial challenge, since the activity of the preservative is dependent on the effect of individual ingredients and the packaging in which it is stored.

Considerable scientific/technical effort and money is invested in reducing the risk of microbial contamination of cosmetics. The manufacturer has the ultimate responsibility for assessing the risk of using an ingredient compared with the potential benefits to be obtained. It is now generally recognized that the incorporation of a preservative system within a product is necessary and should be a primary consideration rather than an afterthought. Ingredients are increasingly selected in conjunction with perceived consumer desires as well as those of the manufacturer and the legislator.

The advent of 'green' and 'natural' products has led to apparent consumer pressure for preservative-free products. Such cosmetics contain multi-functional additives which are not included primarily for their anti-microbial activity and which may only impart partial microbial stability. 'Preservative-free' may result in a reduced ability to prevent contamination with micro-organisms over the anticipated lifetime of a product.

There are currently no internationally agreed standards for microbial preservation of cosmetics owing to the range of organisms, multiplicity of products and diversity of storage conditions.

Microbial limits

Industry has made good progress in producing cosmetics according to guidelines which assure a high safety standard. In attempting to set suitable microbial limits

Further reading

Cosmetics Toiletry & Perfumery Association Ltd (1996). *Microbial Quality Management: CTPA Limits and Guidelines*.

Gray, J.E. & McNamee, P.M. (2000). Preservatives – their role in cosmetic products. *Scientific Review Series*, Munksgaard, Copenhagen.

or standards we are faced with the problem that because of the multiple factors involved it is difficult to define precisely which levels and types of contamination represent a health hazard and which are safe. The Cosmetics, Toiletry & Perfumery Association UK recommends a total viable count of aerobic bacteria, yeast and moulds of less than 100 c.f.u. per gram for eye and baby products, and 1,000 c.f.u. per gram for other products at completion of manufacture. Harmful micro-organisms should not be detectable using standard plate count (SPC) techniques and *P. aeruginosa*, *Staphylococcus aureus* and *C. albicans* are used as indicator organisms.

In setting stricter standards, low levels of micro-organisms below the limit of detection of the SPC can be determined by enrichment testing. If this approach is pursued then the recovery diluent, selective media and the incubation conditions should be selected to promote the growth of the chosen indicator micro-organisms.

● *Dr B.F. Perry, Procter & Gamble Technical Centres Ltd. Tel. 01784 474170 Fax 01784 474428 email perry.bf.2@pg.com*

Microbiology – failing by degrees?

Janet Hurst

A recent article in the *Independent* analysed the popularity of the different science first degree courses with this year's applicants for university places. The bad news is that applications for microbiology were down by 16·5%, whereas molecular biology applications rose by a staggering 26%. These data from the Universities and Colleges Admissions Service (UCAS) came as no surprise to staff in the SGM External Relations Office. All summer we have been receiving phone calls from academics bewailing the lack of interest in their courses, usually followed by a demand to know 'what the SGM is doing about it'.

In fact the SGM is doing all it can to raise the profile and public understanding of microbiology through an extensive and constantly evolving programme of activities. You can read about them every quarter in *Microbiology Today*. The inference from members is that these measures are failing to promote microbiology to school students, but is it true? Surely a range of factors influence university admissions? Here are some of our thoughts on this very controversial issue.

Microbiology is a mandatory subject in the UK National Curriculum at Key Stages 2, 3 and 4. There are several options to study it in depth at post-16. SGM produces a range of resources to support microbiology teaching in schools (see p. 202). Council has allocated considerable funding to projects such as a research assistant to develop exciting practicals and the publication of a pack for primary schools. Our training courses for teachers and technicians in basic techniques, which start this term, are all virtually 'sold out'. The new category of Schools Membership is already proving popular. SGM staff know what's in the curriculum and post-16 specifications, but do you? Do your undergraduate courses match students' knowledge? To check, look at the SGM website where we have posted a summary of the microbiology content of all the GCSE and A2/AS/AVE courses (**www.sgm.ac.uk/pa/edu_car/ed_car.htm**).

But on the topic of first degree course content, is yours designed to be interesting and relevant to modern life? How do you market your course? A hard sell is required today when you are competing with subjects perceived to be more 'sexy', such as forensic science, physiotherapy or sports science. Do you go out to careers fairs and and talk to young people? Your help would be very welcome on the SGM stand at events around the country in 2002. Have you revised your prospectus entry lately? Have you compared the material on your website with that of other courses and institutions? Maybe it's time for a makeover!

The SGM produces free careers information – leaflets and posters – which are available in bulk. We send copies out to schools and individuals all over the country, but admissions tutors are welcome to a supply. Going out to schools is very important, not just to sell your courses directly, but to raise the awareness of microbiology. You can join the Science Ambassadors (see p. 201) or follow the example of members like Joy Perkins or Reg England who hold hands-on microbiology events in their labs for local kids. Any activity which makes microbiology seem relevant and exciting is well received. We can give advice and you can look at Liz Sockett's 'Going Public' factsheets at **www.sgm.ac.uk/pa/edu_car/g_p.htm**

The image of subjects is all important to school students. Molecular biology and genetics appeal because of high profile success stories like the Human Genome Project. These areas are seen as a power for good whereas currently microbiology projects failure – foot-and-mouth disease has wreaked havoc in the UK and no-one seems to be able to control it; doom and gloom stories like BSE/vCJD, TB and food poisoning are always in the headlines. We have to accept this.

Named microbiology courses don't seem to be attracting students, but many school-leavers are hedging their bets and going for a general bioscience degree. Does this matter? In practice they will study some microbiology and could well end up specializing in the subject. How many SGM members actually started out their careers on a named microbiology course? I know I didn't.

Students also follow fashions which are then taken up by the universities – has your institution started a forensic science course this year? There's nothing like a bit of competition from your own department! The extra places on expanded and new medical courses are probably also taking potential microbiologists from the available pool of aspiring bioscientists.

Where do we go from here? SGM will continue to put energy and funding into initiatives for schools. These will take time to work through the system, but hopefully they will make a difference. We are reviewing our careers promotion policy but we can only speculate how bad the recruitment figures would be without our past efforts. You must go out there and evangelize. Look at your course content in relation to the specifications, re-write your prospectuses and web pages. Improve your 'sales technique' by going to the Education Group symposium on careers for microbiologists next April to update your knowledge. A strong partnership between the SGM and its members offers the best way forward.

We also have to recognize that the world changes. Maybe there is no future for named microbiology degree courses – so be flexible, work round it and popularize microbiology by other means, for there's one certainty. In a world threatened by infectious diseases, pollution and even, currently, biological warfare, the need for trained microbiologists has never been greater.

What do you think? Please send your opinions to *Microbiology Today* (mtoday@sgm.ac.uk).

● *Janet Hurst, External Relations Manager*

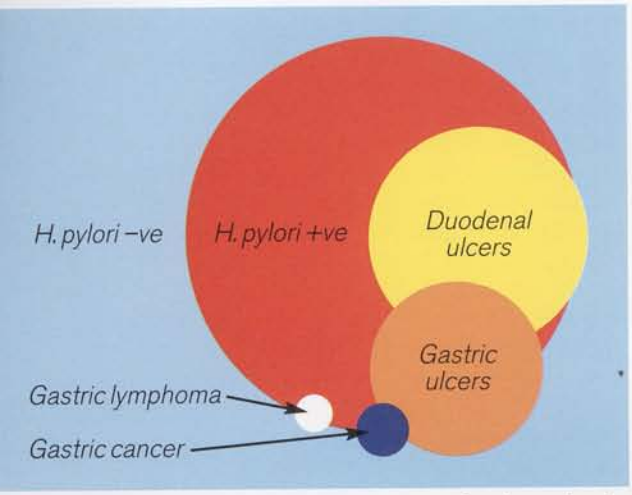
These are personal opinions and do not represent the view of SGM Council.

Infectious ulcers: not hurry, worry and curry?

Dave Kelly

Gastric ulcers were once believed to be caused by lifestyle factors. Dave Kelly describes *Helicobacter pylori*, the microbe now known to be the real culprit.

Until about 20 years ago, if the question 'what causes stomach ulcers?' had been put to any self-respecting GP or even a consultant gastroenterologist, the answer would have included stress, diet, smoking or alcohol (particularly if the patient was also overweight). The notion that bacteria could be a cause of gastric ulcers would not have been considered plausible. The major reason for this was, of course, that the hydrochloric-acid-containing stomach was regarded as essentially a sterile organ. All this changed when two Australian scientists, Robin Warren and Barry Marshall, brought to light an association between spiral-shaped bacteria and inflammation of the gastric mucosa (stomach lining) in 1982. In fact, sporadic reports of the presence of spiral bacteria in both human and animal stomachs appeared in the late 19th century, but the realization that these bacteria might be agents of disease had to wait until they could be cultured. This was the crucial advance made by Robin Warren, using the microaerobic growth conditions that had been recently introduced for campylobacters.



ABOVE:
Fig. 1. Representation of the association of various diseases with *H. pylori* infection in the population of the USA. The pale blue rectangle represents the *H. pylori*-negative population and the red circle within it represents all those infected with *H. pylori*. About 95 % of duodenal ulcer patients (yellow circle) and about 70 % of gastric ulcer patients (orange circle) are infected with *H. pylori*. Gastric cancer (blue circle) is strongly associated with *H. pylori* infection and with untreated gastric ulcers, while most cases of gastric lymphoma (white circle) occur in *H. pylori*-infected patients.

The now famous story of the (re)-discovery of *Helicobacter pylori* is exceptional for several reasons, not least that within a few years, the field of gastroenterology was literally revolutionized, with the realization that this bacterium was implicated in a range of diseases, including gastritis, gastric and duodenal ulceration and as a risk factor for gastric adenocarcinoma and lymphoma (see Fig. 1). The new insights and treatment options for these chronic diseases have undoubtedly relieved much suffering in people worldwide. However, to the frustration of Barry Marshall, the medical establishment took some convincing that *H. pylori* really was a causative agent of human disease. This is where an element of drama was introduced into the story, when in 1984 Marshall decided to drink a suspension of the bacteria to demonstrate that gastritis would result. That he was right is surely the most heroic proof of Koch's postulates in the recent history of microbiology!

The microbe

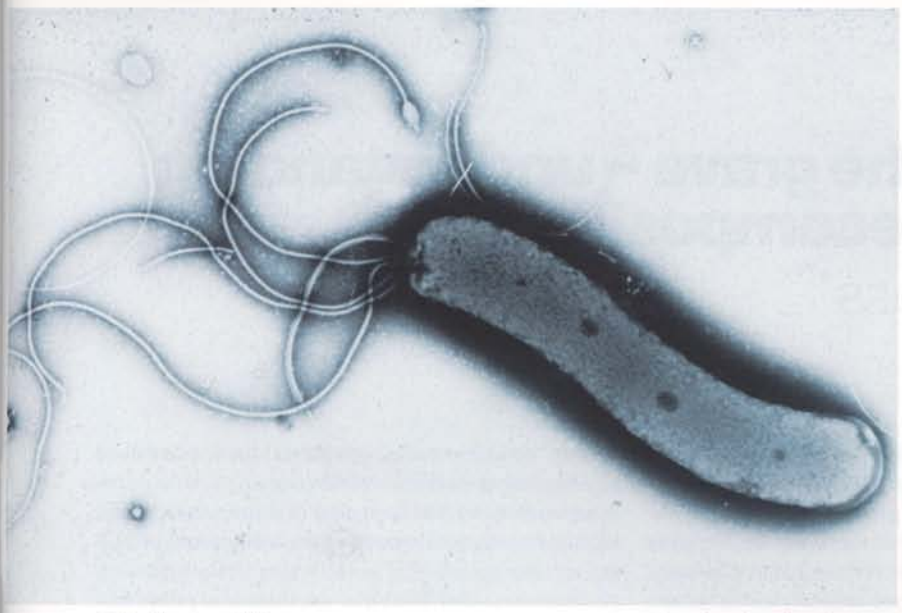
H. pylori is a Gram-negative, microaerophilic, spiral-shaped bacterium, which is actively motile using five to six sheathed polar flagella (Fig. 2). Coccoid-shaped cells accumulate in older cultures; these are dead, as they do not have a membrane potential. After its initial isolation, the bacterium was classified as a new species in the genus *Campylobacter*. However, 16S rRNA sequence data and additional taxonomic features, such as the presence of the sheathed flagella and a distinct SDS-PAGE protein profile, led to the establishment of the new genus *Helicobacter*. There are now about 20 recognized *Helicobacter* species, many of which are animal pathogens. *H. pylori* has a relatively small genome (1·7 Mb), and in 1997 was amongst the first bacterial pathogens to be sequenced. Many insights are being gained into the biology of the organism from experimental approaches that utilize this genomic information.

Infection and epidemiology

H. pylori is extremely widespread in humans and it is now regarded as one of the commonest infections. Even famous people are not immune (Table 1)! There seems to be little relationship between *H. pylori* infection and alcohol intake, smoking or gender. Developing countries generally have a much higher overall prevalence (up to 95 % of the population infected in some countries) compared to the Western world (30–50 % infection rates). The pattern of *H. pylori* disease found within a population is determined by the age of acquisition of the infection. Infection in childhood is common in developing countries and leads to a predominance of gastric ulcer and gastric cancer, whereas infection as an adult generally leads to duodenal ulcer and gastric cancer is rarer. Evidence indicates that infection rates are inversely related to socio-economic class. In developing countries, where poverty may prevail, there is overcrowding and poor childhood health. In Japan the change in epidemiology of *H. pylori* as a result of Westernization has been studied. By testing serum banks for anti-*H. pylori* antibody, it was concluded that in 1940 infection was most likely to occur before adulthood. A similar investigation in 1990, i.e. after an improvement in sanitation and healthcare, indicated that individuals were more likely to become infected between the ages of 20 and 40.

Transmission

Surprisingly, definitive proof of the exact mode of transmission of *H. pylori* infection is still lacking. The oral–oral route, particularly from mother to child, is the most obvious method of spread, but a large number of studies have produced contradictory data. *H. pylori* has been successfully cultured from human faeces which raises the possibility of a faecal–oral route of transmission. The natural niche for *H. pylori* is the human stomach; it has fastidious nutritional requirements and there is no convincing evidence that it is able to grow or survive for extended periods in an *ex vivo* environment. Some excitement has been generated by controversial reports of possible *H. pylori* reservoirs in sheep, domestic cats and even houseflies, but it seems unlikely that *H. pylori* is transmitted zoonotically.



LEFT:
Fig. 2. Electron micrograph of *H. pylori*. Note the characteristic curved/spiral morphology and the terminal tuft of flagella with a terminal bulb.
COURTESY DR ALAN CURRY, PRESTON PHLS LABORATORY

Pathogenicity

Some major discoveries have been made in recent years concerning the mechanisms of pathogenicity of *H. pylori*. One of the most obvious questions is how the organism thrives in the acid environment of the stomach. *H. pylori* is certainly not an acidophilic bacterium and prefers to live in the gastric mucosa which is at neutral pH rather than in the lumen (approximately pH 2). Nevertheless, it may be periodically exposed to stomach acid and has several protection systems, one of which involves the production of huge amounts of urease. The alkaline ammonia produced by urea hydrolysis is proposed to be a major acid protectant, although urease has other physiological roles as well. Animal studies have shown that motility, chemotaxis and urease are all essential for colonization. Another question stems from the ability of *H. pylori* to set up a chronic infection which, if not treated, can be life-long, yet is often asymptomatic. How does *H. pylori* avoid clearance by the immune system? Part of the answer lies in the phase variation and molecular mimicry exhibited by its lipopolysaccharide, which contains Lewis X or Y blood-group antigens, allowing immune evasion to occur. Other roles of the lipopolysaccharide in adhesion and tissue damage via auto-antibody formation have also been shown.

One of the most important discoveries concerning the pathogenicity of *H. pylori* was that it possessed a vacuolating cytotoxin (VacA) that can directly damage epithelial cells. VacA inserts into the lysosomal membrane and forms ion channels which lead to massive vacuole formation and eventually cell death. Another important feature of *H. pylori* is the possession of a 40 kb chromosomal region which constitutes a 'pathogenicity island' (PI). These are found in several pathogenic bacteria and can often be recognized by an unusual GC content and codon usage, suggesting horizontal transfer from foreign species. In *H. pylori* the PI encodes a complex 'type IV' secretion system which functions in the translocation of a protein known as CagA into the host epithelial cell. Here, CagA becomes phosphorylated and induces rearrangements in the actin cytoskeleton which causes the formation of cup-like structures underneath the attached bacteria. Other PI genes induce production of the chemokine interleukin-8 which mediates the infiltration of neutrophils into the infection site, thus generating a strong inflammatory response in the gastric mucosa.

Table 1. A few famous people who were or are probably infected with *H. pylori*

- Ayatollah Khomeini *(died from intestinal bleeding)*
- Lorne Greene *(the 'Bonanza' actor; had peptic ulcers)*
- James Joyce *(died of a perforated ulcer; family history of stomach cancer)*
- George Bush Snr *(had a duodenal ulcer in the 1960s)*
- Pope John Paul II *(had gastric bleeding in the 1980s)*
- Imelda Marcos *(had gastritis and gastric bleeding)*

Source: http://www.helico.com

Gastric cancer

Long-term infection with *H. pylori* is now a well-established risk factor for the development of gastric cancer, and in 1994 the WHO designated *H. pylori* a group 1 (definite) carcinogen. It is not certain whether *H. pylori* directly produces carcinogens, but it is more likely that long-term infection results in changes in factors such as the cellular apoptosis–proliferation balance, effects on signal transduction pathways and gene expression, mutagenic effects of *H. pylori*-induced oxidative stress, etc., all of which can contribute to neoplastic transformation.

Treatment

What are the treatments for *H. pylori* infection? As the bacteria are living in a mucus layer, they are not easy to eradicate using systemic antibiotics. Generally, two antibiotics, often amoxycillin and either metronidazole or clarithromycin, are combined with an acid-lowering drug, such as omeperazole, and taken for up to 2 weeks. Although patient compliance can be a problem, variations on this kind of 'triple-therapy' have become the standard treatment to eradicate *H. pylori* and are quite successful. However, resistance to metronidazole is now common and that to clarithromycin is increasing, so there is a need for new therapies to be developed. Vaccines are being developed for *H. pylori*, but this is proving difficult and it is too early to tell how successful this approach to eradication will be.

The discovery of *H. pylori* has largely replaced 'hurry, worry and curry' as the explanation for the major gastric and duodenal diseases in man. It is a fascinating organism which provides lifelong challenges – whether you are infected with it or study it!

● *Professor Dave Kelly is Chair of Microbial Physiology in the Department of Molecular Biology and Biotechnology at the University of Sheffield, Western Bank, Sheffield S10 2TN, UK. email d.kelly@sheffield.ac.uk*

Further reading

The *Helicobacter pylori* Foundation website (http://www.helico.com), set up by Dr Barry Marshall, the co-discoverer of *H. pylori*, contains a wealth of information aimed at the general public.

Mobley, H. L. T., Mendz, G. L. & Hazell, S.L. (eds) (2001). *Helicobacter pylori: Physiology and Genetics*. Washington, DC: ASM Press. (An authoritative book covering all aspects of the biology of *H. pylori*.)

Beyond the grave – understanding human decomposition

Arpad A. Vass

Eventually all human lives come to an end. Forensic anthropologist Arpad Vass explains the role of microbes in our bodies after death.

Human decomposition begins approximately 4 minutes after death has occurred. The onset is governed by a process called autolysis – or self-digestion. As cells of the body are deprived of oxygen, carbon dioxide in the blood increases, pH decreases and wastes accumulate which poison the cells. Concomitantly, unchecked cellular enzymes (lipases, proteases, amylases, etc.) begin to dissolve the cells from the inside out, eventually causing them to rupture, and releasing nutrient-rich fluids. This process begins and progresses more rapidly in tissues that have a high enzyme content (such as the liver) and a high water content such as the brain, but eventually affects all the cells in the body. Autolysis usually does not become visually apparent for a few days. It is first observed by the appearance of fluid-filled blisters on the skin and skin slippage where large sheets of skin slough off the body. Meanwhile, the body has acclimated to ambient temperature (*algor mortis*), blood has settled in the body causing discoloration of the skin (*livor mortis*) and cellular cytoplasm has gelled due to increased acidity (*rigor mortis*). After enough cells have ruptured, nutrient-rich fluids become available and the process of putrefaction can begin.

Putrefaction is the destruction of the soft tissues of the body by the action of micro-organisms (bacteria, fungi and protozoa) and results in the catabolism of tissue into gases, liquids and simple molecules. Usually, the first visible sign of putrefaction is a greenish discoloration of the skin due to the formation of sulfhaemoglobin in settled blood. The process progresses into distension of tissues due to the formation of various gases (hydrogen sulfide, carbon dioxide, methane, ammonia, sulfur dioxide and hydrogen), especially in the bowels, but I have seen this in many parts of the body, including the face, lips and groin. This is associated with anaerobic fermentation, primarily in the gut, releasing by-products rich in volatile fatty acids, mainly butyric and propionic acids. Gas and fluid accumulation in the intestines usually purge from the rectum, but can be severe enough to rip apart the skin causing additional post-mortem injuries. Shortly after the purging of gases due to putrefaction, active decay begins. Muscle, composed of protein, which in turn is composed of amino acids, readily yields to the formation of additional volatile fatty acids through bacterial action. Further protein and fat decomposition yields phenolic compounds and glycerols. Compounds, including indole, 3-methylindole (skatole), putrescine, cadaverine and various fatty acids have been detected and are significant decomposition products. At this point in the decay cycle electrolytes are rapidly leaching out of the body, both aerobic and anaerobic bacteria are present in large numbers, insect activity is very prominent and carnivores can contribute significantly to the decline of the corpse.

Saponification (the formation of soap from fat under high pH conditions) or adipocere formation typically occurs after the onset of putrefaction in warm, moist, environments and is seen as deposits of a yellowish-white, greasy, wax-like substance. Adipocere develops as the result of fat hydrolysis with the release of fatty acids. Adipocere consistency varies with the type of material to which it is bound and gives some indication as to the rate of decomposition. Rapid decomposition is indicated by a hard and crumbly composition if bound with sodium (primarily from interstitial fluids), but a soft, paste-like complex is formed when bound with potassium (from the breakdown of cell membranes), potentially

indicating slower decay rates. Adipocere formation is accelerated by the post-mortem invasion of tissues by bacteria, especially putrefactive species such as *Clostridium* and it takes from several weeks to months to form.

Mummification is typically the end result of tissue, usually skin, with no nutritional value, which has survived the active decay process and is formed by the dehydration or desiccation of the tissue. Remaining skin is converted into a leathery or parchment-like sheet which clings to bone. Mummification most commonly develops in conditions of dry heat or in areas that have very low humidity, such as in arctic regions or deserts.

Bone goes through yet another complex process called diagenesis. Diagenesis is a natural process that serves to alter the proportions of organic (collagen) and inorganic components (hydroxyapatite, calcium, magnesium) of bone exposed to environmental conditions, especially moisture. This is accomplished by the exchange of natural bone constituents, deposition in voids or defects, adsorption onto the bone surface and leaching from the bone.

Historically, the progression of human decomposition has been described as taking place in four stages: fresh (autolysis), bloat (putrefaction), decay (putrefaction and carnivores) and dry (diagenesis). Current thinking is that it should be segregated into pre- and post-skeletonization, since stages are not always observed and in fact may be totally absent, depending on the taphonomy of the corpse. All these processes together (autolysis, putrefaction and diagenesis) eventually result in complex structures composed of proteins, carbohydrates, sugars, collagen and lipids returning to their simplest building blocks – essentially dust to dust.

How long does decomposition take?

Decomposition is a complicated process, but is primarily dependant on temperature and to a lesser extent on moisture. In our studies we have worked out a simple formula, which describes the soft tissue decomposition process for persons lying on the ground. The formula is $y=1285/x$ (where y is the number of days it takes to become skeletonized or mummified and x is the average temperature in Centigrade during the decomposition process). So, if the average temperature is 10 °C, then 1285/10 = 128·5 days for someone to become skeletonized. Of course, this is a rough estimate since many factors affect this rate and it is typically used at a crime scene when investigators need some time frame from which to begin their investigation. Buried individuals and ones submerged in water have different rates of decomposition. Injuries affect the rate as well since damage to the skin increases blood loss, insect and bacterial action. In severe environments, such as in the arctic or in deserts, rapid desiccation occurs and this makes any accurate determination extremely difficult. Carnivore activity is yet another factor which can radically affect decomposition. Exclusion of insects and carnivores will slow down the process, whereas exposure to many (or larger) carnivores will increase the rate. Remember that decomposition does not end after the soft tissue has disappeared. The skeleton also has a decompositional rate that is based on the loss of organic (collagen) and inorganic components. Some of the inorganic compounds we use to determine the length of time since death include calcium, potassium and magnesium. As with soft tissue, these leach out of bone at a rate determined primarily by temperature and exposure to moisture. As a general rule, bones, within the first year, will begin to bleach and one may see growth of algae or moss on them. Within the first decade one will expect to see exfoliation and the formation of large cracks in the bone. Roots from nearby vegetation may grow into the bone mass, significant rodent gnawing will be present and the appearance of annual leaf falls is evident.

LEFT:
Examples of two stages of human decomposition. The top photograph shows a male subject in active decay after 12 days. The lower photograph shows the same subject after 97 days in the dry stage of decomposition where only mummified skin remains. In temperate regions of the United States individuals can be completely skeletonized in 30–40 days in the summer.
PHOTOS A. VASS

The role of microbes

When I began studying human decomposition over a decade ago in an attempt to determine a more accurate method for estimating the post-mortem interval, I began by investigating bacteria. The concept was that since insects can be used for this task, given that they arrive in characteristic, identifiable waves, why shouldn't bacteria behave in a similar fashion? It only took 3 months to quickly abandon this concept. Even in the very early stages of decomposition, I was inundated by the sheer numbers of organisms isolated – *Staphylococcus*, *Candida*, *Malasseria*, *Bacillus* and *Streptococcus* spp. – just to mention a few. As decomposition progressed, putrefactive bacteria were thrown into the mix followed rapidly by anaerobes.

ABOVE:
The five 'W's.
COURTESY STACEY BARSHACK, OAK RIDGE

These included micrococci, coliforms, diptheroids and *Clostridium* spp. There was a preponderance of certain organisms such as *Serratia* spp., *Klebsiella* spp., *Proteus* spp., *Salmonella* sp. and even gliding bacteria like *Cytophaga* – not to mention pseudomonads and flavobacteria. As these mixed with environmental micro-organisms such as *Agrobacterium*, amoebae and many colourful varieties of fungi and, of course, those brought to the corpse by flies and other insects, I relented. I came to the conclusion, somewhat facetiously, that with the exception of micro-organisms living in deep-sea vents, every micro-organism known is involved in some aspect of the human decompositional cycle from *Acetobacter* to *Zooglea*. While many of the organisms isolated come from the bowel and respiratory tract, literally hundreds of species are involved in the decompositional process and decomposition would not progress without them.

One particular forensic case comes to mind that illustrates this point. Workmen clearing limbs from a roadside guardrail (in the summer) discovered a fully clothed woman dead for an undetermined time. No indication of decomposition and no insect activity led investigators to initially believe this was a very recent homicide. In actuality the woman had been dead for nearly 4 months. She had been sprayed with insecticide (and other chemicals) by the perpetrator to mask the odour of decomposition so she wouldn't be found. Unwittingly, the murderer had essentially sterilized the body and prevented flies from laying eggs. Autopsy showed some internal decomposition, but it was significantly reduced. Apparently, the chemicals seeped into her lungs and then spread throughout her body.

Taphonomic circumstances also play a role in the response of micro-organisms. Several years ago, grave robbers, searching for artefacts, unearthed the coffin of an American Civil War Colonel (Col. Shy). The caretaker of the cemetery called in the police who found a fresh corpse in the grave. After significant investigation, it was ascertained that the fresh corpse was indeed Col. Shy, who '*still had red meat on his bones*'. At that time prominent solders were buried in solid lead coffins – the lead had 'sterilized' the body by poisoning the microflora and decomposition had not progressed past initial autolysis.

Why study human decomposition?

It is critical that the decomposition process be understood because it impacts on forensic investigations in a variety of ways. At every crime scene many questions are asked, but to solve the crime the five 'W's (who, what, when, where and why) must be answered. Studies into human decomposition help answer four questions: who is the victim, how did the victim die, where and when did the victim die? In addition to being extremely useful for 'Time Since Death' determinations, the identification of decompositional products may also be relevant to victim identification. The presence of melanin, for example, may help establish the race of the victim, especially when key skeletal elements are absent. The quantity of various decompositional products, such as fatty acids, may help determine the weight of an individual, which can also be useful in determining the victim's identity. This would be crucial, especially when articles of clothing are unavailable at the crime scene. Knowledge of any trace amounts of chemicals, drugs, medications or toxins present in decomposed tissue may also be of help to investigators in attempting to determine cause of death. Additionally, the study of decompositional products may even be useful in locating human remains or clandestine grave sites by improving the training procedures for cadaver recovery dogs, through the determination of the alerting scent emanating from a corpse, or in the development of field instrumentation for assisting in cadaver recovery searches.

The future

Current techniques to determine the post mortem interval using decompositional products (volatile fatty acids) can range from ± 2 days for soft tissue decay and ± 3 weeks using inorganics for skeletonized material, up to approximately 5 years. Currently we are looking at specific organ biomarkers, which we hope will narrow the estimated range down to less than 12 hours for the first several weeks of decomposition. New, sophisticated hand-held devices are being planned which can be used by police at a crime scene to give them immediate answers as to how long the victim has been dead and to help locate clandestine graves. Novel fingerprint and DNA recovery techniques will aid in both victim and perpetrator identification – all of which are made possible by an intimate knowledge of the decompositional process.

● *Dr Arpad A. Vass is currently a Senior Staff Scientist at Oak Ridge National Laboratory and Adjunct Associate Professor at the University of Tennessee in Forensic Anthropology. Oak Ridge National Laboratory, 1 Bethel Valley Road, X-10, Bldg 4500S, Rm E148, MS 6101, Oak Ridge, TN 37831-6101, USA.*
Tel. +1 865 574 0686; Fax +1 865 574 0587
email av6@ornl.gov

July Council Meeting

New Eukaryotic Microbiology Group

● Council has approved the formation of a new group to reflect the interests of members in yeasts, mycology, algology and parasitology. The focus will encompass the molecular, cellular and organismal biology of eukaryotic microbes. Dr Clive Price will act as the new Convener of the group and it is proposed to hold its inaugural meeting on the cytoskeleton at Loughborough in September 2002 – see pp. 195 & 199 for details.

Comings and goings

The President warmly thanked **Professor Jeff Almond** for all his efforts during the past 5 years as International Secretary and for his earlier service as an elected member on Council. Thanks were also recorded to the two other retiring members of Council, **Dr Ulrich Desselberger** and **Professor George Salmond** for their hard work as elected members. We wish all our retiring colleagues well in the future.

Representation of SGM on outside bodies

Council has agreed that **Dr Stephen Spiro** will serve as its representative on the Microbial Physiology section of the European Federation for Biotechnology. **Dr Fergus Priest** will continue to represent Council on the International Committee on Systematics of Prokaryotes and **Professor Liz Wellington** will continue to represent the Society, which is the publisher of *International Journal of Systematic and Evolutionary Microbiology*, on ICSP.

Key Stage 2 pack for primary schools

Council examined the Society's recently published pack which enables teachers to teach microbiology at Key Stage 2 as part of the National Curriculum for science and also to include its use in work on numeracy, literacy and art. This production is particularly timely as it coincides with the start of the UK Government's *Year of Science*.

● *Alan Vivian, General Secretary*

2002 Degree Course Guide

The 2002 Degree Course Guide *Microbiology, Immunology & Biotechnology* has just been published, edited by member John Grainger. This includes full details of all UK undergraduate courses and useful information about career opportunities. Price £5.50. Tel. 01752 202301 to order a copy.

New Members of Council and Group Committees

Council

With effect from 11 September 2001, **Professor Sir John Beringer** (University of Bristol) commences his 5-year term as International Secretary.

Following the call for nominations to fill three vacancies for elected members of Council, the following have been elected unopposed to serve for 4 years from 11 September 2001:

Professor Alastair Brown	University of Aberdeen
Dr Pauline Handley	University of Manchester
Dr Keith Jones	University of Lancaster *(re-election)*

Biographies of the new Council Members appear on p. 195.

Groups

New Committee members, elected by postal ballot (Clinical Microbiology, Environmental Microbiology and Microbial Infection Groups) or elected unopposed (all other Groups) are as follows:

Cells & Cell Surfaces

Dr Deirdre Devine	University of Leeds
Dr Ian Henderson	Queen's University of Belfast

Clinical Microbiology

Professor Peter Hawkey	University of Leeds

Clinical Virology

No vacancies

Education

Dr Martin Adams	University of Surrey
Dr Heather Sears	University of Leeds

Environmental Microbiology

Professor Geoff Gadd	University of Dundee
Dr Steven Percival	University of Central Lancashire

Fermentation & Bioprocessing

Dr Reg England	University of Central Lancashire
Dr Chris Hewitt	University of Birmingham
Dr Richard Swift	Medeva, Speke

Irish Branch

Dr John McGrath	Queen's University of Belfast
Dr Michael O'Connell	Dublin City University
Dr Kevin O'Connor	University College Dublin
Dr Catherine O'Reilly	(Waterford Institute of Technology) has taken over as Group Convener

Microbial Infection

Dr Nick Dorrell	London School of Hygiene & Tropical Medicine
Dr Jonathan Fletcher	University of Bradford
Dr Olivier Sparagano	University of Newcastle

Physiology, Biochemistry & Molecular Genetics

Dr Jeff Green	University of Sheffield
Dr Jay Hinton	Institute of Food Research, Norwich

Systematics & Evolution

Professor Paul De Vos	University of Gent
Dr Rob Whiley	St Bartholomew's and London School of Medicine and Dentistry

Virus

Dr Wendy Barclay	University of Reading
Dr Stuart MacFarlane	Scottish Crop Research Institute, Dundee
Dr Martin Ryan	University of St Andrews

New Members of Council

Alastair J. P. Brown

Al is a Professor in Molecular and Cell Biology at Aberdeen University, and in the past he has studied in Biochemistry (Aberdeen), Food Science (MIT) and Genetics Departments (Glasgow). Never having trained as a microbiologist, he now joins SGM Council with some trepidation! However, Al revels in membership of the Aberdeen Fungal Group, with colleagues Neil Gow, Graham Gooday, Frank Odds and Ian Stansfield. He also enjoys the strong support of his research team who work on gene regulation and cellular morphogenesis in *Saccharomyces cerevisiae* and *Candida albicans*. He operates both at gene and genome levels to study the biology of these eukaryotic microbes.

Pauline Handley

I graduated as a microbiologist from University College London in 1966. Microbiology at UCL was a new degree course and the department provided a very stimulating atmosphere, so I stayed on to do my PhD. I used electron microscopy techniques to study potassium tellurite reduction in yeasts and streptococci and it was

during my PhD that I developed a life-long interest in the relationship between structure and function in micro-organisms. I was then appointed to a lectureship in Bacteriology at the University of Manchester in the department of Bacteriology and Virology. After a major department reorganization I am now in the microbiology group in the much larger School of Biological Sciences where I became a Senior Lecturer in 1989. In my earlier years in Manchester my research interests focused on the structure, composition and functions of surface structures of oral bacteria. Recently, I have broadened my research to include a number of areas of biofilm research in environmental microbiology. Currently I am working on coaggregation between aquatic biofilm bacteria and the role of biofilms in the colonization and biodeterioration of plastics. I have served as a Committee member on the SGM Cells and Cell Surfaces Group and am currently a member of the Education Group.

A biography of **Keith Jones** was published in the November 2000 issue of *Microbiology Today* (p. 193).

New Convener

Food and Beverages Group

Tom Humphrey

In March 2001 Tom was appointed to the Chair of Food Safety in the Department of Clinical Veterinary Science, University of Bristol. For 20 years before that the Public Health Laboratory Service (PHLS) employed him and for the last 5 years he was head of the PHLS Food Microbiology Research Unit. His initial training was as a meat technologist and he worked for the Animal Health Trust on enteric infections in food animals before reading for a BSc at the Hatfield Polytechnic and studying for a PhD at the University of East Anglia. His research interests include the epidemiology of *Salmonella* and *Campylobacter* spp. in poultry meat and egg production, bacterial stress responses and their impact on survival and virulence and sub-lethal injury in *Campylobacter* spp. His group has also undertaken work on the handling of high-risk foods in domestic kitchens and the persistence of *Salmonella*, *Campylobacter* and *Escherichia coli* following food preparation.

New SGM Eukaryotic Microbiology Group

Many long-standing members of the Society, working on eukaryotic microbes, had come to feel remote from SGM activities. In response to these concerns SGM Council has taken the decision to form a new group, the Eukaryotic Microbiology Group, to represent the interests of this constituency within the SGM. The remit of the group is to provide a forum for the discussion of molecular, cellular and organismal biology of eukaryotic microbes. In particular it is hoped to identify areas of common interest with other SGM groups and to organize joint symposia. Similarly, links will be forged with other UK academic societies with a view to developing future scientific meetings on themes of common interest.

The initial group committee members are **Clive Price** (Lancaster University, Convener), **Al Brown** (University of Aberdeen, Council Representative), **Tony Carr** (University of Sussex), **Mark Caddick** (University of Liverpool), **Alistair Goldman** (University of Sheffield), **Paul McKean** (University of Manchester), **Saul Purton** (UCL) and **Pauline Schaap** (University of Dundee).

The first task of the committee is to organize a two-day symposium on the Cytoskeleton which will take place 19–20 September 2002 at University of Loughborough, immediately following the previously arranged three-day SGM meeting at the same venue. Future plans include meetings on Applied Genomics and Pathogenicity, both areas providing ample scope for joint activities with other SGM groups.

Clive Price can be contacted at the Department of Biological Sciences, Lancaster University, Lancaster LA1 4YQ, UK (Tel. + 44 (0)1524 593137; Fax +44 (0)1524 843854; email: c.price1@lancaster.ac.uk).

Staff News

We are pleased to welcome three new members of staff. **Lesley Hoyles** has become a staff editor in the journals office, working mainly on *Microbiology*. She is completing her PhD at the University of Reading. **Sarah Ferris** is the new editorial assistant on IJSEM and joins the Society with a wealth of previous office experience. **Karen Turner** will be inputting data in the membership office as the annual subscriptions roll in.

Congratulations to **Robin Dunford**, Staff Editor on JGV, and wife Angela on the birth of an 8lb 13oz baby girl, Alice Catherine, on Thursday 4 October.

News of Members

The Society notes with regret the deaths of **Mr G.T.H. Brown** (member since 1979) and **Miss Joyce McQuillin** (member since 1967).

Grants

President's Fund

The President's Fund offers financial support to younger members of the Society for one of the following:

1. Travelling to present a paper or a poster on a microbiological topic at a scientific meeting
2. Attending a short course (up to two weeks)
3. Making a short research visit – larger awards are available for short research visits

1 & 2 – Smaller Awards

Maximum grants are:

- £125 for attendance at meetings/courses in the country of residence
- £200 for travel to another European country
- £300 for travel outside Europe

3 – Larger Awards (research visit)

Up to £2000 is available for making a short research visit of up to two months. The host institution may be overseas or in the country of residence.

All applicants must be resident and registered for a higher degree, or in a first postdoctoral position, in a country in the European Union. Only one application may be made to the fund during the term of a studentship or fellowship. The full rules of the scheme are published on the SGM website, from which application forms may be downloaded.

Postgraduate Conference Grants

Postgraduate Student Members of SGM currently resident and registered for a higher degree in the UK or another European Union country are eligible for a grant to cover the costs of accommodation and travel in attending ONE of the following Society meetings in 2002: University of Warwick, April; University of Loughborough, September; or any other SGM Group or Branch meeting. Application forms giving full details of the scheme were sent to all Student Members in the EU with their subscription invoices. The form can also be downloaded from the SGM website.

Joint Meeting of SGM Clinical Virology Group/ESCV/ESVV

9–11 January 2002, Royal College of Physicians, London

Special rules apply for Postgraduate Conference Grants to attend this meeting. Grants will cover day registration fees at SGM member rates, a contribution towards hotel accommodation and travel at the Younger Persons Railcard rate. Please contact the Grants Office for details before applying.

Public Understanding of Science Awards

Are you planning any projects to promote the public understanding of microbiology? Have you got a National Science Week event in mind? SGM can help. Grants of up to £1,000 are available to fund appropriate activities. Applications are considered on a first come, first served basis. The current funding year runs from January to December 2001. See SGM website for details and an application form.

Details of all Society grant schemes are now on the website at **http://www.sgm.ac.uk**
Most application forms can be downloaded.

Any enquiries should be made to the Grants Office at SGM Headquarters, Marlborough House, Basingstoke Road, Spencers Wood, Reading RG7 1AG (Tel: +44 (0)118 988 1821; Fax: +44 (0)118 988 5656; email: grants@sgm.ac.uk).

Vacation Studentships 2002

The Society offers a limited number of awards to enable undergraduates to work on microbiological research projects during the summer vacation. The purpose of the awards is to provide undergraduates with experience of research and to encourage them to consider a career in scientific research. The studentships provide support at a rate of £150 per week for a period of up to 8 weeks. An additional sum of up to £400 for specific research costs may also be awarded. Applications on behalf of named students are now invited from SGM members in higher education institutions and research institutes. Details of the scheme are given below.

Rules

1. Applicants must be members of the Society working in a higher education institution or research institute in the UK or Republic of Ireland. Applications must be made on behalf of a named student. More than one application from a department/school will be considered, but in the case of several applications being submitted, departments/schools may be asked to rank the applicants.

2. Students must normally be in the penultimate year of their undergraduate course and registered at an institution in the UK or Republic of Ireland. Applications for students in their final year will not be considered. Medical students will be accepted at the end of their intercalated studies, but not during their elective period.

3. The research project must be on a microbiological subject. Studentships will not be awarded for projects that are part of degree work. A studentship may be held in a laboratory away from the normal place of study, but it must be located within the UK or Republic of Ireland.

4. Applications will be assessed by a Council Award Panel, based on the reports of two referees. The scheme is competitive and applications will be judged primarily on the scientific merits of the project and the suitability of the student. Once an award has been offered, it cannot be transferred to another student.

5. The awards will provide support for the student at a rate of £150 per week for a period of up to 8 weeks, and not usually less than 6 weeks. An additional sum of up to £400 for specified research costs may also be awarded. Grants are made to the institution to which the applicant belongs, not to the supervisor, on the understanding that it will administer the award.

6. It is a condition of the award that the student submits a brief report of the research at the completion of the studentship.

7. Applications must be made on the appropriate form, which is downloadable from the SGM website.

The closing date for applications is **1 March 2002**.

Seminar Speakers Fund 2001/2002

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. The full rules of the scheme were published on p. 90 of the May issue of *Microbiology Today*. Applications will be dealt with on a first come, first served basis during the academic year, which is defined as running from September 2001 to June 2002. Written submissions should be sent to the Grants Office at SGM HQ.

Undergraduate Microbiology Prizes

The scheme to encourage excellence in the study of microbiology by undergraduate students continues to be well received in universities in the UK and Republic of Ireland. Institutions offering an appropriate microbiology course were invited to nominate a student for an SGM prize, based on good performance in microbiology in the penultimate year of study for a BSc. The department was able to choose the type of assessed work for which the prize was awarded. Of the 60+ departments circulated, 51 made nominations. Each prizewinner will receive a certificate, a cheque for £50 and a year's free Undergraduate Membership of the Society.

Undergraduate Microbiology Prizes will be awarded annually and the invitations for nominations in 2002 will be circulated next May. Details are also available on the SGM website.

Corporate Membership

Council is delighted to offer a new category of membership for 2002. Companies and other bodies with an interest in microbiology will be eligible for Corporate Membership. Corporate Members will be entitled to the following benefits:

- Receipt of *Microbiology Today*, the award-winning house magazine of the SGM
- Discounted rates for advertising and placing inserts in *Microbiology Today*
- Discounted rates for exhibiting or placing inserts at Society meetings
- Acknowledgement as sponsors in *Microbiology Today*, at Society meetings and on the SGM website

The annual subscription for Corporate Members is only £500.

For further details of Corporate Membership and an application form, please see the website or contact Janet Hurst (Tel. 0118 988 1809; email j.hurst@sgm.ac.uk).

Garnham Slide Collection Catalogue

The Garnham Collection, which includes the type slides for all the important *Plasmodium* strains, is housed at the Natural History Museum. The Museum has spare copies of the catalogue for free distribution. If you would like one, please contact **Dr Dave Roberts** in the Department of Zoology, Natural History Museum, Cromwell Road, London SW7 5BD (email dmr@nhm.ac.uk).

SGM Membership Subscriptions 2002

The following rates were agreed at the AGM of the Society on 11 September 2001.

Ordinary Member	**£**	**US$**
Membership subscription (including *Microbiology Today*)	42.00	72.00
Additional concessionary subscriptions for publications:		
Microbiology	75.00	140.00
Journal of General Virology	75.00	140.00
Int J Syst Evol Microbiol	75.00	140.00

Student or Retired Member	**£**	**US$**
Membership subscription (including *Microbiology Today*)	20.00	35.00
Additional concessionary subscriptions for publications:		
Microbiology	37.00	70.00
Journal of General Virology	37.00	70.00
Int J Syst Evol Microbiol	75.00	140.00

Undergraduate Member (UK and Republic of Ireland)	**£**	**US$**
Membership subscription (including *Microbiology Today* – no concessionary subscriptions to journals are available to Undergraduate Members)	10.00	NA

School Member (UK and Republic of Ireland)	**£**	**US$**
Membership subscription (including *Microbiology Today* – no concessionary subscriptions to journals are available to School Members)	10.00	NA

Corporate Member	**£**	**US$**
Membership subscription (including *Microbiology Today* – no concessionary subscriptions to journals are available to Corporate Members)	500.00	NA

Members are reminded that their 2002 subscriptions are due for payment by **1 December 2001**.

As in previous years, no journal or meetings information will be despatched to members who are in arrears, and there will be no guarantee of provision of back numbers of journals for members who pay their subscription late.

Payment by direct debit or continuous credit card

Subscription notices were despatched recently to all members paying by direct debit or by continuous credit card arrangement. To continue your present status and journal requirements, no further action is necessary. However, if you pay by continuous credit card, you should check that the card number and expiry date on the subscription notice are correct. To change your membership status or journal requirements for 2002, or your credit card details, you should have amended your subscription notice and returned it to the membership office by **15 November 2001**. However, if you have missed this deadline, your amended notice will be accepted if it is submitted immediately.

Payment against invoice

Invoices were despatched recently to all members who pay by this method. If you did not receive one, please inform the Membership Office.

Subscriptions waived for unemployed members

As in previous years, subscriptions may be waived at the discretion of the Society for unemployed members under the age of 35 who are resident in the UK. If you are eligible and wish to benefit in this way in 2002, you should send a signed statement that you are currently unemployed to the Membership Office before **30 November 2001**. (Please note that no increase in journal requirements will be permitted.)

Income tax relief on membership subscriptions

Members who are liable for UK income tax are reminded that their annual subscriptions to the Society have been approved by the Inland Revenue as qualifying for income tax relief. Any member who would like further information or has difficulty in obtaining this relief should contact the Executive Secretary.

Meetings

Meetings on the web

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

On-line booking

On-line booking forms are now available on the SGM website.

Meetings organization

The SGM meetings programmes are organized by the committees of the special interest groups, co-ordinated by the Scientific Meetings Officer, Professor Howard Jenkinson. Suggestions for topics for future symposia are always welcome. See p. 218 for contact details of Group Conveners.

Administration of meetings is carried out by Mrs Josiane Dunn 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).

Abstracts Book

149th Ordinary Meeting

University of East Anglia, 10–13 September 2001

Mycobacteria – New Developments

The full text of the abstracts book covering the sessions at this meeting is now available as a PDF file on the SGM website.

Offered Posters

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.

Promega Prize

Are you

- a member of the SGM?
- a postgraduate or first postdoc in your first two years?
- thinking of presenting an offered paper or poster at an SGM meeting?

Why not enter for the Promega Prize Competition? You could win £200 in the SGM section of the competition and go on to compete for a further £2,000 in the *Young Life Scientist of the Year* event. Contact the Meetings Office or see website for details.

Future Meetings

SPRING 2002 – 150th Ordinary Meeting

University of Warwick 8–12 April 2002

● Main Symposium Signals, switches, regulons & cascades: control of bacterial gene expression

8–9 April

Organizers: S. Busby, R. Dixon, D. Hodgson, H. Jenkinson, G. Salmond & C. Thomas

● Speakers

F. NEIDHARDT (Michigan)
Regulation of the stress response
R. MOXON (Oxford)
Regulation of pathogenicity
C. DORMAN (Dublin)
DNA topology and regulation of gene expression
I. BLOMFIELD (Kent)
DNA rearrangements and regulation of gene expression
M. BUCK (London)
Structure of RNA polymerase
M. BUTTNER (Norwich)
Sigma factors
R. LOSICK (Boston, USA)
Anti-sigma factors
S. BUSBY (Birmingham)
Activators of transcription
B. MULLER-HILL (Köln)
Repressors of transcription
R. SCHLEIF (Baltimore)
Complex regulators
T. HENKIN (Ohio)
Transcription anti-termination
K. GERDES (Odense)
Post-transcriptional regulation
J. HOCH (La Jolla)
Phosphorelay gene regulation
D. MORRISON (Illinois)
Quorum sensing in Gram-positives
R. DIXON (Norwich)
Two-component systems
G. SALMOND (Cambridge)
Quorum sensing in Gram-negatives

● Other symposia, workshops

● Gene expression in the natural environment

Cells & Cell Surfaces/ Physiology, Biochemistry & Molecular Genetics/ Environmental Microbiology Groups

10–11 April

Organizers: G. Black (gary.black@unn.ac.uk), N. High (nicky.high@man.ac.uk) & N. Minton (nigel.minton@camr.org.uk)

● New approaches to vaccination

Clinical Microbiology Group

8–9 April

Organizer: Dlawer Ala-Aldeen (daa@nottingham.ac.uk)

● Virus infection in immunocompromised and transplant patients

Clinical Virology Group

10 April

Organizer: D. Westmoreland (diana.westmoreland@phls.wales.uk)

11 April

Joint symposium with Occupational Health Physicians

● Careers for microbiologists

Education Group

11 April

Symposium and evening workshop with buffet for SGM Student Members and first postdocs.

Organizer: Pauline Handley (p.handley@man.ac.uk)

● Launch of new Food & Beverages Group

The new Food & Beverages Group will be launched at this meeting with a symposium on *Campylobacter*. The new group aims to promote scientific interaction and facilitate education in all aspects of food microbiology throughout the human and animal food chain. The Convener is Tom Humphrey (tom.humphrey@bristol.ac.uk).

A leaflet about the meeting is enclosed with this issue. A poster to publicize the meeting is also available from the Events Administrator if you would like to display a copy on your departmental noticeboard.

● Fermentation studies: post-genomics era

Fermentation & Bioprocessing Group

10 April

Organizer: G. Hobbs (g.hobbs@livjm.ac.uk)

● *Campylobacter*: no longer the forgotten pathogen

Food & Beverages Group

9 April

Organizer: Tom Humphrey (tom.humphrey@bristol.ac.uk)

● Normal flora

Microbial Infection Group

10–11 April

Organizers: Deirdre Devine (d.a.devine@leeds.ac.uk) & Sheila Patrick (s.patrick@qub.ac.uk)

● Aeromonads & Vibrios

Systematics & Evolution Group

9 April

Organizer: Brian Austin (b.austin@hw.ac.uk)

● Infections of the nervous system

Virus Group

8–9 April

Organizers: John Fazakerley (john.fazakerley@ed.ac.uk) & Liz Hoey (e.hoey@qub.ac.uk)

● Virus replication of cellular architecture

Virus Group

11–12 April

Organizers: Geoffrey Smith (glsmith@ic.ac.uk), Tom Wileman (thomas.wileman@bbsrc.ac.uk) & Roger Everett (r.everett@vir.gla.ac.uk)

● Virus Group workshops

10 April

DNA Viruses (all day)
Organized by Roger Everett (r.everett@vir.gla.ac.uk) & James Stewart (james.stewart@ed.ac.uk)

RNA Viruses (all day)
Organized by Ian Clarke (inc@soton.ac.uk) & David Evans (david.evans@vir.gla.ac.uk)

Reversiviruses (half day)
Organized by James Neil (j.c.neil@vet.gla.ac.uk) & Mark Harris (mharris@bmb.leeds.ac.uk)

Hepatitis Viruses (half day)
Organized by David Rowlands (d.j.rowlands@leeds.ac.uk) & John McLauchlan (j.mclaughlan@vir.gla.ac.uk)

Papillomaviruses (all day)
Organized by Sheila Graham (gbga69@udcf.gla.ac.uk) & John Doorbar (jdoorbar@nimr.mrc.ac.uk)

Please contact the named organizers **by 15 February 2002** if you wish to participate in any of these sessions.

● Offered papers and posters

These are welcome for all Group sessions. Please submit titles and abstracts to the appropriate symposium organizer or Group Convener by the deadline of **8 December 2001**. See notice on p. 198 for general conditions for submitting posters.

AUTUMN 2002 – 151st Ordinary Meeting

University of Loughborough
16–20 September 2002

● Main Symposium *Staphylococcus*

16–17 September
Organizers: S. Foster, C. Gemmell, D. Hodgson, H. Jenkinson & S. Patrick

● Other symposia

● Bacterial interactions with extracellular matrix components
Cells & Cell Surfaces Group

● Patents and intellectual property rights
Education Group

● Survival at the limits of life
Environmental Microbiology Group

● Production of protein
Fermentation & Bioprocessing Group

● Pathogenic *E. coli* throughout the food chain
Food & Beverages Group

● Genetic susceptibility to infection
Microbial Infection and Clinical Microbiology Groups

● Launch of new Eukaryotic Microbiology Group

19–20 September 2002

Top international speakers will participate in the first symposium of the new Group which will focus on the Cytoskeleton. See website for details of the programme.

● Symposium 1: Protein traffic and secretion in fungi

● Symposium 2: Cold temperature adaptation
Physiology, Biochemistry & Molecular Genetics Group

● Oral microbiology
Systematics & Evolution Group

Offered posters are welcome for all group sessions. Please submit titles and abstracts to the appropriate symposium organizer(s) or Group Convener by the deadline of **18 May 2002**.

Irish Branch

Microbes, metals and the environment

Institute of Technology, Carlow
26–27 March 2002
Organizers: David Dowling (dowling@itcarlow.ie) & Catherine O'Reilly (coreilly@wit.ie)

Quorum sensing and signalling in soil bacteria

Dublin City University
September 2002
Organizer: Michael O'Connell (michael.oconnell@dcu.ie)

For details of Irish Branch activities contact the Convener, Catherine O'Reilly (coreilly@wit.ie)

Other Events

● Joint Meeting

9–11 January 2002

Royal College of Physicians, London

SGM Clinical Virology Group, European Society for Clinical Virology and the European Society for Veterinary Virology

The meeting will include a symposium on the latest medical and veterinary aspects of viral zoonoses and intercalated offered papers and posters on any subject relevant to clinical virology or veterinary virology.

● PROGRAMME

Wednesday 9 January
CATHY E. ROTH (CSR/WHO, Geneva)
Viral haemorrhagic fevers: global update
BRIAN MAHY (CDC,USA)
West Nile Fever in New York
YOSHI KAWAOKA (Tokyo)
Molecular basis of virulence and host specificity of influenza
IAN BROWN (VLA)
Epizootiology of influenza A viruses in animals and the implications for human health
Offered papers
NORBERT NOWOTNY (Vienna)
Borna disease virus infection in different animal species and in human beings

Thursday 10 January
TONY FOOKS (VLA, Weybridge)
Rabies – global situation, disease surveillance and control
NOEL TORDO (Institut Pasteur, Paris)
Diversity of lyssaviruses and rabies neuropathogenesis
MARKUS GLATZEL (University Hospital Zurich)
Neuroinvasion of prions
BOB WILL (National Creutzfeldt–Jakob Disease Surveillance Unit, Edinburgh)
Clinical and epidemiological features of variant CJD
Offered papers
Evening: *Conference dinner*

Friday 11 January
ADRIAN PHILBEY (Moredun Research Institute, Edinburgh)
Zoonotic paramyxoviruses of pteropid bats: Nipah, Hendra and Menangle viruses
ADEEBA KAMARULZAMAN (University of Malaya)
Nipah in Malaysia
Offered papers
AB OSTERHAUS (Erasmus University, Rotterdam)
The ESCV Gardner Lecture
Viruses emerging from animal reservoirs

CPD: The meeting has been approved for accreditation by the Royal College of Pathologists.

Organizers: J. Best (jenny.best@kcl.ac.uk), N. Brink (n.brink@ucl.ac.uk), D. Paton (david.paton@bbsrc.ac.uk) & T. Wreghitt (Fax 01223 242775)

● International Union of Microbiological Societies Congresses

27 July–1 August 2002, Paris, France

The World of Microbes

See p. 226 for details.

Going Public

Developments in Education Award report

Alphabet of Science

■ Sue Assinder

Science – it's as easy as ABC! That was the message of the 'Alphabet of Science' project held in north Wales in March this year. This was a community-based project co-ordinated by CELTEC (North Wales Training and Enterprise), involving local schools, businesses, the University of Wales, Bangor and the general public.

The idea was simple. Participating schools were assigned a letter of the alphabet, plus a scientific topic beginning with that letter. Their task was to work with 'experts' at the university to research the topic and to produce material to decorate a stand to be displayed in Bangor High Street during National Science Week 2001.

The idea may have been simple, but the logistics of organizing an event of this scale were somewhat overwhelming. Permission was required from the County Council, the Highways Authority and the North Wales Police. Aside from the obvious jobs of recruiting schools and organizing the university contacts, risk assessments had to be written, insurance cover arranged, press coverage and publicity organized and sites for stands negotiated with local tradespeople. I took on the role of liaison within the university and had soon gathered a willing band of students eager to share their skills. Topics were chosen to be as relevant as possible to the National Curriculum and to start with the same letter in both Welsh and English, since all material would be produced bilingually. Some choices were easy (A is for Atom), whilst others required a bit of artistic license (Y is for Y chromosome!). Three microbiological topics were included – B for Bacteria, F for Fungus/Ffwng and V for Virus. Meanwhile, the Schools Advisory Service worked on recruiting the schools and these were then put in touch with an 'expert' contact at the university whom pupils could email for advice.

The design of the stands required careful planning – they needed to be robust enough to not fall over, yet light enough to be wheeled. The display part had to be transparent, but it also had to be possible to make it secure against vandalism. Fortunately, we had on hand the expertise of students at the Further Education College, Coleg Menai, who were able to turn our amateurish scribbles into professionally specified design drawings, which were then passed to a local engineering company for manufacture.

Although the costs of the stands were covered by CELTEC, additional money was needed to pay for publicity material and to give to the schools for production of the contents. Both the SGM and the British Mycological Society were generous in their support of the microbiological displays. Other funding came from local businesses, the British Association for the Advancement of Science (BA) and the Local Education Authority.

The quality of the material produced by the schools was outstanding, with many 3-D models and artefacts. The microbiological topics were well represented by excellent displays produced by sixth formers at Coleg Menai, and covered such diverse areas as AIDS, fungal 'friends and foes' and the biotechnological exploitation of bacteria.

On Friday 16 March children representing the participating schools assembled in Bangor's Penrhyn Hall for a ceremony attended by Professor Roy Evans, the Vice-Chancellor of the University and Mrs Betty Williams MP. Dr Louise Webb from Techniquest, Cardiff, opened the event on behalf of the BA, thereby marking the official launch of National Science Week Wales 2001. The stands were then ceremonially wheeled to their designated spots within and outside the shops in Bangor High Street, where they aroused considerable interest from passers-by during the following week.

National Science Week came to an end, but the Alphabet lived on. The stands were transported 60 miles down the coast to form one of the exhibits at the Wrexham International Science Festival at the North East Wales Institute. The Alphabet proved to be the perfect way of guiding visitors between the major attractions during

ABOVE:
Shoppers browse the Alphabet at the Bangor Wellfield Centre.

RIGHT:
'B is for Bacteria'.

TOP RIGHT:
Finding out about 'F for Fungi'.

the 'Scientriffic' family day, which attracted several thousand visitors.

Inevitably, the project was not without its problems. High winds and torrential rain during National Science Week led to a need for running repairs to the stands and various mopping-up operations. An unanticipated challenge was the foot-and-mouth crisis, which hit hard in north Wales and almost certainly reduced the number of visitors. And the fact that the launch clashed with Red Nose Day did not help when it came to getting publicity. Nevertheless, there was positive feedback from the public and teachers commented on the satisfaction felt by the children in contributing to a high-profile national event. Overall, the project strengthened links between local schools, shopkeepers and the university, and helped to raise awareness of the many ways in which science impinges upon everyday life.

Alphabet of Science – Evaluation

Formal evaluation of the schools' input was carried out via a questionnaire sent within 2 weeks of the event. Responses were generally positive. All schools felt that the children had enjoyed participating in the event and had benefitted from it. In some cases, schools had managed to incorporate the work into normal lessons. For example, the school working on slate researched the material as part of a history project into the development of Bangor in the 19th century and then produced the material during art lessons. Other schools produced the displays as special projects during lunch hours.

It proved to be more difficult than expected to persuade schools to participate, particularly if they could not see a direct link into a topic on the National Curriculum. All of the microbiological exhibits were produced by sixth formers at the local College of Further Education, probably a reflection of the lack of microbiology in the syllabus for the lower Keystages. With hindsight, it might have been better to allow the schools to choose the topics, but this would have made it difficult to get full coverage of the alphabet and to get a balance across the different areas of the physical and biological sciences.

Recruiting students from the University to participate in the event was easy and I was overwhelmed with volunteers. I sought informal feedback from all students who had made contact with a school and they all found it to be a positive experience. Disappointingly, not all schools wanted the help that was offered and some did not respond when contacted by the students. This is an issue which would need to be addressed if planning a similar event.

It was the original intention that students from Coleg Menai would interview members of the public as part of their Key Skills work. However, activities at the College were seriously disrupted by the foot-and-mouth crisis and it was felt that this would not be appropriate. Although formal feedback was not sought, regular visits to the event through the week showed significant interest from the general public in Bangor. The stands then had exposure to several thousand visitors at the Wrexham Science Festival. There was substantial local press interest, particularly of the launch event.

● ***Sue Assinder is Education Secretary of the British Mycological Society and Senior Lecturer in Molecular Genetics at the University of Wales, Bangor, UK.***
Tel. 01248 382604
email s.j.assinder@bangor.ac.uk

Science and Engineering Ambassadors

SCIENCE YEAR

The Science and Engineering Ambassadors Scheme (SEAS) was announced in July 2001. Its objective is to be able to offer ambassadors to schools and bring young people together with role models working in science, technology, engineering and maths, so that they are encouraged to consider a career in these areas. This scheme is an outcome of the 2000 government White Paper *Excellence and Opportunity*. The Department for Trade and Industry and Department for Education and Skills are funding the project. SEAS wishes to build on, strengthen and enhance existing initiatives. It will do this by providing support, guidance and matchmaking services to schools, businesses and other organizations wishing to take part.

● How you can help

Members of the Education Group of the UK Life Sciences Committee, including SGM, have decided to produce, as its Year of Science activity, a database of scientists willing to work with schools and colleges. This database will be part of the SEAS which is to be launched in January 2002. It will be accessible to education providers on the web (**www.Biology4all.com**) or information will be distributed to schools on request.

If you wish to be included on the database please complete the questionnaire *Communicating Science to Schools* which can be downloaded from the SGM website (**www.sgm.ac.uk/education**). It should be returned to me at SGM HQ.

● ***Dariel Burdass***
SGM Education Projects Administrator

SchoolZone

Schools Membership costs only £10 a year. For this, a named teacher representative will receive *Microbiology Today* each quarter, advance notification and copies of new microbiology teaching resources and discounted fees for attendance on SGM training courses and workshops. Application forms are available on the membership page of the SGM website (**www.sgm.ac.uk**).

SGM has recently initiated a new category of membership for schools. Although this does not officially take effect until January 2002, we are delighted to report that at the time of going to press (September) over 100 UK schools have already signed up. A big welcome to them all. They will receive this issue of *Microbiology Today* with our compliments and we hope they find lots of interest to read.

SGM services to schools

Although the Society has only just started to offer membership to schools, we have a good track record of supporting microbiology teaching at all Key Stages. Many resources are available either free or at low cost and we also offer advice and training. We are regular attendees at events such as the ASE Annual Meeting.

The Education activities are administered by **Dariel Burdass**, a microbiology graduate who also has a PGCE and has taught in both primary and secondary schools. She is supported by other members of the External Relations Office team who lend a hand when required and reports to the External Relations Manager, **Janet Hurst**, and the Council Education Officer, **Liz Sockett**, both of whom have extensive experience in raising the profile of microbiology to schools and the public.

On the web

The SGM careers and education pages are at **www.sgm.ac.uk**

The database of microbiology teaching resources, which records the extensive collection of material we hold in the office, is also available on the Schoolscience website (**www.schoolscience.co.uk**).

The database is searchable by keywords. It is updated monthly.

Microbiology on-line

A new website devoted to microbiology education is under development. Watch this space for further news.

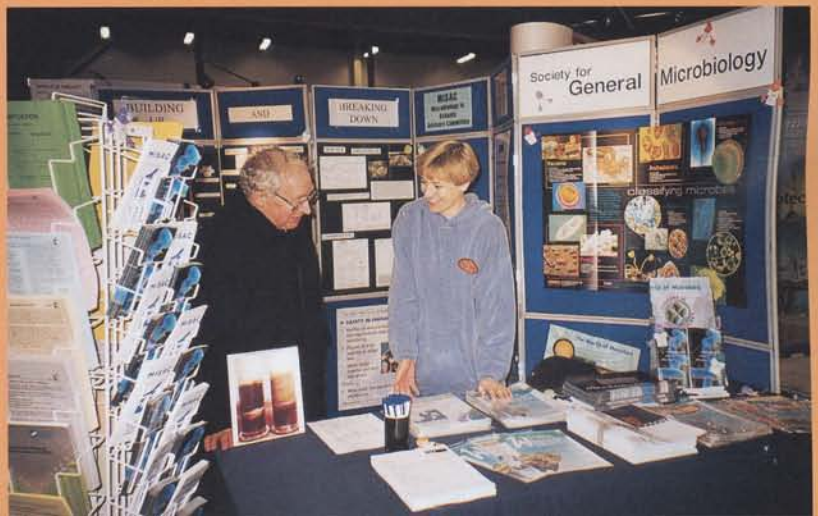
Enquiries

We are happy to answer questions on any aspect of microbiology teaching and have a panel of experts to call on when required.

email **education@sgm.ac.uk**

Resources

- **Posters** *(all free)*: *World of Microbes; Microbes and Food* (set of three); *Microbes and the Environment* (set of two).
- **Factsheets** *(free)* cover a wide variety of topics, including safety, safe micro-organisms for schools, practical investigations, culture maintenance, etc. All are available on the website.
- **Primary Pack – *The World of Microbes***: a new set of booklets and a poster for KS2, in support of NC Unit 6B. *£15.00 inc. p&p.*
- **Careers posters and leaflets** *(free).*



Over to you...

From now on *SchoolZone* will be a regular feature and contributions are welcome from teachers who have interesting microbiology material to share, such as novel investigations, useful tips, or good sources of information. A copy of the post-16 resource *Practical Fermentation* (worth £15.00) will be sent to any school whose submission is published. Of course the Editors of *Microbiology Today* reserve the right to edit any material.

Training Courses

One-day basic practical microbiology training courses for teachers and technicians are being held at venues around the country.

● **11 & 12 October 2001**	University of Reading *(fully booked)*
● **6 November 2001**	Sir John Deane's College, Northwich, Cheshire *(fully booked)*
● **1 February 2002**	At-Bristol
● **8 February 2002**	Woodlands Centre, Chorley, Lancashire
● **2 July 2002**	Institute of Education, London
● **Summer Term** *(date tbc)*	Institute of Education, University of Warwick

The cost is £25.00 per head. A grant towards cover costs is available. Places are filling quickly on a first come, first served basis.

Summer School, 15–19 July 2002

SGM will be running a *Post-16 Microbiology Summer School* in the School of Food Biosciences, University of Reading.

The main objective of this summer school is to raise levels of knowledge and confidence in the teaching of microbiology. The programme has been carefully designed to reflect the content of post-16 examining bodies' specifications, but aims to go beyond the basics by covering the latest research findings in each topic. The summer school also aims to put microbiology into a wider educational perspective and will show how it can be used to teach other issues, such as bioethics, science communication and educational research.

The target audience will be teachers and technicians of post-16 biology and the course will be compulsorily residential. Further details will be available in the near future on the SGM website.

Developing microbiology practicals

One of the frustrating aspects of developing schools microbiology activities at the SGM is that we are based in an office. We can create posters and paper resources, but we have no lab in which to test practical ideas. All this has changed, thanks to a special grant from SGM Council. In August Helen Nankervis was appointed as research assistant to work in Education Officer Liz Sockett's laboratory at Nottingham University, specifically to develop new microbiology investigations. These will be aimed primarily at the post-16 level where there are many options to study microbiology and biotechnology, but few practicals to choose from. She will also be working up other ideas for different age groups. All of the protocols will be thoroughly trialled in schools before being published. The activities will be posted on the SGM website as they become available.

Helen graduated this year in microbiology from the University of Leeds and we hope that she enjoys her exciting new job.

Post-16 Microbiology and Biochemistry Workshop for Teachers

7 June 2001, Glasgow University

■ Dariel Burdass

The one-day workshop, sponsored jointly by the Society for General Microbiology, The Biochemical Society and Glasgow University, was aimed at supporting Advanced Higher Biology teaching and updating teachers' own knowledge. The programme included two practical sessions, one on isolation and observation of *Rhizobium*, a nitrogen-fixing bacterium, and the other on the structure and digestibility of carbohydrates. There were also two talks on the Human Genome Project and an update on bacterial resistance to antibiotics delivered by SGM member Professor Tim Mitchell.

John Grainger, Chairman of the Microbiology in Schools Advisory Committee (MISAC), led the microbiology practical session. He demonstrated how to locate root nodules on both clover and other leguminous plants before washing, sterilizing and crushing some of the *Rhizobium*-containing nodules. A sample of the contents was then inoculated onto an agar culture medium that included a source of fixed nitrogen. The plates were sealed so that they could be taken away and incubated at school.

A second sample was taken, stained and examined under the microscope. One student was fortunate to observe the 'bacteroid' in its Y-shaped form. This created much excitement as in his 30+ years of teaching John Grainger had only seen this form in text books.

Feedback from the teachers was very positive and they found the day extremely informative. As one reported about the microbiology practical, '*it was simple to do, gave good results, was specific to the Scottish curriculum and could be used with students.*' The teachers were keen to attend any future activities.

A copy of the protocol for the *Rhizobium* investigation is available from the External Relations Office of the SGM (email **education@sgm.ac.uk**).

ABOVE:
John Grainger helping teachers with the *Rhizobium* practical in Glasgow.

FAR LEFT (UPPER):
An SGM teachers' workshop led by John Schollar of NCBE.

FAR LEFT (LOWER):
Dariel Burdass (SGM Education Projects Administrator; right) and John Grainger (MISAC Chairman; left) on the SGM/MISAC stand at the ASE Annual Meeting.

PHOTOS SGM

Promega Prize

Tracey Duncombe caught up with some of the Promega Prize contestants at the Society dinner (over a few glasses of wine) to find out their views on the competition and what they felt about career opportunities for PhDs in the UK and abroad.

On 11 September, at the University of East Anglia, 10 postgraduate students faced a panel of judges in the SGM qualifying round of the Promega Prize. Although we say this every year, it was truly amazing to see the very high standard of presentations, which would be envied by any academic. In recognition of this excellence the SGM decided to present each finalist with a cheque for £25.

The two SGM heat winners were **Fionnuala McAleese** from Trinity College Dublin with her presentation *The loss of clumping factor B fibrinogen binding activity by Staphylococcus aureus involves cessation of transcription and cleavage by metallo-protease* and **Rut Carballido-Lopez** of Oxford University with a talk on *The bacterial cytoskeleton: cell shape determination in Bacillus subtilis*. Both received cheques for £200 and now go forward to compete in the *Young Life Scientist of the Year* final next year.

'I was quite overawed at the standard of the talks. Everyone was *very* confident and the presentations were all fantastic. I think everyone was pretty nervous beforehand and we all had a bit of trouble setting up. We got on really well; nothing like a bit of computer trouble to bring people together,' said Fionnuala.

According to Karen Keith of Imperial College, London, 'When I heard that I was nominated for the competition I couldn't believe it. I was only 6 months into my PhD and had very few results. Speaking at UEA was an excellent opportunity and it will stand me in good stead for future talks. It's something worthwhile to have on my CV too, especially as more and more people are now aware of the competition. Also, the opportunity to win money is certainly enough to catch the attention of any student!'

Sarah Cassidy of Kings College London said, 'As I was talking first it was quite a relief to get it over with, but I felt guilty during the coffee break as I had done my bit and those still left to talk were looking nervous. Once the talks were over, everyone seemed more relaxed and I think everyone enjoyed the Society Dinner without even giving a second thought to the competition, especially in the light of the terrorist attacks, which seemed to put everything into perspective.'

Joo Wook Ahn of University College London emphasized, 'It's very important to give lots of talks because it is one of the main ways of communicating your work to a larger audience than just to your specific peers. Gauging a presentation to the audience allows you to practise important skills, which come in very useful when you're down the pub and someone asks 'what do you do?'

And in the future?

'As far as the situation for PhD career opportunities in Ireland is concerned there are plenty of postdoc positions available. However, there is a bit of a bottleneck if you want to continue in academia as only five or six lectureships become available every year. With regard to industry there are virtually no pharmaceutical/biotech industries that carry out R&D; it's all manufacturing (though apparently this is all changing at the moment),' noted Fionnuala.

Karen said, 'I seriously doubt that I will stay in academia when I complete my PhD. Working on short-term contracts for low wages doesn't really appeal that much. I'd love to work abroad and could certainly see myself working for a large pharmaceutical company.'

Wook had strong views. 'I'd like to work in a lab outside the UK, probably in Europe, not because of lack of jobs here, just a wish to spread my wings. However, it's really being reinforced in my mind that the practical aspects of a career in academia can really suck. I don't want to be too pessimistic, but it does seem that you don't get rewarded for performing what I regard as a valuable role in society. Some friends of mine who left university and started jobs, for example as engineers or journalists, are being paid close to £30K at this stage with secure long-term prospects.'

Karen Jolly of Leeds University followed on saying, 'Science research appears to be so much faster and better funded in America that I have been considering going out there for a postdoc. However, the lack of job security and difficulty in returning following a career break, whilst not immediate problems, definitely make me wonder about pursuing other options. Also, as Wook pointed out, academic careers are unlikely to provide much financial recompense for the hours of hard graft put in, plus within any given area of science the number of places which specialize are limited and if you are part of a couple, it can be difficult to reconcile the locations which are suitable with the other person's job.'

A continental perspective was provided by Erik Gimpel of Cambridge University. 'The situation in France is far worse than in the UK and Ireland. Most French scientists have to complete two or three postdocs abroad before they can hope to get a position of any value in France (but at least once they get such a position, it is a long-term contract). Pay is also not particularly high in France, but research positions have a much higher social value than they do in the UK. You may not earn as much as bankers or lawyers, but you are considered as their equals, if not better.'

Erik continued, 'Switzerland is a very different kettle of fish. A PhD salary in Switzerland is higher than that of an experienced postdoc in the UK and tenure positions have salaries equivalent to industry. However, these opportunities are highly sought after because they are few in number. Also, it is expensive to live in Switzerland and you can expect your salary to be reduced by about 20% in real terms due to the increased cost of living. But you would still be significantly better off than in the UK.'

An encouraging point of view (for microbiology in the UK) was provided by Anne McKie of CPHL, London, who said, 'I feel that there are good career opportunities for me in this country and I have no real desire to work abroad. I currently live in London so I shouldn't have a problem finding a job, whether I decide to stay within PHLS or make a move into industry.'

Annie Tan of the University of Newcastle shared the same opinion. 'After my PhD, I'd like a postdoc position in the UK, although I haven't decided whether this should be in industry or academia. One day I plan to return to my home country to cultivate new scientific minds in academia.'

● If you have any stories or news for publication in Gradline, or if you would like to see any topics featured, please contact Tracey Duncombe at **pa@sgm.ac.uk**

Student Membership

Student Membership of SGM is available to postgraduate students worldwide who have no taxable income. For an annual subscription of only £20.00 (US$35.00) Student Members can take advantage of benefits such as free registration at Society meetings and the purchase of SGM publications at greatly discounted prices. In addition, Student Members who are resident and registered for a higher degree in any European Union country may apply for awards from the President's Fund and Postgraduate Conference grants (see p. 196 for details) which provide financial assistance for attendance at scientific meetings.

Undergraduate Membership

Undergraduate Membership is open to students resident and registered for a first degree in the UK or Republic of Ireland. For the bargain subscription of £10.00 Undergraduate Members receive *Microbiology Today* and may attend SGM meetings without payment of a registration fee. Careers advice is also freely available. However, Undergraduate Members are not eligible for travel or conference grants.

Life Science Careers 2001

- **3 November 2001** University of Bristol
- **17 November 2001** University of Newcastle
- **1 December 2001** University of Westminster, London

These all-day conferences are for life science undergraduate (graduating in 2002 or 2003) and postgraduate students. Each conference includes a range of talks on career choices and further training, an exhibition and a CV clinic. Full details and a booking form were published in the August issue of *Microbiology Today*. Don't miss the chance to attend the nearest event to your institution – further information and a booking form are available on the web: **www.sgm.ac.uk/meetings.htm**

Sponsored by Science Next Wave

Science next wave

Organized by members of the UKLSC

UKLSC

Soapbox!

From genetics to journalism

Dear Soapbox

When I was a wet-behind-the-ears first-year PhD student I was really passionate about the importance of communicating science to an increasingly suspicious lay-public. Coming from a family almost entirely composed of arts graduates and literateurs who were at once interested, and yet completely baffled by what I had chosen to do, I was already well-versed in explaining biological terms to people who thought that DNA was a kind of perfume. When I went into research I saw it as a challenge to try and prevent my friends having to stare embarressedly into their pints whenever they were brave enough to ask what I was studying (though, I admit 'functional genomics of yeast' must be one of the most successful conversation-stoppers I've ever come across).

However, over the last 3 years I have become increasingly disillusioned by the way that science is reported in the non-specialist press, in that very frequently only science that is perceived as being 'of interest' to the public is actually written about or published. In fact, on a recent BBSRC workshop we were told that in an average broadsheet newspaper, when science is generally competing for space with some pressing world issue, the Editor would only include your article if he or she deems it of sufficiently broad appeal. In fact, a scientist who was lucky enough to get a media fellowship with the BBC was told the role of the science journalist was to entertain and not to educate.

While I can see that this all makes some kind of sense (the importance of drawing people towards science, igniting their interest so that they are encouraged to look further into it and so on) I also feel that the public, or those that are sufficiently 'interested', gain a very skewed perception of what actually goes on in research. Microbiology and molecular biology seem most often to compete for and lose column space to behavioural studies, psychology and zoology – fields which people are perceived as being better able to relate to.

My argument is that surely the true skill of the science journalist should lie in the ability to write (or speak) interestingly and engagingly about any science (and I truly think this is possible!), especially fields that are conceptually more challenging or marginal. Surely otherwise the public will ultimately become increasingly removed from them.

I remember as an undergraduate being inspired by Mark Ptashne's *A Genetic Switch*. It was perhaps the first science that I had read that was as page-turning as fiction and yet it was describing the complex regulatory circuitry of a phage. Extrapolating from lambda to *E. coli* and other familiar undergrad stalwarts, I became fascinated by how amazingly intricate these organisms were, to the extent that they became transformed from the pathogenic germs of 'Domestos' adverts to almost (if you will forgive the journalistic anthropomorphism) individual 'people'. This is how I wish microbiology could be portrayed in the news, were it only given the chance.

Jess Allen, Institute of Biological Sciences, University of Wales, Aberystwyth, UK

Whether you're an undergrad or a postgrad the SGM wants to hear from you. Anything goes as long as it's relevant to microbiology.

Win £25 for the best letter published in *Microbiology Today*. Send your contributions to **soapbox@sgm.ac.uk**

SGM reserves the right to edit letters prior to publication.

PLUS Meeting

Science in Society

Over 250 postgraduate students attended a meeting of the Postgraduate Lifescience Universities in Scotland (PLUS) at the University of Glasgow, 17 September, to discuss a broad range of issues affecting both science and society. Tracey Duncombe reports.

TOP RIGHT:
'A new slant on Bioethics?' Prof. Neil Gow (Aberdeen) chairs and starts the morning session giving an outline of PLUS and its activities.

BELOW:
'Men in suits' at the entrance to the Boyd Orr Building where the lectures took place. *Left to right*: Prof. Willie Russell (St Andrews), Prof. Tony Trewavas (Edinburgh), Prof. John Coggins (Glasgow), Prof. Gordon Graham (Aberdeen), Sir Kenneth Calman (Durham), Dr Austin Smith (Edinburgh) (not shown Dr Mark Matfield of RDS).

PHOTOS COURTESY UNIVERSITY OF GLASGOW

The event, which was co-sponsored by the SGM, hosted several speakers of national prominence, including Sir Kenneth Calman, Vice Chancellor of the University of Durham, former Chief Medical Officer at the Department of Health and recently co-opted member of the Nuffield Council on Bioethics. Sir Kenneth emphasized the importance of engaging in debate with members of the public instead of the out-dated approach of talking at people as a means of increasing understanding on both sides. He also raised the possibility of a code of ethics for scientists, which could have parallels with the Hippocratic oath taken by physicians, as a way to increase public confidence in scientists carrying out research.

The problems of how scientists should tackle public fears and uncertainties, and how these fears can be capitalized upon by certain environmental and animal rights pressure groups, also featured heavily in two separate presentations on GM crops and animals in research.

Prof Trewavas of the University of Edinburgh explained how the precautionary principle is being exploited by Greenpeace in their campaign for a permanent and complete ban on the release of GMOs to the environment, irrespective of further scientific research or improved procedures with regards to safety. There is no question that developing countries face increasing difficulties to produce enough food to feed their ever-growing population, or that the amount of land for agricultural use cannot increase at the same rate. Prof Trewavas said that although the Green revolution increased crop yields successfully in the late 20th century through the application of fertilizers, pesticides and the development of dwarf crop varieties, new technologies are now needed to gain further improvements if people around the world are to be adequately fed in the future. But by opposing testing Prof Trewavas argues that Greenpeace are denying a solution to a problem where the benefits could far outweigh any possible risks.

Dr Mark Matfield of the Research Defence Society gave a dramatic example of how animal experiments have saved the lives of over 22 million people with type I diabetes since 1922. This figure, he said, is bigger than the entire population that has ever lived in Scotland. Dr Matfield pointed out the results of a recent MORI poll which indicated that most members of the public will accept the need for research on animals in the case of life-threatening diseases, such as cancer, although their main concern is for the welfare of the animals. The perception of cruelty to laboratory animals amongst the public is one which needs to be addressed. Dr Matfield said that one of the best ways to reassure the public that animals are well-cared for is to let them look around animal houses and laboratories. Simply by talking to the technicians who care for the animals assuaged many of the anxieties of those who had visited.

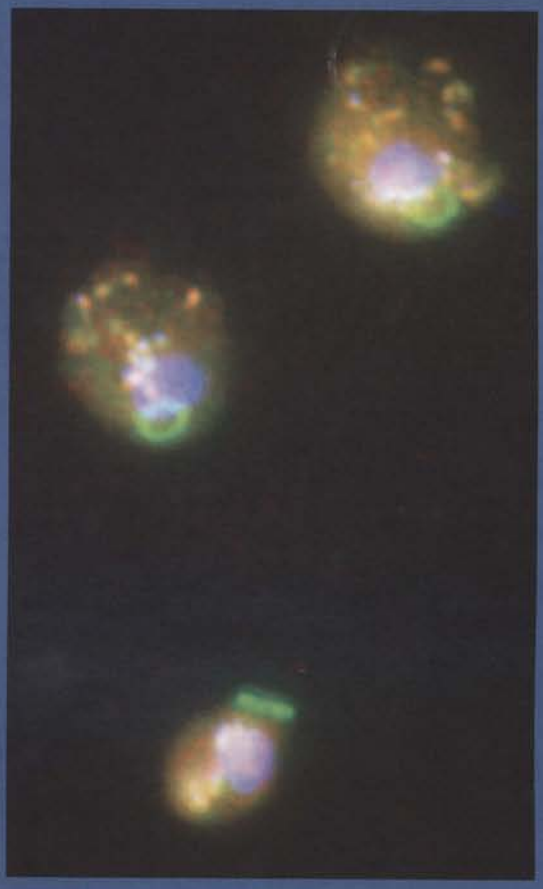
Other topics addressed included:

- The importance of the Royal Societies, professional bodies and the need for scientists to be more interested in politics
  Professor Willie Russell (University of St Andrews)
- The essentials of stem cell technology and the need to use pre-implantation embryos
  Dr Austin Smith (Director, Centre for Genome Research, University of Edinburgh)
- The commercialization of science
  Professor John Coggins (University of Glasgow)
- Science and religion
  Professor Rick Randall (University of St Andrews)

PLUS aims to be the forum for postgraduate training and education in all biological, biomedical and related life sciences in research-led universities in Scotland. Details of PLUS events can be found on the web at ***http://www.plus.ac.uk/***

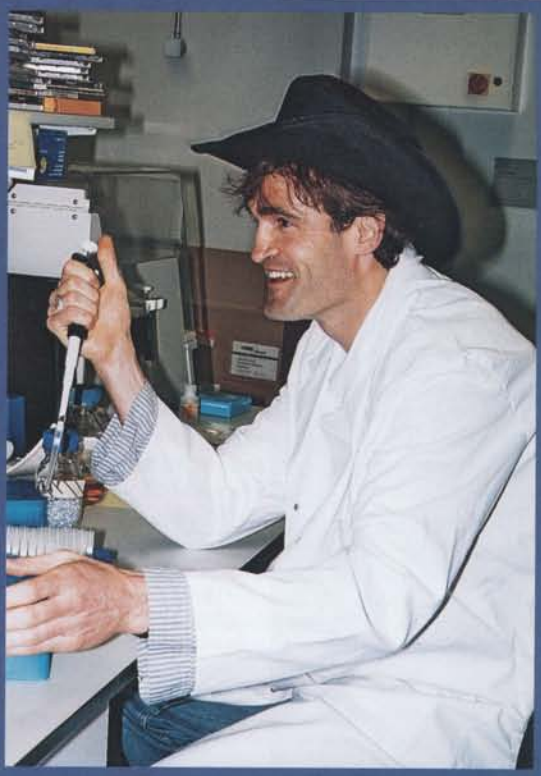
Photo2001

The SGM's annual photographic competition was judged at the Society's meeting at the University of East Anglia in September. There were seven entries and the judging panel, made up of President Sir David Hopwood, General Secretary Alan Vivian, Treasurer Peter Stanbury, Education Officer Liz Sockett, Executive Secretary Ron Fraser and Public Affairs Administrator Tracey Duncombe, had a difficult job in deciding on the best shot. Eventually a consensus was reached and the winner was announced by the President at the Society Dinner. First prize of £250 went to **Dr Victor Cid**, Assistant Professor at Universidad Complutense, Madrid, Spain, for a photograph of *Saccharomyces cerevisiae* cells expressing a *ubc9* mutation.



RIGHT:
First prize. Immunofluorescence on *Saccharomyces cerevisiae* cells expressing a *ubc9* mutation, showing characteristic arrest in the G1 phase of the cell cycle. The septin ring marking polarity sites (green) and the nucleus (blue) are conspicuous.
DR VICTOR CID, UNIVERSIDAD COMPLUTENSE, MADRID, SPAIN

LEFT:
Second place. Fungal growth on a living tree.
MARGARET SINDALL, COLYTON GRAMMAR SCHOOL, DEVON



LEFT:
Third place. Surfing USA! The photo is of Dr Steve Garvis, a postdoc in Professor David Holden's laboratory in the CMMI/Biochemistry department at Imperial College, researching staphylococcal virulence factors. Steve comes from South Dakota, famed for its Sioux Indian tribes, cowboy traditions and diverse wilderness, including the 'Badlands'.
DEREK PICKARD, IMPERIAL COLLEGE, LONDON

Hot off the Press

Microbiology Today Editor 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.

Programmed to die

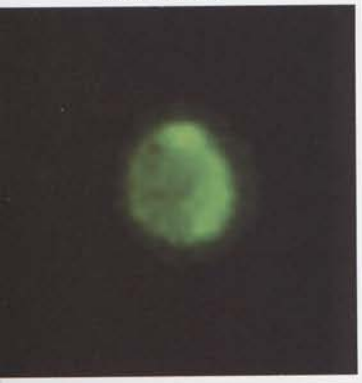
Dying cells have become one of the most exciting topics in biology in the last decade. Once researchers realized that the highpoint in the life of some cells was to die at exactly the right moment, they saw many phenomena with new eyes. The cells between the fingers in a human embryo have to die, neatly and on time, to form a hand, and plant cells surrounding one infected by a bacterial disease die to prevent the disease spreading. The way in which these cells die is so characteristic that the phenomenon is called programmed cell death.

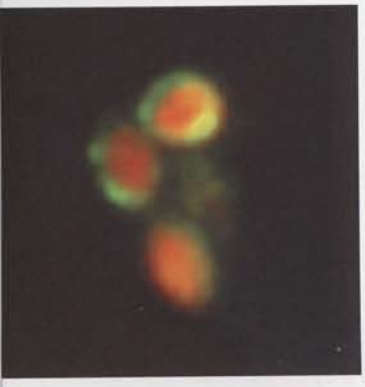
In hindsight, the value to multicellular organisms of cells dying to sculpt the shape of an embryo, or to confine a pathogen, is obvious. For a single-celled organism, programmed suicide seems much less appealing. However, the sacrifice of some individuals might be advantageous to the rest of a unicellular population, if, for example, it stopped the spread of a virus. Nevertheless, the idea that everyone's favourite yeast, *Saccharomyces cerevisiae*, opts to die in particular circumstances, is still controversial. Although some researchers have recorded the characteristic signs of an organized death in yeast cells experiencing oxygen stress, not everyone is convinced.

Researchers from the Universidade do Minho and Instituto de Biologia Molecular e Celular in Portugal have now reported their studies into the death of *S. cerevisiae* in dilute acetic acid, because this also has the hallmarks of programmed cell death. Yeast is very familiar with acetic acid, because it is a normal end product of its alcoholic fermentation. The exact amount of the acid is crucial. Yeast cells certainly die when the concentration is above 80 mM, but in a messy way that has nothing to do with programmed cell death. However, at 40 mM, death happens in a very different way. Each cell's chromosome condenses and is then chopped into neat pieces as the cell's membrane subtly rearranges, in the type of events typical of programmed cell death in animal cells. As extra support, the researchers found that adding a chemical that prevents yeast making new proteins delayed death, implying that new proteins have to be made to carryout the neat, but lethal, process. This adds to the emerging picture of how even a unicellular yeast can organize its own death.

Ludovico, P., Sousa, M.J., Silva, M.T., Leao, C. & Corte-Real, M. (2001). *Saccharomyces cerevisiae* commits to a programmed cell death process in response to acetic acid. *Microbiology* 147, 2409–2415.

BELOW:
Annexin V-PI staining of *Saccharomyces cerevisiae* exponentially growing cells exposed to 20 mM (upper) or 120 mM (lower) acetic acid for 200 min. The cell in the top panel is stained only in green by annexin V, but not in red, indicating that it is in an early stage of apoptosis. On the contrary, the cells in the lower panel are stained both green and red, indicating that they are in advanced apoptosis or in necrosis.
PHOTO COURTESY M. CÔRTE-REAL, BRAGA, PORTUGAL





Breaking down the wall

Although the yeast *Saccharomyces cerevisiae* benefits the human race by making both bread and beer possible, other fungi with a single-celled life style are much less benign. One of them is *Candida glabrata*, an opportunistic pathogen that is now the second most common cause of systemic candidosis. It infects people who are already ill and makes a difficult situation much worse. The patients often die, partly because there is no really effective treatment. *C. glabrata* shrugs off most antifungal drugs. The hunt is therefore on for new compounds that will be lethal to this fungal pathogen.

One obvious target is the yeast's cell wall. This very dynamic structure surrounds each cell, and as well as being responsible for its shape, it mediates interactions with the environment, including any unfortunate human host. Features of the way the wall is synthesized and re-modelled are unique to fungi, and researchers hope that they can use this to design more effective antifungal drugs, or at least better diagnostic tests so that there is more time for doctors to act against infections.

S. cerevisiae cell walls contain a protein called Gas1, which is essential for maintaining the correct levels of sugar polymers in the cell wall. Without it, the cells lose their normal spherical shape. *S. cerevisiae*, in fact, contains five genes capable of producing a protein very similar to Gas1, but only one of them actually works. *Candida albicans*, the yeast that most commonly causes candidosis, has only two genes to produce this sort of protein, but both can work, depending on the level of acidity around the cells.

Fritz Mühlschlegel, who has recently moved to the University of Kent at Canterbury from Würzburg University, and his colleagues in Germany and Imperial College in London, wondered which system was used in *C. glabrata*. They looked for DNA sequences in this yeast that closely matched the *GAS* genes of the other yeasts, and found three. Two of them, which they called *CgGAS-1* and *CgGAS-2*, were used to produce proteins all the time, and in all the environments that the researchers tested. The third gene did not appear to work.

The researchers designed experiments to discover what happened if these two genes stopped working, either individually or both together. When they removed only one, the appearance of the yeast cells changed. They grew more slowly and stuck together. However, try as they might, the researchers could not knock out both of the genes. They never obtained living cells from experiments designed to make this happen. They think that a lack of both these genes is lethal and want to test this idea in more complicated experiments designed so that each gene can be switched on or off at will by the researchers. If these proteins do turn out to be essential for survival of this pathogen, they may be good targets for new antifungal drugs.

Weig, M., Haynes, K., Rogers, T.R., Kurzai, O., Frosch, M. & Mühlschlegel, F.A. (2001). A GAS-like gene family in the pathogenic fungus *Candida glabrata*. *Microbiology* 147, 2007–2019.

Immunobiology of TSEs

One of the many puzzles about mad cow disease (BSE) is exactly how an animal catches it. Even though a similar disease of sheep, called scrapie, has been around for centuries, the way in which it is transmitted is equally unknown. A major component of the agent that causes BSE, scrapie and several other degenerative diseases of the brain, collectively called transmissible spongiform encephalopathies (TSEs), appears to be an abnormal form of a host protein called PrP^{c}. It is found in all animals, and an abnormal version (PrP^{Sc}) seems responsible for TSEs, by subverting PrP^{c} into the lethal PrP^{Sc} form. Consumption of contaminated feed was almost certainly the way that it entered the cows' bodies, but how did it then manage to cause fatal changes in their brains? After all, every mouthful that we eat is laden with bacteria, viruses, fungi and protozoa, not to mention the complex chemicals in plants. Although most are harmless, there are sophisticated systems to eliminate any threats. One of these is the immune system, which identifies and destroys anything foreign within the body. Neil Mabbott and Moira Bruce at the Institute for Animal Health in Edinburgh have been reviewing how much we know about the way that TSEs slip past the immune system.

The key seems to lie within the lymphoid tissues. These collect and filter fluid containing a mixture of cells and dissolved solutes that accumulate within all the tissues of the body. Many of these cells play a part in the immune system in complex interactions that result in the destruction of foreign materials. Pinning down the exact role for each cell-type in TSE disease can therefore be difficult. A further complication is that all TSEs do not seem to take the same route from gut to brain, with some studies giving directly contradictory results. The reviewers think that although this can sometimes be explained by differences in the way the experiments were carried out, there is also good evidence of real differences between different TSE diseases, and also different strains of the same TSE. For example, the lymphoid tissues associated with the gut are the first place that PrP^{Sc} appears in animals infected with scrapie, but in BSE it seems confined to nervous tissue.

One particular type of lymph cell, called the follicular dendritic cell (FDC), turns out to contain high levels of the normal PrP^{c} protein, and so researchers have suspected that this might be where the abnormal form is generated. FDCs make an ideal site for multiplication of PrP^{Sc} because they are long-lived cells containing a high level of PrP^{c} that are specialized to trap and retain molecules on their surface. A further indication of the crucial role of FDCs comes from experiments with mice able to, or unable to, synthesize PrP^{c} on their FDCs. In these experiments, scrapie only accumulated in the spleen if the FDCs expressed PrP^{c} on their surface. Scrapie did not accumulate in the spleens of mice in which PrP^{c} was expressed on lymphocytes alone.

The only other cells with lots of PrP^{c} are in the nervous system, where PrP^{c} may play an important role in neurotransmission and sleep patterns. However, the normal function of PrP^{c} in FDCs is not obvious. One suggestion is that it helps protect them from oxidative damage during their long lives. The normal work of FDCs is as part of the system that detects and destroys any foreign molecules within an animal. Once invaders have been identified, by becoming attached to antibodies or other proteins, they can be trapped on the surface of FDCs. This is important for the development of a strong antibody response to the invaders. Recent work strongly suggests that the ability of FDCs to trap foreign molecules is hijacked by TSEs.

When a TSE infection has spread to the central nervous system it may be too late to reverse the neurodegenerative effects. However, treatments that interfere with the early stages of infection can significantly impair the spread of the disease to nervous tissue. With the accumulating information on the importance of FDCs in the amplification of PrP^{Sc}, researchers are naturally thinking of treatments involving this early stage. One vulnerable point is the maturation of the FDCs, which is dependent on a series of signals from B lymphocytes. These are essential for maturation of FDCs and animals without B lymphocytes are particularly resistant to scrapie. Taking this to even greater detail, researchers showed that lack of one particular signal molecule sent from B lymphocytes to FDCs is enough to make an animal resistant. In another experiment, the researchers blocked a different signal from the B lymphocytes, which resulted in the temporary disappearance of all FDCs from the animal for a time, and this simultaneously also reduced the animal's susceptibility to scrapie.

There remains the one final step in any TSE infection, which is when it begins to affect the brain. This relies on the PrP^{Sc} moving on from the lymphoid tissues to nerves, but the way in which this happens is only now being determined. Although researchers have made considerable progress in understanding this distressing disease, it retains many of its secrets.

Mabbott, N.A. & Bruce, M.E. (2001). The immunobiology of TSE diseases. *J Gen Virol* **82**, 2307–2318.

Metal-resistant bacteria

Some bacteria are remarkably resistant to toxic metals, such as mercury, lead, cadmium and nickel. The genus *Ralstonia* appears to have more than its fair share. Scientists have been assessing them for exploitation to recycle polluted soils, treat wastewater or to simply detect the presence of excess toxic metals. However, one member of the genus is an important plant pathogen and several are opportunistic pathogens of humans. Clearly, before using any *Ralstonia* on a large scale in the environment everyone needs to be assured that it does not share these pathogenic characteristics.

One of the difficulties with bacterial classification is that as new species are identified, a genus that once had only a few, very distinctive members can change. Several new species have been added to *Ralstonia* in recent years and they suggest that the genus is much more diverse than anyone had suspected. Belgian researchers, led by Johan Goris at the University of Gent, decided that it was time to check how well the features used to identify *Ralstonia* species actually distinguish each one. They subjected 54 strains of *Ralstonia* to a battery of tests that ranged from classical biochemical ones to more modern methods that check the sequence of genes, the pattern of all the cell proteins or the type of fats within the cells. The final step was to run the information through a program that groups strains together based on the similarity of their results in each test. To make this easy to visualize, the program drew a tree-like diagram, called a dendrogram. The most similar strains appear on adjacent twigs, but were joined to the others on more distant branches.

When the dendrogram based on protein patterns was examined, the clusters of strains did not always correspond to the names already attached to them. Together with their data on the DNA of the bacteria, and the biochemical tests, the researchers felt confident that they were dealing with at least two new species, whose similarity to other *Ralstonia* species had let them remain undetected before this investigation. One of these contained many of the toxic-metal-resistant strains and so was named *Ralstonia metallidurans*. The other contained several strains from the Campine region in north-east Belgium, so they called it *Ralstonia campinensis*.

Goris, J., De Vos, P., Coenye, T., Hoste, B., Janssens, D., Brim, H., Diels, L., Mergeay, M., Kersters, K. & Vandamme, P. (2001). Classification of metal-resistant bacteria from industrial biotopes as *Ralstonia campinensis* sp. nov., *Ralstonia metallidurans* sp. nov. and *Ralstonia basilensis* Steinle *et al.* 1998 emend. *Int J Syst Evol Microbiol* **51**, 1773–1782.

Detecting pre-clinical BSE in sheep

Although there is now only very low level, or no, BSE contamination in the UK food-chain from bovine sources, the consequences of previous exposure are still being felt. For example, the UK national sheep flock may also have received BSE-contaminated feed and so, theoretically, the disease could now be present in sheep. Since BSE in sheep may well have similar clinical symptoms to scrapie, their natural TSE, it would be good to have a reliable method to differentiate the two diseases to be able to test this possibility.

James Foster and his colleagues at the Institute of Animal Health Neuropathogenesis Unit in Edinburgh have been trying to find out which tissues within sheep harbour the abnormal prion protein of BSE, called PrP^{Sc}. They used sheep that came from other long-term experiments. These sheep had been deliberately fed BSE and symptoms have so far started to appear between 1·5 and 3 years from the start of the experiment, although some of the sheep are still healthy. One of the conditions of these experiments is that the sheep will be humanely killed if they start to show signs of the distressing symptoms of BSE.

The researchers have examined a large range of tissues from the sheep, using an immunochemical staining method that can detect very small amounts of PrP^{Sc}. All had very extensive vacuolation in their brains, although it was most obvious in parts of the brainstem. In addition, the researchers could detect PrP^{Sc} in central and peripheral nervous tissue, and in many lymphoid tissues throughout all of the animals. The distribution and level of PrP^{Sc} fitted with the idea that the infectivity travelled from the digestive system to the nerves, although the intensity of the stain was much greater than in cattle with BSE. Other major organs, like the heart, lungs, liver and muscles, seemed free of the prion protein. The nictitating membrane from sheep's eyes has been proposed as a good location site for a routine test, but the researchers could only detect PrP^{Sc} there in two of four diseased sheep.

However, the key question was whether disease caused by BSE could be reliably distinguished from scrapie. The researchers still cannot give a firm answer, because they do not have enough detailed information on the distribution of PrP^{Sc} in sheep with natural scrapie. From the limited comparisons they have been able to make, there are some subtle, but suggestive differences, such as more intense staining in the brainstem in sheep infected with BSE. In addition, the intense staining in the sheep's lymphoid and nervous tissues may provide a way of detecting pre-clinical cases of BSE in sheep much more easily than in cattle.

Foster, J.D., Parnham, D.W., Hunter, N. & Bruce, M. (2001). Distribution of the prion protein in sheep terminally affected with BSE following experimental oral transmission. *J Gen Virol* **82**, 2319–2326.

Prion wasting disease in deer

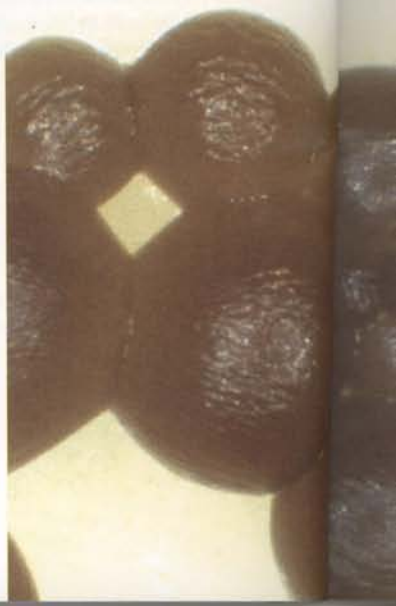
Edward Hoover of Colorado State University, along with colleagues in veterinary medicine and wildlife management, and in collaboration with the Swiss company Prionics AG, has been studying the distribution of the abnormal form of a cellular protein, PrP^{CWD}, in one of the natural TSEs of wild animals. The one they chose was chronic wasting disease (CWD) in the mule deer that roam wild in Colorado and Wyoming, USA. Even though this can affect up to 15 % of the deer in an area, relatively little is known about transmission and progress of the disease. The hypothesis was that the deer eat the abnormal PrP^{CWD}, and this then travels from the digestive tract to the alimentary nerves, and then to the brain.

Of course, it is always good to have some data to test such assumptions, and this is now possible because there are methods to detect PrP^{CWD} within tissues. These rely on the ability to create an immune response against the prion protein and then use these antibodies to test for PrP^{CWD} in samples of tissue from symptomatic mule deer with naturally occurring chronic wasting disease. The brains of all the deer had the spongiform degeneration that is the hallmark of this disease, along with easily detectable PrP^{CWD}. The researchers chose to look at nerves that were associated with the alimentary tract, and others like the sciatic nerve which have nothing to do with the digestive system. They also examined other tissues from the regions that they anticipated would be most affected by PrP^{CWD}.

Mule deer have two major autonomic nerve tracts associated with their digestive systems. The vagosympathetic trunk includes nerves that connect with the myenteric plexus, a nerve centre within the small intestine. The splanchnic nerves reach to the oesophagus, stomach and small intestine. All the deer they tested had PrP^{CWD} in the nerves of the vagosympathetic trunk, and also in most myenteric plexuses. The researchers were rather surprised that there was little evidence of PrP^{CWD} in the splanchnic nerves, although they detected PrP^{CWD} in the adrenal medulla; the best explanation for its presence there was that it had been transported via the splanchnic nerves. In contrast, as they expected, there was little sign of PrP^{CWD} in tissues like the sciatic nerve that are distant from the digestive system or in deer from a geographic region without chronic wasting disease.

These results fit with the idea of PrP^{CWD} travelling within nerves to reach the brain, but also PrP^{CWD} being able to reach other organs within the deer. They are piece by piece building up a full picture of this disease.

Sigurdson, C.J., Spraker, T.R., Miller, W., Oesch, B. & Hoover, E.A. (2001). PrP^{CWD} in the myenteric plexus, vagosympathetic trunk and endocrine glands of deer with chronic wasting disease. *J Gen Virol* **82**, 2327–2334.



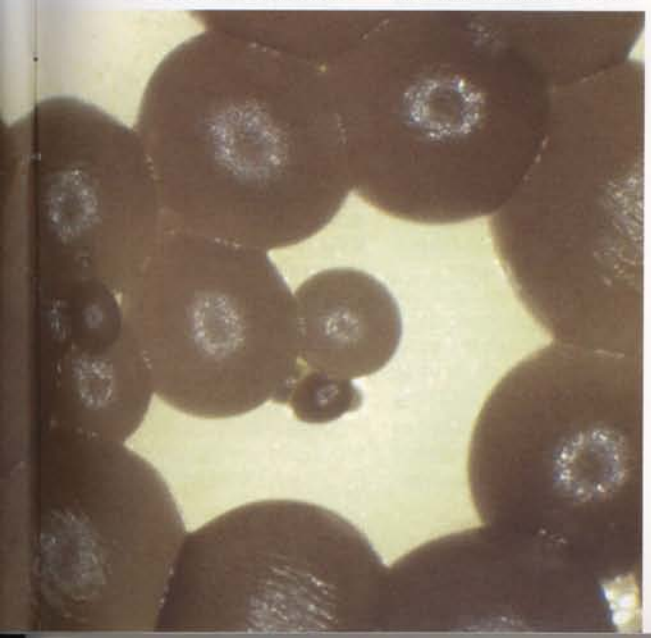
RIGHT:
'Pearls' (approx. 1–5 mm diam.) formed by colonies of the cyanobacterium *Nostoc commune* growing on calcium carbonate-supplemented agar. The dark-brown coloration is due to the UV-absorbing pigment scytonemin.
PHOTO SUPPLIED BY MALCOLM POTTS, VIRGINIA TECH CENTER FOR GENOMICS, BLACKSBURG, USA

Pearls of cyanobacterial wisdom

Sometimes the word microbe seems inappropriate. For example, patches on limestone rock that are blackened and crispy when dry, but green and gelatinous when wet, have been confidently identified and collected as *Nostoc commune* for over 200 years. Its visibility comes from the enormous number of individual cells in the colony in an environment where few others can compete. This conspicuous slimy organism was once considered to be a relation of seaweeds, but it is now known to be a member of the Cyanobacteria, a group of photosynthetic bacteria. It is a conspicuous component of the terrestrial microflora all over the world, especially in nutrient-poor soils.

However, some aspects of *N. commune*, and other cyanobacteria, are still a puzzle for scientists. One of these is how to identify it. Although it may be distinctive when growing on a rock in the wild, once researchers take it home to the lab, its appearance and behaviour can change so completely that it has acquired other names in culture collections. Consequently, researchers have tried the full arsenal of molecular taxonomic methods in search of a definitive identification method. One that seems particularly useful uses the group I introns within some genes in these bacteria. Introns are regions of a gene that are clipped out and discarded from the RNA that forms a gene's working copy within a cell. They are very common in eukaryotes, but more unusual in bacteria. The acquisition, transfer and distribution of introns is both important in understanding the evolution of species, and controversial.

Malcolm Potts and his colleagues at the Virginia Polytechnic Institute and State University in the USA realized that *N. commune* could provide unique information on this topic. This is because there are specimens dating from the 1850s in herbaria, often accompanied by detailed records of their time and place of collection. Some even appear to have lain undisturbed since they were deposited. There are few other bacterial species where well-documented specimens are available from before the era of antibiotics and rapid world travel, and even from before the Industrial Revolution. The researchers were able to examine samples that had been stored in the Wien Herbarium, Austria, since the 1860s along with others collected more recently from continents as far apart as Antarctica, Australasia, Europe and the Americas.



After extracting the minute amount of DNA in these dried cells, they used the polymerase chain reaction to amplify any introns in one of the genes and finally recorded the DNA sequence of the introns. The researchers also scoured the scientific databases for any additional sequences from strains that had already been published to include in their study. Overall, 25 of the samples collected by several investigators during two centuries turned out to have extremely similar introns, fully justifying their identification as *N. commune*. Although there were small differences between the introns in many isolates, this did not seem to relate to factors like geographical distribution. For example, two isolates collected in Virginia, USA, had an identical intron to one collected in Java 118 years earlier. A more critical look at the way the isolates could be clustered using the small differences between their introns gave the impression that they formed a continuum, punctuated by clusters with ill-defined borders. This reinforces the value of morphology in identifying at least this cyanobacterial species.

Wright, D., Prickett, T., Helm, R.F. & Potts, M. (2001). Form species *Nostoc commune* (Cyanobacteria). *Int J Syst Evol Microbiol* 51, 1839–1852.

Biofilm formation in the cystic fibrosis lung

It may be convenient for microbiologists to grow bacteria as uniform suspensions in a liquid medium, but in nature bacteria exist predominantly as communities on surfaces, called biofilms. Many bacterial infections owe their success to the production of a biofilm that shields the cells from both their unwilling host's immune system and antibiotics. The lungs of patients suffering from cystic fibrosis can become coated with a layer of bacteria embedded in their own polysaccharide matrix. One of the bacteria in these biofilms is *Burkholderia cepacia*, and understanding how it forms a biofilm may help devise new strategies for treatment.

In tests on mutants of *B. cepacia* that had lost the ability to form biofilms, a group of Danish and German researchers realized that one mutant had simultaneously developed a defect in the *cep* quorum-sensing system. This system enables a cell to detect the number of other bacterial cells in its vicinity. In *B. cepacia* this works through the production of a chemical called a homoserine lactone (involving the protein CepI), which can be detected by a sensor (called CepR) within each cell. Once the sensor detects enough homoserine lactone, it switches on a suitable response. For a pathogen, this might be something that starts an infection, because there are now enough bacteria to overwhelm the host before it can mount an efficient counter-attack.

The researchers wanted to find out how lack of either CepI or CepR stopped a biofilm being formed. So they created mutants that not only lacked either CepI or CepR, but also glowed through production of a green fluorescent protein. The way that these mutants grew on microscope slides was intriguing. Both normal and mutant cells first covered the slides with tiny microcolonies, but that was where the mutants stopped, while the normal cells went on to develop into a thick, rough layer. When the researchers repaired the malfunction in the quorum-sensing system by adding homoserine lactone to the mutant that could not synthesize it, the cells now formed a biofilm that was indistinguishable from the one made by normal cells.

The nature of the link between quorum-sensing and growth in a biofilm remained elusive, but the researchers already knew some properties that bacteria must have to form a biofilm. The ability to move is very important. *B. cepacia* has flagella that it uses for swimming, so the scientists focused on checking whether the *cep* system was also involved in controlling motility. The cells could still swim, but the researchers spotted that *B. cepacia* could also move by swarming across a surface in a thin film of biological detergent secreted by the cells themselves. The mutant cells were unable to do this, probably because they were unable to secrete the detergent. So although quorum-sensing is not essential for starting the formation of a biofilm, it may be crucial for finishing it.

Huber, B., Riedel, K., Hentzer, M., Heydorn, A., Gotschlich, A., Givskov, M., Molin, S. & Eberl, L. (2001). The *cep* quorum-sensing system of *Burkholderia cepacia* H111 controls biofilm formation and swarming motility. *Microbiology* 147, 2517–2528.

Reviews

If you would like your name to be added to our database of book reviewers, please complete the book reviewer interests form now available on the SGM website.

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

Comprehensive Reports on Technical Items Presented to the International Committee or to Regional Commissions 2000

Published by Office International des Epizooties (2001)
€25.00, pp. 301
ISBN: 92-9044-523-8

The current book in this report series follows the usual pattern with the key papers written in several different languages. In all cases English is one of the four languages used for the International Committee reports, one of two for those of the Regional Commission for the Americas and one of three for the Regional Commission for Europe. The two general session reports to the International Committee concern the prevention and control of aquatic animal diseases and the diagnosis, control and eradication of bovine tuberculosis (*Mycobacterium bovis*). Both these are comprehensive and should be read by anyone with an interest in these subjects. It would be worth buying the book for access to either of these reports. The Americas regional session deals with vesicular stomatitis, brucellosis and eradication of the screwworm. While not in the United Kingdom, the screwworm * is a blowfly which causes major economic losses in animals and birds in many parts of the Western Hemisphere, Africa and Asia. The European Regional session deals with swine vesicular disease and an interesting report on 'Ensuring a limited disease environment for optimal production in the livestock industry'. All the topics covered in the book will provide useful background reading for those already interested in the subject and particularly the two International Committee papers will serve as an introduction to the subjects.

■ ***Anthony Andrews***
Welwyn

Functional Analysis of Bacterial Genes: A Practical Manual

Edited by W. Schumann, S.D. Ehrlich & N. Ogasawara
Published by John Wiley & Sons Ltd (2001)
£70.00, pp. 373
ISBN: 0-471-49008-3

A comprehensive functional analysis has been carried out of the genes of *Bacillus subtilis* by two consortia, one European and one Japanese. Their findings are brought together in this fine book, which may serve in the future as a model for similar publications on other cell types whose genomes have been sequenced completely. Altogether, the *B. subtilis* project has allowed functions to be assigned to 543 genes previously classed as having no known roles in the cell. The reader is provided with ample background material on the organism and the methods used to study its genes, in particular the methods for global and systematic analysis of gene expression. The methodology is quite detailed, as one would expect in a practical manual, and there is a useful index and a glossary. The book should be of interest to the *B. subtilis* research community and to those involved in 'post-genomics' work with other systems.

■ ***Charles Dorman***
Trinity College, Dublin

Bacterial Toxins: Methods and Protocols. Methods in Molecular Biology, Vol. 145

Edited by O. Holst
Published by Humana Press (2000)
US$89.50, pp. 373
ISBN: 0-89603-604-9

This is no ordinary book on bacterial toxins. Rather it is a practical guide to diverse state-of-the-art techniques being used in the field. If fluorescence resonance energy transfer (FRET), Fourier-transformed infrared (FTIR) spectroscopy and matrix-assisted laser desorption/ionization time-of-flight mass spectrometry (MALDI-TOF MS) mean as little to you as they did to me, this book outlines their application to research, using toxins as examples. There are two excellent overview chapters on exotoxins and endotoxins (first class reading for undergraduates). Authors with hands-on experience of the described techniques have written the other chapters. Most usefully each of these chapters has notes on tips, difficulties, limitations and solutions to problems. Although highly specialized, this is a much-needed book for non-experts or non-cognoscenti. However, collaborative research with an exponent would seem to me to be an easier option than DIY, albeit that this book would explain what one's collaborator is doing!

■ ***Cyril J. Smyth***
Moyne Institute, Trinity College Dublin

Industrial Biofouling: Detection, Prevention and Control

Edited by J. Walker, S. Surman & J. Jass
Published by John Wiley & Sons Ltd (2000)
£70.00, pp. 239
ISBN: 0-471-98866-9

This sounds like the guest publication on *Have I Got News For You*. However, in reality it is a more serious assessment of how biofouling occurs, how it is detected and how it is prevented or controlled in the industrial environment. The book covers drinking water systems, industrial waters in pipelines and the problems encountered in the food and beverage industry. This is a multi author book and each 'environment' has its own section subdivided into similarly formatted chapters with different authors covering problems, detection and control. The chapters are well referenced and the figures are clearly presented. It concludes with a chapter on the future which covers a few themes from automated monitoring to non-culturable cells. Overall, the information is up-to-date, yet provides a historical perspective, so will be relevant to a number of readers from students to experts moving into this field. In summary, a good book with lots of information but a little expensive.

■ ***Roger Pickup***
CEH-Windermere

Affinity Chromatography: Methods and Protocols. Methods in Molecular Biology, Vol. 147

Edited by P. Bailon, G.K. Ehrlich, W.-J. Fung & W. Berthold
Published by Humana Press (2000)
US$79.50, pp. 240
ISBN: 0-89603-694-4

This text presents the reader with a detailed selection of methods and applications of affinity chromatography. It focuses on the cutting edge, rather than techniques that are already well established in the modern laboratory. It will be of particular use to those interested in protein biochemistry and process scale production of recombinant proteins, as well as the molecular biologist. Given the book's cost and target audience, it would be suitable for institutional purchase as well as purchase by the scientific professional. Protocols are set out for easy reference. They are concise and easily supply enough detail to ensure reproducibility by the experienced researcher. The choice of content guides the reader through complimentary technologies for drug discovery and development, as well as analytical approaches for assessing interaction between molecules. There is some elegant science as well as some surprising applications for affinity chromatography.

■ ***Gordon Rigg***
University of Manchester

Dogs, Zoonoses and Public Health

Edited by C.N.L. Macpherson, F.X. Meslin & A.I. Wandeler
Published by CABI Publishing (2000)
£65.00/US$120.00, pp. 382
ISBN: 0-85199-436-9

This book covers all the important aspects of canine population biology and the possible viral, bacterial and parasitological zoonoses carried by dogs throughout the world. Apart from well written and extensively researched chapters on the more high profile canine zoonoses (rabies, *Echinococcus* and *Toxocara*), other chapters review less well known, yet equally important canine zoonoses. All chapters are well formatted, easy to read and end with a concluding paragraph and an extensive bibliography. The publication of this book is well timed. The recent withdrawal of the rabies quarantine regulations may lead to the introduction of a number of 'exotic' canine diseases into the UK, some of which may be considered zoonotic. This book therefore would be a useful investment for all practice libraries, veterinary research establishments, veterinary schools and government Animal Health Offices.

■ ***David Wassall***
Veterinary Laboratories Agency, Weybridge

Lethal Lozenges and Tainted Tea: John Postgate and the Crusade for Safe Food

By J. Postgate
Published by Brewin Books (2001)
£11.95, pp. 90
ISBN: 1-85858-178-8

Today food scares are often in the headlines, but compared with 150 years ago our daily fare is relatively pure. In the 19th century arsenic, lead and copper compounds, as well as bulking agents such as chalk and sand, were common food additives. Medicines often contained a greater proportion of harmful than beneficial ingredients. Illness, and not infrequently death, resulted from this adulteration of food and drugs. A Birmingham doctor, chemist and lecturer, John Postgate, became aware of this evil when treating his patients and spent over 20 years of his life campaigning for legislation to stamp out the practice in the face of powerful vested interests and the indifference of most parliamentarians. In this book, John Postgate, past SGM President and well known science writer, describes the important role of his great-grandfather and namesake in the crusade for safe food. It also covers 'John the Doctor's' life and times, his genealogy and honestly appraises his character and the unhappy effect of the campaign on his own wife and family. The book is thoroughly researched and written in the lucid prose we expect from 'John the Microbiologist'. It gives due credit to a figure who has been largely ignored by historians and reveals an aspect of 19th century social history of which many readers will be unaware. Unfortunately, very few family papers have survived, resulting in a shortage of illustrations to break up the text.

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

Water Management in the Design and Distribution of Quality Foods

Edited by Y.H. Roos, R.B. Leslie & P.J. Lillford
Published by Technomic Publishing Co. Inc. (1999)
£147.00, pp. 602
ISBN: 1-56676-763-6

This book, which is the conference proceedings for the Seventh International Symposium on Properties of Water in Foods, is an authoritative, up-to-date account of all aspects of water in foods. Only about 100 of the book's 600 pages deal directly with the role of water in microbiology: these cover bacterial spores, osmotic stress, membrane damage by water flow and microbial modelling. However, much of the surrounding material is relevant; the chapters dealing with freezing stresses and freeze-induced dehydration of biological membranes are of particular interest. Curiously, there is a chapter on the interaction of water with DNA but none on water–protein interactions, this would have been valuable as the area is one in which there has been considerable progress in recent years. The wide range of this book should make it a valuable addition to one's bookshelf; unfortunately the high cost is likely to preclude this.

■ ***Peter Belton***
University of East Anglia, Norwich

Cancer Biology, Second Edition

By R.J.B. King
Published by Pearson Education Ltd (2000)
£21.99, pp. 308
ISBN: 0-582-40432-0

Many teachers in HFE will find this book a very useful teaching aid. It provides a well-rounded account of the subject, with enough medical material (e.g. on pathology, epidemiology and treatment) to make the clinical background comprehensible to the science student, while including sufficient cell biology for the biochemist or molecular geneticist. An appendix on features of selected cancers is particularly useful for the non-medic. Contentious matters such as diet are dealt with judiciously. Teaching devices such as boxes and keywords are prominent. Diagrams are soberly British in style (shades of blue provide the one colour other than black and white), clear and comprehensible, especially in the treatment of complex signalling pathways: see for instance Fig. 11.13 depicting the phosphatidylinositol system. As a bacterial geneticist who has given a cancer genetics course for over 20 years, I have found this book invaluable, and am happy to recommend it strongly.

■ ***Simon Baumberg***
University of Leeds

Prion Diseases: Diagnosis and Pathogenesis

Edited by M.H. Groschup & H.A. Kretzschmar
Published by Springer-Verlag & Co. KG (2000)
DM250.00/öS1,750.00/sFr215.00/US$129.00, pp. 290
ISBN: 3-211-83530-X

This is an excellent account of the current state of a number of areas in the TSE field, based on a meeting held in Tübingen in 1999. In particular there are some good accounts of work using transgenic mice to study the species barrier and familial forms of TSE, and to devise faster and more effective infectivity assays. These types of study have tended to be talked about and presented at meetings and it is particularly useful to have them in print. The application of diagnostic tests in field settings and the epidemiology of disease are also well reviewed and presented. I think this is a very useful volume and summary of an interesting and important area.

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

The World of the Cell, Fourth Edition

By W.M. Becker, L.J. Kleinsmith & J. Hardin (Contributor J. Raasch)
Published by Benjamin/Cummings (d/b Pearson Education) (2000)
£31.99, pp. 878
ISBN: 0-8053-4488-8

Students have never been better served for textbooks that straddle the molecular–cellular interface and my immediate reaction on receiving this book was, 'how has it survived in the face of such fierce competition?' In fact, this is an excellent introduction to cellular organization and function, not least because of its manageable length, well-chosen examples and lucidity. Perhaps inevitably, the text has a mostly eukaryotic slant. For instance, it states that '*flagella are bounded by an extension of the plasma membrane*'. With the emergence of cellular microbiology, however, tomorrow's microbiologists will need to get to grips with topics that were previously regarded as out of bounds or peripheral. This book is a generally first-rate introduction to such topics and includes some nice examples of cellular subversion by microbes. The historical vignettes that intersperse the main text enhance the book's readability and, all in all, it is a creditable rival in a highly competitive area.

■ ***David O'Connor***
University of Southampton

Flow Cytometry for Research Scientists: Principles and Applications

By R. Nunez
Published by Horizon Press (2001)
£59.99/US$119.99, pp. 112
ISBN: 1-898486-26-3

Over the last 10 years, applications of flow cytometry to microbiology have increased dramatically. Unfortunately this book fails to recognize this fact and concentrates on biomedical aspects. Despite acknowledging that flow cytometers analyse particles down to 0·3 µm there is not a single microbial example discussed other than a brief 3-page chapter on allopurinol susceptibility of *Leishmania*. The book, at 112 pages for £59.99, is an expensive addition to any library and even for the biomedical target audience does not provide much information that cannot be more fully accessed in reviews and other related books published in the last 5 years. Despite its brevity, there are 14 chapters of variable length and this means that an interesting area like molecular cytometry receives a miserly allocation of 4 pages. The text contains simple errors (notably chapter 2) and some of the figures are very poorly represented. All in all this has little to offer microbiologists and I could not recommend it even for a wider audience.

■ ***Clive Edwards***
University of Liverpool

Fields Virology, Fourth Edition, Volumes 1 and 2

Edited by D.M. Knipe, P.M. Howley, D.E. Griffin, R.A. Lamb, M.A. Martin, B. Roizman & S.E. Straus
Published by Lippincott Williams and Wilkins (2001)
US$339.00, pp. 3,087
ISBN: 0-7817-1832-5

Since its first edition in 1985, *Fields Virology* has become a widely appreciated, comprehensive textbook on virology by bringing together basic virus research and medical virology in a major way. The 4th edition delivers in full on the high standards virologists worldwide will expect from this 5-year update on the 3rd edition.
The organization of the book into part I (general aspects of virology) and part II (replication and medical aspects of particular virus families) has been retained, but in detail significant changes have been made. General principles of virus replication are now reviewed in five chapters, and the chapters on pathogenesis, immune responses, cytokines, virus evolution and antivirals reflect the rapid progress made in recent years. A new chapter deals with viral vectors and their applications. The chapter on diagnostic virology reflects the enormous progress made recently with the wide application of nucleic-acid-based detection techniques.
In the virus-specific part of the book many chapters have been completely rewritten, and all chapters have been significantly updated and consolidated. There are new chapters on arteriviruses, the *Bornaviridae* and HHV-8. Although prions are now accepted as proteinaceous infectious particles lacking nucleic acid and thus are not viruses, a thorough revision of the prion chapter has been kept in this edition.
References of most chapters are remarkably up-to-date: they all read into 1998, and many have considered important original papers of 1999 and 2000 (one even of 2001).
This is a rich, highly competent and exciting source of knowledge for many areas of virology. I have only minor points of critique relating to some (although not many) duplications, the rather abbreviated treatment of virus classification and the comparatively small emphasis on reverse genetics in the general chapter on RNA virus replication. The new edition of *Fields Virology* continues to set the highest standard for presentation of virology as a basic science and medically applied discipline alike. The book is a must for every biomedical library, for students and researchers in all areas of virology, and for countless people working in other biomedical areas. The price of the two volumes is high, but this grand opus is worth every penny of it.

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

From Genome to Therapy: Integrating New Technologies with Drug Development Novartis Foundation Symposium 229

Edited by G.R. Bock, D. Cohen & J.A. Goode
Published by John Wiley & Sons Ltd (2000)
£75.00, pp. 165
ISBN: 0-471-62744-5

This volume includes short presentations and more detailed debate around underlying issues. Although at times this format reads more like a play than an expert text, it does successfully convey to the reader areas of controversy as well as the tremendous range of approaches and views popular currently in the application of genomics to pharmaceutical discovery and development. The sections on bioethics and patents are particularly enlightening. From a microbial perspective there is some emphasis on the use of microbial genomes in drug hunting as a model for more complex areas and some fascinating ideas on the role of chronic infections such as malaria in selecting of human genotypes. This volume covers a lot of ground, including microarray, proteomics, sequencing methodologies, as well as more political issues. It is not comprehensive but will be of interest to those working or interested in pharmaceutical research.

■ ***Aileen Allsop***
AstraZeneca

Smallpox Vaccine: Ahead of its Time: How the late development of laboratory methods and other vaccines affected the acceptance of smallpox vaccine

By D. Baxby
Published by The Jenner Museum, Church Lane, Berkeley, GL13 9BH, UK (2001)
£2.50 + £1.00 p&p, pp. 36
ISBN: 0-9528695-1-9

This is a very readable booklet by an acknowledged world expert on smallpox vaccine and its history. I find the story gripping and familiar. It involves a medical intervention whose consequences with respect to safety and efficacy were not fully understood at the time. I am not sure that they are understood now; if there was a real need for smallpox vaccine it is not obvious whether you would make it in cell culture (which might, according to some, give a less effective product based on current trials using vaccinia vectors), or in animals (where the contamination possibilities and ethical questions are legion). Strong positions were taken for and against the vaccine at the time, which gives the story a very modern feel to it. For instance there seem to be parallels with the long-running current argument about a link between measles mumps and rubella vaccines and Crohn's disease/autism. The evidence for a connection is feeble in my opinion, although it is heavily promoted by the media and the anti-vaccine camp. On the other hand there are clear (although in my view irrelevant) major holes in our understanding of how the vaccine does its business. Very thought-provoking.

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

The Yeast Nucleus. Frontiers in Molecular Biology, Vol. 33

Edited by P. Fantes & J. Beggs
Published by Oxford University Press (2000)
£32.50, pp. 316
ISBN: 0-19-963772-5

Seventeen internationally respected authors have contributed to this scholarly volume of reviews on *Saccharomyces cerevisiae* and *Schizosaccharomyces pombe*. There is excellent coverage of the cell cycle, transcription, chromosome structure and transport, but there is a noticeable shortage of material on DNA transactions. Except for a short and out-of-place chapter on *S. cerevisiae* functional analysis, most are substantive at 35 pages long. Reviews do two valuable things: they explain clearly the state of play in a developing area and they provide convenient tables and illustrative diagrams. The first is dealt with superbly, but the latter is inadequate with few figures (one per six pages) and half that frequency of tables. The index is unhelpful because it is mostly a list of genes – but there are 1,400 references! The potential audience is the expert and the price makes it competitive for both personal and institutional purchase.

■ ***Alan Wheals***
University of Bath

Immunology, Immunopathology, and Immunity, Sixth Edition

By S. Sell (Contributing author E.E. Max)
Published by ASM Press (2001)
US$69.95, pp. 774
ISBN: 1-55581-202-3

This book is a rarity, and nowadays a challenge, in that a huge area of research and clinical practice is comprised under a single author's name (with the exception of chapter 4). The book has developed over a period of almost 30 years and originated from both teaching and postgraduate research. About one-third of the space is occupied by chapters on basic immunology, and the rest by reviews on clinical immunology, emphasizing the understanding of immune defences as a 'double-edged sword' which can restitute health by neutralization or lysis of micro-organisms, but also contribute to disease (immunopathology).
I found most chapters very well done and mostly up-to-date. The molecular basis of many of the immune phenomena is clearly presented and supported by special references reaching into the late 1990s at the end of chapters. Aspects of vaccine development would in my opinion have deserved a more comprehensive and less scattered coverage. Some aspects of recent immunology research, i.e. the use of knock-out mice, are not yet included. The overview of immune complex diseases is fascinating.
In summary, I regard this book as very stimulating for undergraduate and postgraduate students of medicine and biological sciences alike. It represents excellent value for its price, and I wish it a wide distribution.

■ ***Ulrich Desselberger and D. S. Kumararatne***
Addenbrooke's Hospital, Cambridge

The Hepatitis C Viruses. Current Topics in Microbiology and Immunology, Vol. 242

Edited by C.H. Hagedorn & C.M. Rice
Published by Springer-Verlag & Co. KG (2000)
DM379.00/öS2,767.00/sFr342.00/£146.00/US$239.00, pp. 391
ISBN: 3-540-65358-9

Research into hepatitis C virus (HCV) has progressed rapidly in recent years and it is inevitable that reviews of the field will soon become outdated. Nevertheless, this book comprises an excellent selection of chapters that together provide a comprehensive and authoritative overview of our knowledge of HCV up to, and including, 1999. Although the main emphasis of the book is on

the molecular aspects of virus structure and function, it does include important chapters on the epidemiology of the virus, animal models and the immune response to infection. The chapters are well referenced and are authored by some of the leading researchers in the field. Although it is rather expensive, it would be a worthy addition to the shelves of any laboratory engaged in research into this virus.

■ ***Dave Rowlands***
University of Leeds

Proteome Research: Mass Spectrometry

By P. James
Published by Springer-Verlag GmbH & Co. KG (2001)
DM98.00/öS716.00/sFr86.50/£34.00/US$49.95, pp. 250
ISBN: 3-540-67256-7

This book provides a snapshot of a rapidly developing field. The authors are all leading researchers who have made major contributions to proteomics. There are a few surprising gaps. One particularly noteworthy omission is that the hybrid quadrupole/Time-of-Flight mass spectrometer receives only a cursory mention. These instruments first appeared in 1996 and have very rapidly established themselves as the LC/MS/MS instruments for peptide sequencing. A further disappointment is the absence of any discussion of staining procedures compatible with MALDI-ToF, although it is possible that other volumes in the series may cover this area.
Despite these omissions, the book deserves a strong recommendation. It is very well written and covers a wide range of practical and theoretical issues. It will be useful as a primer to those entering the field, as a handbook for practitioners, and as a reference publication for institutional purchase.

■ ***Fred A. Mellon***
Institute of Food Research, Norwich

100 Years of Virology. The Birth and Growth of a Discipline

Edited by C.H. Calisher & M.C. Horzinek
Published by Springer-Verlag & Co. KG (1999)
öS1736.00/DM248.00/sFr224.00/US$146.00, pp. 220
ISBN: 3-211-83384-6

This nicely produced but rather expensive book is a virologist's 'coffee table' volume and a must for aficionados of the history of virology. Virology was born as a new field of biological science in 1898 when Beijerinck showed that the infectious agent causing tobacco mosaic disease was replicated in plants but was not a bacterial agent and at about the same time Loeffler and Frosch made similar observations with foot-and-mouth disease. Two meetings in Germany and Holland, close to the sites where this work was done, were organized to celebrate the centenary of these momentous discoveries and selected presentations from these meetings are collected in this book. The first few chapters are devoted to the histories of the people and places involved in the initiation of this new science of virology. The remainder cover an eclectic mix of topics by a number of eminent virologists. Overall, a good read.

■ ***Dave Rowlands***
University of Leeds

RNA-Binding Antibiotics. Molecular Biology Intelligence Unit 13

Edited by R. Schroeder & M.G. Wallis
Landes Bioscience (2001)
US$119.00, pp. 181
ISBN: 1-58706-012-4

This book develops from the growing understanding that catalytic RNA is critical in the activity of the ribosome, and perhaps responsible for the peptidyl transferase activity itself. Based on this premise it provides state-of-the-art reviews with impressive technical detail on the interactions of different antibiotics with RNA. Obscure agents, such as viomycin and bleomycin, are covered, as well as more familiar aminoglycosides and tetracyclines. Strategies for docking drugs with RNA are explored, as are discovery strategies for new RNA-binding agents. The book will be invaluable to the pharmaceutical chemist or biochemist concerned with ribosomal function and antibiotic development. It makes few compromises to the more general scientific reader, let alone to the clinical user of these antibiotics. Overall, a wealth of detail for the specialist, though the lack of an index is regrettable. The individual articles are available gratis at **http://www.eurekah.com**, allowing prospective purchasers a useful preview.

■ ***D.M. Livermore***
Central Public Health Laboratory, Colindale

Applied Microbial Systematics

Edited by F.G. Priest & M. Goodfellow
Published by Kluwer Academic Publishers (2000)
NLG460.00/US$225.00/£143.00, pp. 479
ISBN: 0-412-71660-7

This is an eminently readable book which achieves what it says on the back cover, '*to understand how systematics can enhance microbiology beyond the routine of classification, nomenclature and identification*'. The various authors achieve this through a rather eclectic set of case studies, but the overall message remains coherent that a clear understanding of the taxonomy of a group can contribute substantially to the understanding of its biology and biotechnological applications. It was a pleasure to read chapters on groups about which I know very little, but still to feel as though I was on familiar ground through the framework of the systematics itself. The title might sound dull: the book isn't! It is hard to see what Kluwer have done to justify the cover price, though, because the volume lacks the subject index promised in the contents and clearly has not benefitted from the attention of a copy-editor, which is a shame.

■ ***Dave Roberts***
Natural History Museum, London

Super Bugs: Rogue Diseases of the Twenty-first Century

By P. Moore
Published by Carlton Books Ltd (2001)
£14.99, pp. 222
ISBN: 1-84222-179-5

In the genre of popular science, the author attempts to bring to life some of the events surrounding the dry facts of newly emerging pathogens and antimicrobial resistance. Vignettes of some individual important case histories are well drawn, and provide the kind of intimate detail which fleshes out the historical records. This is an enjoyable read, styled in the manner of newspaper articles, and is recommended for undergraduates and anyone interested in broad issues of human microbial pathogens. A good Christmas stocking filler, if you can afford the hardback price of £14.99.

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

Marek's Disease. Current Topics in Microbiology and Immunology, Vol. 255

Edited by K. Hirai
Published by Springer-Verlag & Co. KG (2001)
DM289.00/öS2,110.00/sFr249.00/£99.50/US$149.00, pp. 296
ISBN: 3-540-67798-4

This is an excellent volume on the biology of Marek's disease virus (MDV). The Editor, has assembled the great and the good to cover all aspects of the agent and disease. Peter Biggs gives an excellent account of the history of Marek's disease and the biology of the virus, highlighting the role of the Houghton Poultry Research Station in many of the key discoveries. Other chapters deal with the pathology of MDV, vaccination against the disease, immunology of the infection, genetic resistance, the virus genome structure and organization, and mechanisms of latency and oncogenesis, in particular the role of *meq*. This comprehensive overview should appeal to all in the field of herpesvirology, whether from a medical or veterinary background. If you don't already subscribe to the CTMI series then this volume is well worth the investment.

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

Molecular Biology of Human Hepatitis Viruses

By J. Monjardino
Published by Imperial College Press (1999)
£16.00, pp. 133
ISBN: 1-86094-048-X

This little book provides thumbnail sketches of the structure and molecular biology of the five known human hepatitis viruses, together with brief descriptions of their epidemiology and pathogenesis. The final chapter deals with the more recently identified hepatitis G virus or GBV-C, although the definite association of infection with this virus and the development of liver disease is now less than certain. The human hepatitis viruses are a taxonomically diverse collection of agents whose only common feature is their tissue tropism and ability to cause liver disease. The book provides a good introduction and foundation for the study of this disparate group of viruses and the low price will make it readily accessible to students of microbiology, virology and medicine. The text is marred in places by rather a large number of typographical errors.

■ ***Dave Rowlands***
University of Leeds

Address Book

Council 2001–2002

Officers

President
PROF. SIR DAVID HOPWOOD
John Innes Centre,
Norwich Research Park,
Colney, Norwich NR4 7UH
Tel. 01603 450000
01603 450338 (direct)
Fax 01603 450045
email david.hopwood@bbsrc.ac.uk

Treasurer
MR PETER F. STANBURY
Department of Biosciences,
Faculty of Natural Sciences,
University of Hertfordshire,
Hatfield Campus,
Hatfield AL10 9AB
Tel. 01707 284550
Fax 01707 285258
email p.f.stanbury@herts.ac.uk

General Secretary
PROF. ALAN VIVIAN
Centre for Research in Plant Science,
Faculty of Applied Sciences,
University of the West of England,
Coldharbour Lane,
Bristol BS16 1QY
Tel. 0117 344 2470
Fax 0117 344 2904
email alan.vivian@uwe.ac.uk

Scientific Meetings Officer
PROF. HOWARD JENKINSON
Department of Oral and Dental Science,
Division of Oral Medicine, Pathology and Microbiology,
University of Bristol Dental Hospital and School,
Lower Maudlin Street,
Bristol BS1 2LY
Tel. 0117 928 4358 (direct)
0117 928 4304 (office)
Fax 0117 928 4428
email howard.jenkinson@bristol.ac.uk

International Secretary
PROF. SIR JOHN E. BERINGER
School of Biological Sciences,
University of Bristol,
Wood land Road,
Bristol BS8 1UG
Tel. 0117 928 7471
Fax 0117 925 7374
email jberinger@bristol.ac.uk

Education Officer
DR LIZ (R.E.) SOCKETT
Genetics Division, School of Clinical Laboratory Sciences,
Queen's Medical Centre,
University of Nottingham,
Nottingham NG7 2UH
Tel. 0115 919 4496
Fax 0115 970 9906
email liz.sockett@nottingham.ac.uk

Editor, Microbiology Today
DR MERIEL G. JONES
School of Biological Sciences,
Donnan Laboratories,
University of Liverpool,
Liverpool L69 7ZD
Tel. 0151 794 3605
Fax 0151 794 3655
email meriel.jones@liv.ac.uk

Editor-in-Chief, Microbiology
PROF. CHRISTOPHER M. THOMAS
School of Biosciences, University of Birmingham, Edgbaston,
Birmingham B15 2TT
Tel. 0121 414 5903
Fax 0121 414 5925
email c.m.thomas@bham.ac.uk

Editor-in-Chief, JGV
PROF. STUART SIDDELL
Division of Virology,
Department of Pathology and Microbiology,
School of Medical Sciences,
University of Bristol,
University Walk,
Bristol BS8 1TD
Tel. 0117 928 7889
Fax 0117 928 7896
email stuart.siddell@bristol.ac.uk

Members

PROF. ALASTAIR J.P. BROWN
Molecular and Cell Biology,
Institute of Medical Sciences
University of Aberdeen,
Foresterhill,
Aberdeen AB25 2ZD
Tel. 01224 273183
Fax 01224 273144
email al.brown@abdn.ac.uk

PROF. RICHARD M. ELLIOTT
Institute of Virology,
University of Glasgow,
Church Street,
Glasgow G11 5JR
Tel. 0141 330 4024
Fax 0141 337 2236
email elliott@vir.gla.ac.uk

DR PAULINE S. HANDLEY
School of Biological Sciences,
1.800 Stopford Building,
University of Manchester,
Oxford Road,
Manchester M13 9PT
Tel. 0161 275 5265
Fax 0161 275 5656
email p.handley@man.ac.uk

DR COLIN R. HARWOOD
Department of Microbiology & Immunology,
University of Newcastle,
Framlington Place,
Newcastle upon Tyne NE2 4HH
Tel. 0191 222 7708
Fax 0191 222 7736
email colin.harwood@ncl.ac.uk

PROF. COLIN R. HOWARD
Department of Pathology & Infectious Diseases,
The Royal Veterinary College,
Royal College Street,
Camden,
London NW1 0TU
Tel. 0207 468 5302
Fax 0207 383 4670
email choward@rvc.ac.uk

DR KEITH JONES
Department of Biological Sciences, IENS,
University of Lancaster,
Lancaster LA1 4YQ
Tel. 01524 593993
Fax 01524 843854
email k.jones@lancaster.ac.uk

PROF. DAVE J. KELLY
Department of Molecular Biology & Biotechnology,
Krebs Institute,
University of Sheffield,
Firth Court,
Western Bank,
Sheffield S10 2TN
Tel. 0114 222 4414
Fax 0114 272 8697
email d.kelly@sheffield.ac.uk

PROF. HILARY M. LAPPIN-SCOTT
School of Biological Sciences,
Exeter University,
Hatherly Laboratories,
Prince of Wales Road,
Exeter EX4 4PS
Fax 01392 263700
email h.m.lappin-scott@exeter.ac.uk

DR LYNNE E. MACASKIE
School of Biological Sciences,
University of Birmingham,
Edgbaston,
Birmingham B15 2TT
Tel. 0121 414 5889
Fax 0121 414 5925
email l.e.macaskie@bham.ac.uk

PROF. TONY A. NASH
Department of Veterinary Pathology,
University of Edinburgh,
Summerhall,
Edinburgh EH9 1QH
Tel. 0131 650 6164
Fax 0131 650 6511
email tony.nash@ed.ac.uk

PROF. IAN R. POXTON
Department of Medical Microbiology,
University of Edinburgh
Medical School,
Teviot Place,
Edinburgh EH8 9AG
Tel. 0131 650 3128
Fax 0131 650 6531
email i.r.poxton@ed.ac.uk

PROF. IAN S. ROBERTS
School of Biological Sciences,
1.800 Stopford Building,
University of Manchester,
Oxford Road,
Manchester M13 9PT
Tel. 0161 275 5601
Fax 0161 275 5656
email isrobert@fs1.scg.man.ac.uk

Group Conveners

Cells & Cell Surfaces
DR DAVID (C.D.) O'CONNOR
Division of Biochemistry & Molecular Biology
School of Biological Sciences,
University of Southampton,
Bassett Crescent East,
Southampton SO16 7PX
Tel. 02380 594336
Fax 02380 594459
email doc1@soton.ac.uk

Clinical Microbiology
PROF. STEPHEN H. GILLESPIE
Department of Medical Microbiology,
Royal Free & University College Medical School,
Rowland Hill Street,
London NW3 2PF
Tel. 0207 794 0500
Fax 0207 794 0433
email stepheng@rfc.ucl.ac.uk

Clinical Virology
DR TIM WREGHITT
Clinical Microbiology and Public Health Laboratory,
Addenbrooke's Hospital,
Cambridge CB2 2QW
Tel. 01223 257030
Fax 01223 242775
email tim.wreghitt@msexc.addenbrookes.anglox.nhs.uk

Education
DR PETER WYN-JONES
School of Sciences, Darwin Building,
University of Sunderland,
Wharncliffe Street,
Sunderland SR1 3SD
Tel. 0191 515 2520
Fax 0191 515 2531
email peter.wyn-jones@sunderland.ac.uk

Environmental Microbiology
DR KIRK T. SEMPLE
Department of Environmental Science,
Institute of Environmental and Natural Sciences,
University of Lancaster,
Lancaster LA1 4YQ
Tel. 01524 594534
Fax 01524 593985
email k.semple@lancaster.ac.uk

Eukaryotic Microbiology
DR CLIVE PRICE
Department of Biological Sciences,
University of Lancaster,
Lancaster LA1 4YQ
Tel. 01524 593137
Fax 01524 843854
email c.price1@lancaster.ac.uk

Fermentation & Bioprocessing
DR GLYN HOBBS
School of Biomolecular Sciences,
Liverpool John Moores University,
Byrom Street,
Liverpool L3 3AF
Tel. 0151 231 2198
Fax 0151 207 4726
email g.hobbs@livjm.ac.uk

Food & Beverages
PROF. TOM HUMPHREY
Department of Clinical Veterinary Science,
University of Bristol,
Langford House,
Langford,
Bristol BS18 7DT
Tel. 01179 289280
Fax 01934 853145
email tom.humphrey@bristol.ac.uk

Irish Branch
DR CATHERINE O'REILLY
Department of Chemical and Life Sciences,
Waterford Institute of Technology,
Cork Road,
Waterford,
Ireland
Tel. +353 51 302626
Fax +353 51 378292
email coreilly@wit.ie

Microbial Infection
DR PETRA C.F. OYSTON
Department of Microbiology,
DSTL,
CBS Porton Down,
Salisbury SP4 0JQ
Tel. 01980 613641
Fax 01980 613284
email poyston@hotmail.com

Physiology, Biochemistry & Molecular Genetics
DR DAVID A. HODGSON
Department of Biological Sciences,
University of Warwick,
Coventry CV4 7AL
Tel. 024 7652 3559
Fax 024 76 52 3701
email dm@dna.bio.warwick.ac.uk

Systematics & Evolution
DR GERRY SADDLER
Head of Diagnostics and Molecular Biology,
Scottish Agricultural Science Agency,
82 Craigs Road,
East Craigs,
Edinburgh EH12 8NJ
Tel. 0131 244 8925
Fax 0131 244 8940
email gerry.saddler@sasa.gov.uk

Virus
PROF. GEOFFREY L. SMITH
Wright-Fleming Institute,
Imperial College School of Medicine,
St. Mary's Campus,
Norfolk Place,
London W2 1PG
Tel. 0207 594 3971/2
Fax 0207 594 3973
email glsmith@ic.ac.uk

Diary

december 2001

IMMUNOLOGY: BASIC TERMS AND TECHNIQUES
A ONE-DAY LABORATORY/LECTURE COURSE

University of Hertfordshire, Hatfield, 18 December 2001

CONTACT: Dr Ralph Rapley, Department of Biosciences, University of Hertfordshire, College Lane, Hatfield, Herts AL10 9AB (Tel. 01707 285097; Fax 01707 286137; email r.rapley@herts.ac.uk; http://www.herts.ac.uk/natsci/STC)

march 2002

MOLECULAR BIOLOGY UPDATE
A FOUR-DAY LABORATORY/LECTURE COURSE

University of Hertfordshire, Hatfield, 25–28 March 2002

CONTACT: Dr Virginia Bugeja, Department of Biosciences, University of Hertfordshire, College Lane, Hatfield, Herts AL10 9AB (Tel. 01707 285948; Fax 01707 286137; email v.bugeja@herts.ac.uk; http://www.herts.ac.uk/natsci/STC)

april 2002

WAM 2002 – A MICROBIOLOGICAL ODYSSEY

Southampton 19–21 April 2002

CONTACT: Jane Pike, Chair, Wessex Applied Microbiologists (email jane.pike@doh.gsi.gov.uk) or Andy Barber (Tel. 01202 442282 http://www.wam2002.org)

NSF INTERNATIONAL SYMPOSIUM: HPC BACTERIA IN DRINKING WATER – PUBLIC HEALTH IMPLICATIONS?

Geneva, Switzerland 22–24 April 2002

CONTACT: NSF Conference Services, 789 North Dixboro Road, PO Box 130140, Ann Arbor MI 48105, USA (Tel. +1 734 913 5789; Fax +1 734 827 7187; email conferences@nsf.org; http://www.nsf.org/conference/hpc)

may 2002

VIII PLANT VIRUS EPIDEMIOLOGY SYMPOSIUM: FIRST STEPS INTO THE NEW MILLENNIUM

Aschersleben, Germany 12–27 May 2002

CONTACT: t.kühne@bafz.de (http://virus-2002.bafz.de)

INFLUENCE OF ABIOTIC AND BIOTIC FACTORS ON BIOCONTROL AGENTS: SEVENTH MEETING OF THE WORKING GROUP ON BIOLOGICAL CONTROL OF FUNGAL AND BACTERIAL PLANT PATHOGENS

Kusadasi, Turkey 22–26 May 2002

CONTACT: Yigal Elad, Department of Plant Pathology, The Volcani Center, Bet Dagan 50250, Israel (Tel. +972 3 9683580; Fax +972 3 9683688; email elady@netvision.net.il)

june 2002

RRI-INRA 2002: BEYOND ANTIMICROBIALS – THE FUTURE OF GUT MICROBIOLOGY

Aberdeen, 12–15 June 2002

CONTACT: Dr R.J. Wallace, Rowett Research Institute, Bucksburn, Aberdeen AB21 9SB (Fax +44 1224 716687; email rjw@rri.sari.ac.uk; http://www.rri.sari.ac.uk/RRI-INRA2002)

MOLECULAR BIOLOGY: BASIC TERMS AND TECHNIQUES
A ONE-DAY LABORATORY/LECTURE COURSE

University of Hertfordshire, Hatfield, 26 June 2002

CONTACT: Dr Ralph Rapley *(see above)*

june–july 2002

ANAEROBE OLYMPIAD 2002. 6TH BIENNIAL CONGRESS OF THE ANAEROBE SOCIETY OF THE AMERICAS

Park City, Utah, USA 29 June–2 July 2002

CONTACT: Anaerobe Society of the Americas, PO Box 452058, Los Angeles, CA 90045-8526 (Tel. +1 310 216 9265; Fax +1310 216 9274; email asa@anaerobe.org; www.anaerobe.org)

july 2002

9TH INTERNATIONAL SYMPOSIUM ON THE GENETICS OF INDUSTRIAL MICRO-ORGANISMS (GIM-2002)

Gyeongju, Korea 1–5 July 2002

CONTACT: GIM-2002 Secretariat, Intercom Convention Services Inc., 4th Floor, Jiseong Building, 645-20 Yeoksam 1-dong, Gangnam-gu, Seoul 135-910, Korea (Tel. +82 2 501 7065/566 6339; Fax +82 2 565 2434/3452 7292; email gim2002@intercom-pco.co.kr; http://www.gim2002.or.kr)

RNA EXTRACTION AND ANALYSIS
A ONE-DAY LABORATORY/LECTURE COURSE

University of Hertfordshire, Hatfield, 4 July 2002

CONTACT: Dr Ralph Rapley *(see above)*

PCR METHODS AND APPLICATIONS
A ONE-DAY LABORATORY/LECTURE COURSE

University of Hertfordshire, Hatfield, 5 July 2002

CONTACT: Dr Ralph Rapley *(see above)*

ANTI-INFECTIVES: THE WAY FORWARD (INSTITUTE OF BIOLOGY AND ACADEMY OF PHARMACEUTICAL SCIENTISTS, WITH THE SUPPORT OF THE BRITISH ELECTROPHORESIS SOCIETY AND THE ROYAL PHARMACEUTICAL SOCIETY OF GREAT BRITAIN)

London, 8–9 July 2002

CONTACT: Amy Scales, IoB Conferences, Institute of Biology, 20–22 Queensberry Place, London SW7 2DZ

DOROTHY HAVEMEYER FOUNDATION WORKSHOP ON *RHODOCOCCUS EQUI* & EQUINE RHODOCOCCAL PNEUMONIA

Washington, DC, USA 13–17 July 2002

CONTACT: Washington State University: Dr Steve Hines (email shines@vetmed.wsu.edu). UK: Dr Iain Sutcliffe (email iain.sutcliffe@sunderland.ac.uk)

AMERICAN SOCIETY FOR VIROLOGY 21ST ANNUAL SCIENTIFIC MEETING

Lexington, Kentucky, USA 21–25 July 2002

CONTACT: Sidney E. Grossberg, Secretary-Treasurer, American Society for Virology, Dept of Microbiology and Molecular Genetics, Medical College Wisconsin, 8701 Watertown Plank Road, Milwaukee, WI 53226-0509 USA (Tel. +1 414 456 8104; Fax +1 414 456 6566; email segrossb@mcw.edu; www.mcw.edu/asv)

6TH INTERNATIONAL MEETING ON MOLECULAR EPIDEMIOLOGY AND EVOLUTIONARY GENETICS IN INFECTIOUS DISEASES (MEEGID-VI)

Institut Pasteur, Paris, France 24–27 July 2002

CONTACT: Altaf Lal (aal1@cdc.gov), Michel Tibayrenc (Michel.Tibayrenc@mpl.ird.fr), Geneviève Milon (gmilon@pasteur.fr) or Patrick Grimont (pgrimont@pasteur.fr)

september 2002

9TH INTERNATIONAL SYMPOSIUM ON NITROGEN FIXATION WITH NON-LEGUMES

Leuven, Belgium 1–5 September 2002

CONTACT: Anita Vermassen, Katholieke Universiteit Leuven, Centre of Microbial and Plant Genetics, Kasteelpark Arenberg 20, B-3001 Heverlee, Belgium (Tel. +32 16 32 16 31; Fax +32 16 32 19 63, email cmpg@agr.kuleuven.ac.be)

ROYAL MICROSCOPICAL SOCIETY IMMUNOCYTOCHEMISTRY COURSE

Oxford, 2–6 September 2002

CONTACT: The Administrator, Royal Microscopical Society, 37/38 St Clements, Oxford OX4 1AJ (Tel. 01865 248768; Fax 01865 791237; email info@rms.org.uk; http://www.rms.org.uk)

ROYAL MICROSCOPICAL SOCIETY FLOW CYTOMETRY COURSE

Sheffield 9–13 September 2002

CONTACT: Rebecca Morden, Royal Microscopical Society, 37/38 St Clements, Oxford OX4 1AJ (Tel. 01865 248768; Fax 01865 791237; email rebecca@rms.org.uk; http://www.rms.org.uk)

FIFTH INTERNATIONAL CONFERENCE OF THE HOSPITAL INFECTION SOCIETY

EICC, Edinburgh 15–18 September 2002

CONTACT: Concorde Services/HIS2002, Unit 4b, 50 Speirs Wharf, Port Dundas, Glasgow G4 9TB (Tel. 0141 331 0123; Fax 0141 331 0234; email his@concorde-uk.com; http://www.his2002.co.uk)

october 2002

8TH SYMPOSIUM OF AQUATIC MICROBIAL ECOLOGY (SAME-8)

Taormina-Messina, Italy 25–30 October 2002

CONTACT: Scientific Secretariat, Istituto Sperimentale Talassografico, Spianata S. Ranieri, 86 98122 Messina, Italy (Tel. +39 090 669003; Fax +39 090 669007; http://www.same-8.it)

Comment

BSE/vCJD: A calm in the storm?

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

Sources of data

Worldwide BSE cases: http://ourworld-top.cs.com/j1braakman/BSE.htm

UK cases of CJD month by month http://www.doh.gov.uk/cjd/stats/jan01.htm

Treatments for TSEs on the way: http://sparc.airtime.co.uk/bse//Treatmentall.html

Diagnostic test systems being developed for BSE/vCJD: www.airtime.co.uk/bse/adco.htm

Further reading

Doh-Ura, K., Iwaki, T. & Caughey, B. (2000). Lysosomotropic agents and cysteine protease inhibitors inhibit scrapie-associated prion protein accumulation. *J Virol* 74, 4894–4897

Rabenau, H.F., Cinatl, J. & Doerr, H.W. (eds). *Prions: A Challenge for Science, Medicine and Public Health Systems.* Basel: Karger.

Dealler, S.F. (2001). Should young UK cattle be considered free of BSE or is it endemic? *Br Food J* 4, 264–280.

While BSE fades, the vCJD is rising. I will try to explain how good news may in fact be round the corner.

Clinical cases of bovine spongiform encephalopathy (BSE) first certainly appeared in small numbers in the UK in around 1983 although we did not realise it until 1986, and even then it was thought an interesting but rare condition. It was only when we could see the numbers rising rapidly that we understood just how serious it was. We now know that over a million cattle were infected, that we ate over 80% of them and that only around 181,000 cattle have been seen as clinical cases. On average everyone in the UK has eaten 50 meals made of the tissues of infected cattle. The number of infected humans could be somewhere between 1,000 and ten million. The first variant Creutzfeldt-Jakob disease (vCJD) cases (now known to be infected with the same strain of prion as BSE) appeared in late 1995. The incidence increased dramatically in 2000 and again in 2001, as if entering an epidemic rise. Predictions that human cases would peak in the next 3-5 years might indicate the total number to be low but other calculations suggest a much later peak will be reached between 2010 and 2020, followed by a long slow decline, resulting in a higher number of cases.

We are now at the point in the UK where BSE cases have faded to around 50 per month, with few animals born (so far) after the 1996 ban on bovine materials ending up in cattle food. Congratulations and a lot of crossed fingers in the meat industry tell us that BSE in the UK is on its way out. Look across the Channel, however and the numbers are rising rapidly. In Germany they only really stopped feeding infectious material to cattle in October 2000 so their epidemic peak will not be reached until 2005. BSE cases have been incubating in large numbers in Europe for the last 5 years and meal made from unwanted bovine products to feed cattle has been exported around the world. BSE is now appearing further and further away with cases reported in Spain, the Czech Republic, Greece, and Hungary. The Food and Agriculture Organization has recently issued an international message telling everyone to stop feeding cattle with bovine products, no matter what the source, as it expects BSE to be present everywhere in small amounts already.

So at the moment there is calm here in the UK but a storm is brewing: vCJD cases are rising but the cases currently without symptoms are the problem. In such people we must assume infectivity to be throughout the body. For example, vCJD prions may be in their blood and it follows that current UK blood donations may be from an infected person; also the prions will be in body tissues and so surgical instruments will be contaminated after an operation on an infected person. The cost of discarding surgical equipment and importing blood products is currently being covered by Government funding. What is needed desperately is a diagnostic test but if we had one, potentially large numbers of people would be told they are to die of vCJD with no treatment available.

Well, all that was until very recently! Prusiner's group in California demonstrated an old anti-malarial, quinacrine, to be active against the build up of prions in cell cultures. A Warrington 20 year old, Rachel Forber, diagnosed with vCJD, and told that there was no treatment, went over to San Francisco and was treated aggressively with the drug. Her father is determined that she is improving. A second patient started the drug in London at the end of August and full-scale clinical trials are being organized in the UK.

The diagnostic field for BSE/vCJD is not looking quite so blank as it had been only 3 months ago either. One group in Geneva has managed to get prions to multiply in test tubes, potentially to numbers large enough for our current tests to find them. The inventor tells the media that he is hoping the process will be available in a few years. In the meantime, Ruth Gabizon's group in Israel has shown an altered form of the prion to be present in the urine early in the incubation period of mice. She is expecting the test to be available within a year. In London a company is now predicting its test of blood to be available around the same time and that it will be adequately practical for the screening of large numbers of samples.

Is there light at the end of the tunnel? Will we test all the cattle we eat, and screen people before surgery or dentistry? Will we be able to avoid all the CJD risks from blood transfusion and treat the asymptomatic blood donors that we find with the tests? My own opinion is: Yes, the good news in on the way. We may end up testing everyone, but at the moment the UK owes the world a lot for our BSE so we must not stop now.

● ***Dr Stephen Dealler is Consultant Medical Microbiologist at Burnley General Hospital, Burnley BB10 2PQ. He has been working on BSE since 1989, focusing on human risk, diagnostic tests and the treatment of any disease condition that may appear in humans as a result of BSE.***

Table 1. vCJD in UK

Year	1995	1996	1997	1998	1999	2000	2001
Cases	3	10	10	18	15	28	38*

*Predicted for 2001 at current rates.

Table 2. European BSE

Country	1999	2000	2001*	Country	1999	2000	2001*
Belgium	3	9	22	Greece	0	0	1
Czech Rep.	0	0	2	Italy	0	0	23
Denmark	0	1	3	Netherlands	2	2	12
France	31	162	140	Portugal	170	163	44
Germany	0	7	94	Spain	0	2	57

*Until August, if known.