Quarterly SGM

VOLUME 25 PART 2

MAY 1998

- New-look IJSB published
- The changing face of HIV
- Molecular archaeology
- Genome sequencing
- NHS – 50 years on

PUBLISHED BY THE SOCIETY FOR
GENERAL MICROBIOLOGY

Quarterly

Volume 25
Part 2 • May 1998

CONTENTS

Articles

Regular Features

Other Items

APOLOGY

WE REGRET the late publication and distribution of the February *Quarterly* which led to members receiving the programme booklet for the Society's spring meeting close to the deadline for the receipt of bookings. This was due to a breakdown in the machinery at the printers and was beyond our control. The deadline was in fact extended to allow for any delay but we apologize for any inconvenience that may have been caused to members.

Front cover: The first issue of the new-look International Journal of Systematic Bacteriology, now published by SGM, was delivered on 16 March. The second issue is nearly complete and will be published soon. See p. 76.

REMEMBER! Always quote your Membership number in any correspondence.

SGM Headquarters: Marlborough House, Basingstoke Road, Spencers Wood, Reading RG7 1AE (Tel. 0118 988 1800; Fax 0118 988 5656; Email quarterly@socgenmicrobiol.org.uk).

SGM Website: http://www.socgenmicrobiol.org.uk

Editor: Dr Dave McL. Roberts

Managing Editor: Janet Hurst

Production Editor: Ian Atherton

Production Assistant and Book Review Manager: Janice Meekings

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

ISSN: 0142-7547

COPY DATES

Last dates for receipt of copy at Marlborough House are:

Issue	General Copy	Advertisements (camera-ready copy)
August	15 May	15 June
November	11 September	12 October

Advertisements *– all enquiries should be sent to Ina Cocks, NWH Sales Ltd, Cedar House, Cedar Lane, Frimley, Surrey GU16 5HY (Tel. 01276 685111; Fax 01276 685011).*

Special Mailings *– all enquiries should be sent to Janice Meekings, SGM Headquarters (Tel. 0118 988 1802; Fax 0118 988 5656; Email j.meekings@socgenmicrobiol.org.uk).*

COMMENT

The Food Standards Agency

Most wealthy countries in the world have just started, are in the middle of, or have just finished reforming their systems for making food policy. This gives one clear strong message. It is that none of the current systems work particularly well. One doesn't have to be an expert in food safety to work out why politicians are acting now. Food scares have been too common and too prominent for comfort.

The publication of the Government's White Paper *The Food Standards Agency. A Force for Change* in January of this year marks the beginning of this reforming process for the UK. Will it be successful? The best way to start answering this question is to look at some of the important challenges that the Agency will face and examine how it is supposed to deal with them.

The second of the nine guiding principles of the Agency (the first is its mission – the protection of public health) is that "the Agency's assessments of food standards and safety will be unbiased and based on the best available scientific advice, provided by experts invited in their own right to give independent advice." Microbiologists know only too well how difficult the giving of that advice can be. Reflect on BSE and *E. coli* O157. Both are new. That gives us a good excuse when we say, rightly, that our scientific understanding of them is incomplete. For BSE, of course, the problem is compounded by enormously long incubation periods and an agent so difficult to handle that we haven't purified it to homogeneity yet – even if it is a protein, which some make a good case for doubting. For *E. coli* O157, despite our encyclopaedic knowledge of the species as a whole, we haven't the vaguest idea why human infections are four times commoner in Scotland than in England. These deficiencies are embarrassing enough. Even more difficult to admit is the degree of ignorance we have about the basic biology of *Campylobacter*. Although the commonest cause of food poisoning with 50,000 bacteriologically confirmed cases annually and despite a good deal of research effort over the years, we cannot say what the source of infection is for the overwhelming majority of human infections. So the scientists advising or working for the Agency are going to have a hard, if interesting, time. It is just as well that it will have a science budget!

The White Paper is, however, unclear about the exact limits of the Agency's research portfolio. It concerns itself mostly with activities which will not be the responsibility of the Agency. It proposes a review of the borderline programmes relevant to the responsibilities of both the Agency and Agriculture and Health Departments. This might be a useful mechanism for working out ground rules to determine boundaries. On the other hand it could provide an opportunity to limit the role of the Agency. It is suggested that co-ordination might best be done through R&D consultative committees. This implies that a good deal of research which the Agency should know about will remain with other bodies. In some areas at least the existence of these committees could constrain the freedom of the Agency to set its own research agenda. Let us hope not.

So there is still a good deal to play for. It is up to microbiologists to make their voice heard. Whatever funding mechanisms finally emerge we must make sure that the sums voted are sufficient for us to sort out the questions that policy makers – and the public – need answers to now. Taking into account the range of topics that the Agency will have to cover, the White Paper's suggested £25 million research budget is far from excessive.

Providing answers to outstanding scientific questions will take time and will not be easy. This means that the Agency will have to have high on its list the problem of how to proceed rationally in the absence of well established scientific consensus. The White Paper is quite clear on how decision making will proceed. It lays down the principles that it "will be open, transparent and consultative" and that it "will consult widely, including representatives of those who would be affected." It marks an acceleration in the already on-going process of an increase in openness in the way that experts interact with Government. We should not be worried about it. More open processes will protect us from the accusations made by some critics that we sometimes fall into the trap of entering into cosy arrangements with officials, and with vested interests, allowing the impression to be given that policy drives science rather than the other way round. That is not to say that open debates will be easy. Because science is epistemologically conservative it usually assumes that null (no effect) hypotheses are provisionally acceptable until they are rigorously falsified. In risk assessment, however, this principle – which works well in basic science – is not good enough because explicit account has to be taken of uncertainty and of social, economic and ethical considerations. Difficult decisions have to be faced, such as which policies should be favoured, those which give the best degree of protection from risk when measured as the average across a population, or those which give the maximum protection to the worst off? The beef-on-the-bone ban has shown how difficult trade-offs of this kind can be.

It is proposed that the Agency will be a public body with advisory and executive powers. It will have a structure based on the Health and Safety Commission/Executive model, at arm's length from the Government but reporting to Parliament through Health Ministers. Most of its staff will be drawn from existing sections of the

In this issue ...

MICROBIAL GENOMICS is currently a topic of great interest. Pat Goodwin summarizes the progress of sequencing projects taking place around the world on pp. 52–53 whilst on pp. 56–57 Eddie Homes describes how gene sequences can help to chart the emergence of infectious diseases.

Much research into HIV and AIDS has been carried out in recent years. According to Peter Balfe (pp. 54–55) it now appears that the nature of the HIV epidemic in the UK is changing fast, presenting yet another challenge to microbiologists. Clinical virologists in the PHLS also have to keep up with rapid developments, particularly in diagnostic practice, as Tim Wreghitt describes on pp. 60–61.

1998 sees the 50th anniversary of the founding of the UK National Health Service. Some of the activities planned to commemorate the event are listed on p. 59. Meanwhile at the SGM celebrations have been in order to mark the publication of the first issue of the *International Journal of Systematic Bacteriology* produced in-house (p. 76).

Teaching and training also feature in this issue. Student directed learning techniques are being used to great effect with microbiology undergraduates in Glasgow (pp. 62–63); Elke Jaspers gets into the mire (literally) to find out about microbial diversity at Woods Hole (pp. 64–65) and a grant from the SGM helps medical workers in Tanzania to learn about advances in respiratory infections (p. 58).

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

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

Government departments concerned with food standards. A key role will be played by the Commissioners. Not only will they set the agenda for the Agency and lead its work but they will be responsible for engineering the culture change that will be needed amongst the Agency's new employees and those individuals and organizations with which it will closely interact. After all, one of the main driving forces behind the creation of the Agency is that their activities, however excellent, are perceived to have failed because they have not stopped food scares, nor stemmed the seemingly inexorable rise of food poisoning. Of main concern to politicians, neither have they prevented the loss of confidence of the public in food safety, whether due to *E. coli* O157, prions, pesticide residues, antibiotic resistance or GMOs.

A particularly important task for the Commissioners will be to ensure that the boundaries between the Agency and other organizations concerned with food standards are managed actively and in the public interest. The White Paper highlights a good example of this by pointing out that the Agency will need to secure the confidence, support and co-operation of all sectors of the food industry. The power of large food processors and retailers to maintain and further raise standards in their own businesses and in those of their suppliers is very great. The Agency will have to work out how best to encompass the benefits of this in its own work while at the same time maintaining its independence.

The White Paper identifies three major reasons why public confidence in the effectiveness of the current food safety system has eroded over the last decade. They are the conflict of interest caused by MAFF's dual remit of food safety and food industry sponsorship and the way this has been handled; the fragmentation and lack of co-ordination between the many official and professional bodies involved in food policy and in the monitoring and control of food safety; and an uneven enforcement of food law throughout the UK.

It outlines a structure which responds to these problems by proposing the creation of a single Agency at arm's length from Government, with its essential aim the protection of public health in relation to food, a statutory remit across the whole food chain and with a monitoring role over the whole food chain with powers to act if there is a failure in the system. I believe that these proposals are appropriate. They should be welcomed.

Whether the creation of the Agency will lead to improvements in food standards and a return of public confidence will depend on its performance. The proposed structure gives it the potential to do all these things. Markers for its success are easy to find. My favourite one is a decline in the number of food poisoning cases. The proof of the pudding will be in the eating!

Hugh Pennington, University of Aberdeen

Address Book 1998

A new edition of the Society's Address Book for Members will be produced this year. Any member whose current address (as it appears on his/her mailing label) needs amendment, or whose telephone, fax or Email number has changed since the last edition, should inform the Membership Office at Marlborough House **by 29 May.**

It would be helpful if amendments could be notified by showing them on the present address label from a *Quarterly* or Journal wrapper, which includes the membership number in the top left corner.

Microbial Genome Sequencing – Where Are We Now?

Pat Goodwin

In the two and a half years since the first bacterial genome sequence was published, the field has grown rapidly. This article summarizes the on-going microbial genome sequencing projects.

Publication of the first complete bacterial genome sequence (*Haemophilus influenzae*) in 1995 caused great excitement in the microbiological community. It was also rather sobering – about 40% of the predicted genes had no known function and about half of these were 'new', i.e. did not match anything in the databases at the time. Since then 11 more microbial genome sequences have been published and have revealed many more novel genes of unknown function. Sequencing of at least a further 60 microbial genomes is now under way; these are listed in Table 1, which will undoubtedly be out-of-date by the time this article is published. A list of current microbial genome sequencing projects can also be found at the web site of The Institute for Genomic Research (TIGR, http://www.tigr.org/) and from here there are links to other sequencing centres. Progress on these sequencing projects was described at a recent conference on Microbial Genome Sequencing held at Hilton Head Island, South Carolina, and the proceedings of this meeting have been published in *Microbial and Comparative Genomics*, Vol. 3 (1998). There were reports of several more completed genomes and the expectation is that 25–30 complete sequences will be published in 1998. Some of the highlights are described below.

Some classical ideas will need to be revised and the text books rewritten. It has been clear for some time that the traditional view of the bacterial genome as comprising one circular chromosome, with additional small, extrachromosomal elements (plasmids) which encode non-essential functions, is incorrect and that some bacterial genomes are quite complex. The publication of the complete genome of *Borrelia burgdorferi*, which causes Lyme Disease, illustrates this. It has a linear chromosome of 0.91 Mbp which contains genes encoding proteins for DNA replication, transcription, translation, solute transport and metabolism. However, genes for cellular biosynthetic reactions are found exclusively on 'plasmids', of which there are at least 17. Some are linear and some circular; they range in size from 9 to 56 kbp and have a combined size of more than 0.5 Mbp. So are the large plasmids really additional chromosomes? This will probably be a matter of debate for some time!

Whole genome sequencing is also giving leads which will help better understanding of microbial biochemistry. For example, a previously unknown pathway for L-idonate metabolism in *Escherichia coli* has been predicted from genome analysis and then verified biochemically. And it will be of interest to look at the biochemistry of *Chlamydia trachomatis* in more detail – apparently it lacks peptidoglycan, but genome analysis predicts that it contains all the biosynthetic enzymes necessary for synthesis of this compound which is normally a constituent of the cell wall.

It is now possible to carry out extensive comparative genomic

TABLE 1 MICROBIAL GENOME SEQUENCING PROJECTS

PATHOGENIC BACTERIA

Actinobacillus actinomycetemcomitans
Bartonella henselae
Bordetella pertussis
*Borrelia burgdorferi**
Brucella abortus
Campylobacter jejuni
Chlamydia pneumoniae
Chlamydia trachomatis (mouse pneumonitis)
Chlamydia trachomatis
Enterococcus faecalis
Escherichia coli O157
Francisella tularensis
*Haemophilus influenzae**
*Helicobacter pylori**
Legionella pneumophila
Listeria monocytogenes
Mycobacterium avium
Mycobacterium leprae
Mycobacterium tuberculosis CSU#93
Mycobacterium tuberculosis H37Rv
*Mycoplasma genitalium**
Mycoplasma mycoides subsp. *mycoides* SC
*Mycoplasma pneumoniae**
Neisseria gonorrhoeae
Neisseria meningitidis MC58
Neisseria meningitidis Z2491
Porphyromonas gingivalis
Pseudomonas aeruginosa
Rickettsia prowazekii
Salmonella typhimurium
Staphylococcus aureus
Streptococcus pneumoniae
Streptococcus pyogenes
Treponema denticola
Treponema pallidum
Ureaplasma urealyticum
Vibrio cholerae
Xylella fastidiosa
Yersinia pestis

NON-PATHOGENIC BACTERIA

Aquifex aeolicus
*Bacillus subtilis**
Caulobacter crescentus
Chlorobium tepidum
Clostridium acetobutylicum
Corynebacterium glutamicum
Deinococcus radiodurans
Dehalococcoides ethenogenes
Desulfovibrio vulgaris
Escherichia coli K-12*
Pseudomonas putida
Rhodobacter capsulatus
Shewanella putrefaciens
Sphingomonas aromaticivorans (plasmid)
Streptomyces coelicolor
Synechocystis sp.*
Thermotoga maritima
Thiobacillus ferrooxidans

ARCHAEA

*Archaeoglobus fulgidus**
Halobacterium sp.
Halobacterium halobium
Halobacterium salinarum
*Methanobacterium thermoautotrophicum**
*Methanococcus jannaschii**
Pyrobaculum aerophilum
Pyrococcus furiosus
Pyrococcus horikoshii
Sulfolobus solfataricus
Thermoplasma acidophilum

EUKARYOTES

Candida albicans
Leishmania major (chromosome 1)
Plasmodium falciparum 3D7
*Saccharomyces cerevisiae**
Schizosaccharomyces pombe

*Published.

analysis, particularly in the context of determining evolutionary relationships between organisms. This has supported the hypotheses that the Eukarya are more closely related to the Archaea than to the Bacteria and that rickettsias and mitochondria share a common ancestor. We can now also begin to compare the genomes of closely related organisms. For example, the laboratory strain of *Escherichia coli*, K-12, and strain O157, which was responsible for several recent outbreaks of food poisoning, can be compared, as can the genomes of two strains of *Mycobacterium tuberculosis*, with a view to understanding the basis of differences in pathogenicity observed in different strains.

A number of new genome sequencing projects is under way, including several thermophiles, whose ability to withstand high temperatures and pressures may be exploited commercially. The genome of the radiation-resistant bacterium *Deinococcus radiodurans* is also being sequenced and it is hoped that this will be of use in understanding the unique DNA repair pathways of this bacterium which enable it to repair double-stranded breaks in DNA faithfully.

Several funding bodies have made major commitments to the sequencing of microbial genomes, particularly the Wellcome Trust, the Burroughs Wellcome Fund, the US Department of Energy and the US National Institute of Health. Whilst most bacterial genomes are small enough to be sequenced at a single centre, the effort required to tackle the genomes of eukaryotic microbes is a scale of magnitude greater and requires a collaborative effort, as demonstrated by the yeast community – the completion of the *Saccharomyces cerevisiae* genome involved over 600 scientists working in 96 laboratories.

In January the Wellcome Trust announced the investment of £7 million in Beowulf Genomics (http://www.beowulf.org.uk/), a collaborative initiative aimed at funding and coordinating the sequencing of microbial pathogens and other microbes of relevance to human and animal health. It is committed to the early release of data to the scientific community. At least three centres – The Sanger Centre, situated on the Wellcome Trust Genome Campus at Hinxton near Cambridge (www.sanger.ac.uk), and the Universities of Stanford (http://sequence-www.stanford.edu) and Oklahoma (www.genome.ou.edu) – routinely release finished and unfinished data before they are fully annotated; once annotation is complete they are submitted to the EMBL database.

And what of the future? By the end of the millennium we will probably know the sequences of at least 50 bacterial and archaeal genomes. In addition to the whole genome sequence of *Saccharomyces cerevisiae*, we shall have the sequences of at least some of the chromosomes of other eukaryotes – *Plasmodium falciparum*, *Leishmania major*, *Schizosaccharomyces pombe* and *Candida albicans*.

Two major challenges face us – storing, accessing and analysing this vast amount of information and interpreting it in biological terms. This will require collaborations on an international scale, and again the yeast community is leading the way with a programme to obtain deletion mutants systematically and then analyse their phenotypes. It is an enormous undertaking, and requires new technologies enabling the screening of many hundreds of clones for characteristics of interest. We will then have to wait and see how long it will take to realize the potential of genome sequencing projects in the development of new drugs and vaccines, and the exploitation of novel proteins in industrial processes.

Pat Goodwin is the Scientific Programme Manager of the Infection and Immunity Panel at The Wellcome Trust and also Scientific Meetings Officer of the SGM. Her contact details appear inside the back cover of this Quarterly.

The Changing Face of the HIV Epidemic: New Rules and New Problems

Peter Balfe

Increased quality of life due to improved drug therapy and changing patterns of infection are beginning to make fundamental changes in the epidemiology of HIV infection in the UK.

It has been true to say that the first 15 years of the AIDS epidemic in the UK, from 1980 to 1995, has been a tale of defeat. However, new therapies for treating HIV infection based on combination therapies targeted to different steps in the viral life cycle are beginning to change the quality of life for infected individuals and to increase life expectancy. In time it is hoped that judicious administration of such anti-retrovirals, coupled with improvements in the immune system they generate, may give HIV-seropositive people the hope of a much better quality of life for a far longer period than previously.

In the mid-1980s, when no therapies were available to treat HIV infection, the mean life expectancy of HIV-seropositive individuals was 4–7 years, with only a few patients expected to live longer. Although of limited success, the original trials of anti-retroviral monotherapy (especially the Concorde trial), demonstrated that intervention in the HIV life cycle could result in changes in the immune profile (increased CD4 counts) and in reduced viral load. However, these first monotherapy trials did not show any long-term sustained benefit with any single drug. Re-emergence of virus (as demonstrated by increasing viral load) and renewed CD4 cell decline occurred in most cases. In the case of Zidovudine (Azidothymidine, AZT) this loss of benefit took up to a year to emerge. With other drugs, most notably 3TC (3-thia-cytidine), the re-emergence was as rapid as 2 weeks. *In vitro* assays of virus present after therapy showed a widespread pattern of mutations associated with drug resistance. These observations clearly indicated the need for more aggressive intervention with several agents simultaneously, and a number of dual and triple drug combination trials, using both the 'traditional' nucleic acid analogues and newer 'designer drugs' targeting the protease gene, were initiated. This latter group of drugs are chemical structures designed to occupy the active site of the protease and are based on the three-dimensional structure derived from X-ray crystallography. Almost without exception these trials showed enhanced benefit for most pairwise combinations of drugs and led to the rapid adoption of 'combination therapy' as a first choice for the treatment of HIV disease.

Widespread adoption of multi-drug or combination therapy in the UK began in 1994, and as Fig. 1 shows, the overall impact has been dramatic. The figure shows that since 1994 the number of AIDS diagnoses (the number of people whose HIV disease progressed to a point where they suffered one of the variety of infections used to define autoimmune deficiency) has dropped by nearly a third in the UK (1810 cases in 1994, 1297 in 1996; for 1997 the figures are still incomplete, but are lower again). Even more dramatic is the fact that the number of people dying of AIDS has dropped by two-thirds (1216 AIDS deaths in 1994, 364 in 1996; again the provisional figures for 1997 show a further reduction). The difference between these two sets of numbers is in part a reflection of the way in which AIDS itself is classified, in that many of the patients who had received a diagnosis of immunodeficiency have shown remarkable recovery of immune function after initiation of therapy, together with improvements in all aspects of their general health.

Unfortunately in some patients there are emerging signs of long-term intolerance to the combination therapies being utilized at present. Several reports have shown that some patients receiving these cocktails of drugs over long time periods begin to suffer side effects. One of the most remarked upon of these is a phenomenon termed 'lipidopathy' wherein aberrant patterns of fat deposition and other lipid-associated abnormalities occur. These side effects can be serious and may require discontinuation of therapy in some cases. Unfortunately the pharmacopiae of anti-retroviral therapies available is currently limited, and hence it is possible to run out of combinations. No clear idea yet exists as to what should be done when that happens. However, in the short term improvements in patient health and life expectancy have led many clinicians to revise upwards their estimates of life expectancy to 10 or even 15 years and perhaps as important, to realistically anticipate an extended period of improved quality of life.

Concurrent with the changing profile of life expectancy, a second trend may be found in the current HIV statistics in the UK. In the early phase of the epidemic most HIV infection was diagnosed in gay men, with relatively few cases in other risk groups. For example, in 1987, 78% of newly diagnosed HIV infections in England, Wales and Northern Ireland (1502 cases) were in gay men, with the rest being in intravenous drug users (12%, 236 cases) and 9% being of probable heterosexual origin (178 cases). Over the past 10 years the figures have changed dramatically. In 1997 the absolute number of cases in gay men had improved a little (1302 cases), but the number of heterosexual cases had increased to 738, a fourfold increase (Fig. 2a). Heterosexual transmission accounts for 34% of the total number of new cases seen, with over half of these cases being women (Fig. 2b). This trend will probably continue with the numbers increasing over the next few years. Indeed it is probable that by the early years of the next century the number of new HIV infections in the heterosexual population will exceed that seen for gay men.

Fig. 1. Downturn in AIDS diagnoses (■) and in AIDS-related deaths (Δ) since the introduction of multi-drug therapy.

Associated with this emergent pattern of disease is a second phenomenon which is a property of the heterosexual epidemic itself. In practice there is little inter-group transmission of HIV, that is relatively few of the heterosexual infections are traceable to homosexual transmission events. Two-thirds of the heterosexual infections reported to date can be traced to infection overseas, with the majority occurring in Africa. One of the correlates of this observation is that the common subtype of HIV previously seen in

the UK (subtype B) is a declining proportion of the total number of new infections occurring. Estimates vary, but up to two-thirds of heterosexually transmitted cases of HIV-1 may involve viruses of subtypes other than B.

The practical consequences of this shift in the epidemic are at present unknown, but changes in the ways in which viral load estimations are done and in the ways in which infected people are cared for will probably be necessary. Recently, much speculation has taken place as to the 'transmissibility' of these new genetically distinct viruses. It is known for other infectious diseases that differing strains may exhibit differing disease profiles and rates of transmission. What is not yet known is whether this will be true for HIV-1. Currently the evidence suggests that any differences between strains may be of relatively little consequence *in vitro*, but patterns of disease progression and transmission *in vivo* remain to be established. In those regions of Africa in which epidemiological studies have been performed it seems that the rates of progression to disease for these strains of HIV-1 are relatively similar to those seen for the B subtype. A second cause of concern is the possible difference in the responses of these strains of HIV-1 to current anti-retroviral therapies. For example, the current generation of protease inhibitors was designed to fit the crystal structure of the subtype B protease, but the protease in the other strains may be of a slightly different conformation and hence the potency of the current generation of inhibitors may be altered for these viruses. Unfortunately, little therapy has been available to HIV-infected individuals in those parts of the world where these strains are currently endemic, and so the answers to these concerns are not yet known.

In conclusion, it seems that as we approach the third decade of the HIV epidemic, the questions being asked are slowly shifting. The figures cannot show the improved quality of life of many HIV-infected persons over the last few years, nor do they predict the emerging problems of the disease as it spreads more widely in the heterosexual population. What is clear from the figures, however, is that the very nature of the HIV epidemic is changing, and changing surprisingly fast. To quote the Chinese curse, it is likely that from a virological perspective 'we are living in interesting times'.

Peter Balfe, Department of Virology, UCLMS, 46 Cleveland Street, London W1P 6DB (Tel. 0171 380 9490; Fax 0171 580 5896; Email p.balfe@ucl.ac.uk; Websites http://www.ucl.ac.uk & http://www.ucl.ac.uk/windeyer-institute/).

ACKNOWLEDGEMENTS

I'd like to thank Andrew Phillips (Royal Free Hospital) and Jon Clewley (CPHL) for access to their unpublished data.

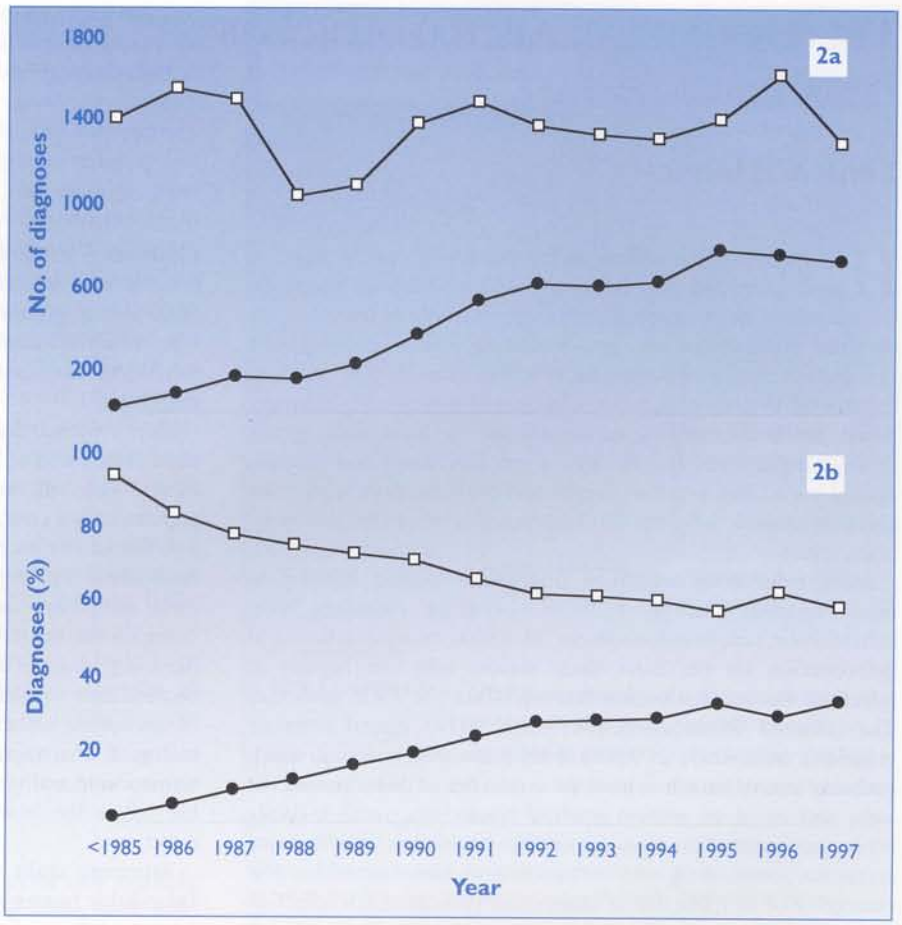


Fig. 2. Changing profile of heterosexually transmitted (●) and homosexually transmitted (□) HIV infections in the UK. (a) The number of heterosexually transmitted infections has increased over time, whilst the number of homosexually transmitted infections has not. (b) As a result, the proportion of transmitted infections of heterosexual origin is an increasingly large fraction of the total (note that these two numbers do not add up to 100% since we have not included infections due to intravenous drug use, infections due to contaminated blood products or mother to child transmission).

The Molecular Archaeology of Infectious Disease

Eddie C. Holmes

Phylogenetic analyses of gene sequences are providing a fascinating new perspective on when and why infectious diseases emerged in human populations.

Hypochondriacs should avoid the popular science sections of book shops. In the last few years we have witnessed an epidemic of texts investigating the origins of human disease, most of which propose that our species is facing a nasty assortment of new and unanticipated pathogens, as well as a few old foes that have reappeared to plague us again. Clearly the most direct challenges posed by these 'emerging' pathogens are to track their spread through populations and to develop effective drugs and vaccines against them. But a rather deeper and perhaps more disturbing question remains: why has this resurgence of microbial infections taken place?

Aside from drug resistance, a problem all too familiar to microbiologists, changes in human ecology, including mass urbanization, improved networks of global transportation and deforestation are the most likely reasons why our burden of infectious disease has become heavier.[7] Take the AIDS epidemic. The causative immunodeficiency virus (HIV) almost certainly originated somewhere in Africa from a monkey reservoir, which probably existed at a low level for a number of years out of the sight and mind of western medical researchers, until it finally broke into a massive new susceptible population after gaining access to sexual, drug and vertical transmission networks. The emergence of HIV, like that of many other pathogens, is a reflection of the way we live today.

But what of the great plagues of the past? What factors allowed pathogens to emerge in the absence of the mega-city and the jet engine? As well as providing important general information about disease emergence, reconstructing this epidemiological history may provide insights into some of the idiosyncrasies of our own genetics. As a case in point, consider one of the most important factors influencing susceptibility to infection by HIV – the chemokine receptor 5 (CCR5), which the virus uses to infect macrophages. About 10% of Caucasians have a 32 bp deletion (Δ32) which inactivates the CCR5 gene, and those homozygous for this deletion (about 1% of the Caucasian population) have a greatly reduced susceptibility to HIV infection.[8] Heterozygotes, although still susceptible, seem to progress more slowly to immunodeficiency disease. The puzzle for evolutionists is that Δ32 is at a high frequency in Caucasians yet very rare in African and Asian populations. Could it be that Δ32 conferred a selective advantage against a past infection which struck the peoples of Europe, so that individuals with this mutation preferentially survived? What this past infection may have been is currently the subject of much debate.

A BRIEF HISTORY OF INFECTIOUS DISEASE

If the history of infectious diseases in humans is analysed in more detail, two things become apparent: many infections have been acquired relatively recently in our evolutionary history and major changes in human society, such as the development of farming and the growth of cities, are often associated with the emergence of new pathogens.[6] In the case of farming it appears that the transition to this way of life from pre-agricultural foraging, which marks the boundary of the Palaeolithic and Neolithic ages (some 10,000 years ago), may have greatly increased the disease burden on human populations because the first farmers lived in larger populations, were more sedentary and developed longer-lasting associations with animals. Support for this comes from studies of palaeopathology which have revealed an increase in malnutrition, anaemia and possibly viral infections such as measles in farmers compared to their hunter-gatherer ancestors.[6] Unfortunately, studies of this type are often inconclusive because most infectious diseases affect soft rather than hard tissues, and skeletal lesions are often not diagnostic.

More evidence that the march of human society brought with it an increased load of infectious diseases comes from epidemiological theory. This tells us that the number of susceptible hosts in a population is a critical parameter in disease transmission, such that a threshold size needs to be reached before pathogens can become established. Furthermore, larger population sizes usually also mean an increase in both disease incidence and prevalence.[1] For example, the hunter-gatherers of the Palaeolithic may have had a narrower range of infections than their agricultural descendants because their smaller population sizes set a limit on the availability of susceptible hosts. The threshold itself is set by other important biological characteristics of the pathogen, such as its mode of transmission and virulence (for example, the greater the virulence, the larger the host population usually needed to sustain the infection).

Returning again to the diseases of antiquity, it is likely that Palaeolithic hunter-gatherer populations would have lived in small groups, perhaps of 100 individuals or less, so that microbes with very high transmission rates and long incubation times (and which are often sexually transmitted) would be the only ones likely to become established.[4] We can glimpse this in those cultures who still follow this mode of subsistence today: in a now classic paper, Black examined the disease burden in various Amazonian Indian populations, finding a high prevalence of diseases such as herpes, Epstein–Barr virus, cytomegalovirus and hepatitis B virus – all with the characteristics expected to survive in small host populations.[3] In contrast, the first agriculturalists, with their larger populations and reduced mobility, may have experienced an increase in waterborne and helminth infections, while the first city-dwellers, (who appeared at around 5000 years ago), would have had population sizes large enough to sustain bacterial and viral infections with lower transmission rates and higher virulence. At this point we can also turn to historical records for support. Hippocrates, for example, reported what appears to be diphtheria, mumps, malaria and tuberculosis in Greece in 400 BC.[4] As cities became more frequent in number and larger in size, so many more of the diseases we know today began to appear.

THE GENOME TELLS ALL

Theory, and some limited data, has therefore provided us with a set of important predictions about how major changes in human ecology have influenced patterns of disease emergence, and more particularly, about which types of infections began spreading at specific points in our history. But how might these predictions be tested? The answer may lie in the genomes of pathogens themselves.

One of the main aims of the developing science of molecular epidemiology is to recover information about the patterns and rates of pathogen transmission by the comparative analysis of gene sequences. This has three steps. First, the evolutionary relationships among pathogen strains can be reconstructed using phylogenetic trees – the *de rigueur* tool of evolutionary biology. These trees can

tell us where the pathogen first arose (i.e. the locality which contains the most divergent strains) and how it has spread to other areas since its emergence. Second, if mutations between strains accumulate at a constant rate (i.e. conforming to a 'molecular clock' of evolution), and if this mutation rate can be measured (often no easy matter), then it is possible to estimate when the pathogen in question first appeared or started to spread most rapidly. For example, most molecular clock analyses of HIV-1 suggest that this virus emerged within the last 50 years or so, whilst hepatitis C virus, although clearly associated with human populations for much longer (for hundreds and possibly even thousands of years), likewise began to spread rapidly in the last 50 years, perhaps because some of the new hosts open to HIV also became available to HCV. Finally, by analysing the branching structure of these molecular phylogenies, that is looking at the rates at which lineages appear across the tree, it is also possible to characterize rough rates of population growth: put simply, the more lineage splits we see, the greater the increase in pathogen population size.

If we apply these analyses to pathogens with different modes of transmission it should be possible to assess whether their emergence coincides with major changes in our ecology. For instance, if the development of agriculture really did increase our load of infectious disease, particularly for zoonotic infections requiring a fairly large population, then we should expect our molecular estimates of emergence times for pathogens in this class to be within the last 10,000 years.

AND THE DATA?

Although molecular estimates of emergence times are only available for a few pathogens, these seem to fit the predictions quite well. Let's take two examples. At one end of the extreme is human papillomavirus (HPV), a sexually transmitted DNA virus which is a major cause of human neoplasias, both benign and malignant. Over 70 types of HPV have been recognized, two of the most important being HPV-16 and HPV-18, both of which are commonly found in cervical cancers. Despite these serious disease consequences, papillomaviruses as a whole exhibit low pathogenicity and immunogenicity such that they might be expected to persist in small populations. And this appears to be the case. In particular, HPV-16 and HPV-18 appear to have been around for as long as the human species and have tracked our movement across the globe. What's more, the tree of these HPVs, like that linking modern humans, is rooted in Africa.[2] It is also worth noting that HPVs illustrate that not all viruses evolve quickly, having mutation rates of between 10^{-7} and 10^{-8} per base per year – about five orders of magnitude slower than HIV-1.

A much more recent invader into human populations is dengue, a mosquito-borne RNA virus that infects some 100 million people annually in tropical and sub-tropical regions. Although dengue usually only leads to a mild febrile infection, it can sometimes cause more serious disease in the form of dengue haemorrhagic fever (DHF) and dengue shock syndrome (DSS). Studies of dengue gene sequences have revealed that although the four serotypes which make up this virus emerged in humans within the last 2000 years (so that our hunter-gatherer ancestors would not have experienced dengue), the virus did not start to spread rapidly until the last 200 years or so when the size of human populations (particularly in an urban setting) began to rise dramatically and humans in different locations around the world came into greater contact through the development of global trade networks (Fig. 1).[5] The result of this massive increase in the number of susceptible hosts was sustained viral transmission and large-scale epidemics, the first of which were documented at the end of the 18th century. We might also translate this historical process into a lesson for today: as human populations are increasing in size, urbanization and mobility, so dengue will become an increasing problem.

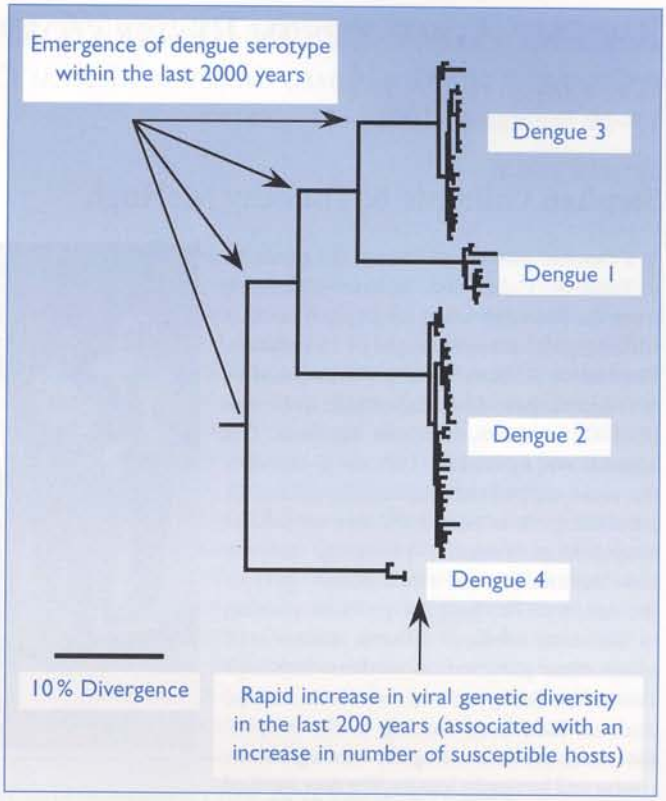


Fig. 1. Phylogenetic tree of the E (envelope) gene of 66 worldwide isolates of dengue virus representing the four viral serotypes. The times at which the four serotypes emerged and rapidly increased in genetic diversity are also shown. Horizontal branch lengths drawn to scale. Adapted from Holmes *et al.* (1998).[5]

Reconstructing the history of infectious diseases using only a small sample of extant pathogen strains is a difficult exercise, ripe with over-speculation, especially given the fickle nature of molecular clocks. However, it is equally clear that pathogen genomes contain a rich archaeological record about their emergence and spread in human populations, which can be revealed using appropriate molecular and evolutionary tools. Ultimately this approach to epidemiology is likely to provide us with a new and exciting perspective of the factors which have enabled pathogens to emerge, and perhaps serve a useful warning about what may happen in the future.

Dr Eddie Holmes, whose research focuses on the molecular evolution of viral epidemics, is a Royal Society University Research Fellow at the Wellcome Trust Centre for the Epidemiology of Infectious Disease, Department of Zoology, University of Oxford, Oxford OX1 3PS (Tel. 01865 271282; Fax 01865 310447; Email Edward.Holmes@zoo.ox.ac.uk).

REFERENCES

1. ANDERSON, R.M. & MAY, R.M. (1991). *Infectious Diseases of Humans.* Oxford: Oxford University Press.
2. BERNARD, H.-U. (1994). *Trends Microbiol* 2, 140–143.
3. BLACK, F.L. (1975). *Science* **187**, 515–518.
4. DOBSON, A.P. & CARPER, E.R. (1996). *Bioscience* **46**, 115–126.
5. HOLMES, E.C., BARTLEY, L.M. & GARNETT, G.P. (1998). In *Emerging Infections.* Edited by R.M. Krause. New York: Academic Press.
6. McKEOWN, T. (1988). *The Origins of Human Disease.* Oxford: Blackwell.
7. MORSE, S.S. (editor) (1994). *The Evolutionary Biology of Viruses.* New York: Raven Press.
8. O'BRIEN, S.J. & DEAN, M. (1997). *Sci Am* **277**, 28–35.

Recent Advances in Respiratory Infections

A Course at the Kilimanjaro Christian Medical Centre, Tanzania
15–19 September 1997

Stephen Gillespie & Timothy McHugh

In October 1997 a new university opened in Tanzania. Called the Tumaini University from the Kiswahili word for hope, it offers a wide range of subjects taught in 13 faculties. The Health Sciences Faculty will be based at the Kilimanjaro Christian Medical Centre (KCMC) in Moshi, Northern Tanzania. The hospital was opened in 1971 on a site with the snow-capped mountain, Kilimanjaro, as a backdrop. It is one of the five consultant hospitals in Tanzania providing tertiary care facilities for the north-eastern part of the country. The hospital provides training to assistant medical officers, nurses and many other paramedical workers. Although Tanzanian, European and American medical students have been coming to the hospital for many years, a complete undergraduate course will be taught locally. The new medical course will admit 15 students in its first year. Our course was intended to support the development of local research capabilities which are an essential complement of teaching undergraduate students and will support the MSc in Clinical Tropical Microbiology. This course will be offered as a partnership between the Royal Free Hospital School of Medicine and KCMC in 1998, with students taught in both London and Tanzania.

Members of the course outside the lecture theatre at KCMC.

Students for the SGM-funded course *Recent Advances in Respiratory Infections* were drawn from the KCMC, the National Mycobacterial Reference Laboratory, and Tuberculosis and Leprosy Control Programme, the National Tuberculosis Hospital and our locally based Clinical Research Centre.

The practical component of the course comprised three units, restriction digestion of λ DNA, restriction fragment length polymorphism (RFLP) analysis of *Mycobacterium tuberculosis* and PCR-based analysis of penicillin resistance in *Streptococcus pneumoniae*. This programme provided basic molecular biology skills in the context of local conditions. At the end of the course each of the students had successfully performed a diagnostic PCR and an *M. tuberculosis* fingerprint by the international standard method. The practicals were complemented by a series of lectures, which discussed current concepts of pathogenesis and drug resistance in respiratory pathogens.

This course has provided an introduction to the discipline of molecular biology applied to respiratory pathogens. This will be complemented further in the coming months by the on-going collaboratory molecular research projects on tuberculosis epidemiology and *Ascaris* population genetics.

Dr Stephen H. Gillespie, Reader in Medical Microbiology and Dr Timothy D. McHugh, Lecturer in Medical Microbiology, The Royal Free Hospital School of Medicine, London and Kilimanjaro Christian Medical Centre.

50 Years Old and Still Going Strong!

Tim Wreghitt

Tim Wreghitt reminisces about the changes in clinical virology diagnostic practice since he started work in the PHLS in 1977. Tests such as gel diffusion have now been replaced by ELISAs and molecular methods.

The NHS and I have something in common – we are both 50 years old! Whether we are both 'still going strong' is quite another matter. So why have I ended up working as a virologist in the NHS and how has the scientific practice changed during that time? Well, it's like this.

When I was taking my 'A' level exams I hadn't a clue what I wanted to do. I liked biology and so I elected to do an applied biology BSc degree at Chelsea College, University of London. I loved it! Living on the King's Road Chelsea in the late 1960s was quite an experience. It was the heyday of Mary Quant, The Beatles and Twiggy, and a very hip place to be.

So, why did I end up becoming a virologist? Well, I had what equated to a religious conversion when attending lectures by Dr Stuart Chant. He was such an interesting and enthusiastic lecturer that after hearing a few of his virology lectures, I decided that I definitely wanted to be a virologist (or as I have been described in print before – a virologit!). After graduating with my BSc I was awarded a Wellcome studentship to do a PhD on mycoplasmas (although I tried, I was not able to gain a virology PhD studentship). I worked at The Wellcome Research Laboratories at Beckenham (known in those days as the University of South London) and the degree was awarded by the University of Surrey. When my PhD work was coming to fruition and I needed to find another job one of those pieces of luck occurred which have blessed my career. I was having lunch with Gwen Lawrence (who was in charge of R&D for Wellcome's virus vaccines) when we were joined by Dr June Almeida. When she discovered I was looking for a postdoctoral post, she told me that she was looking for someone to fill just such a position. This is when I really started to perform virology research.

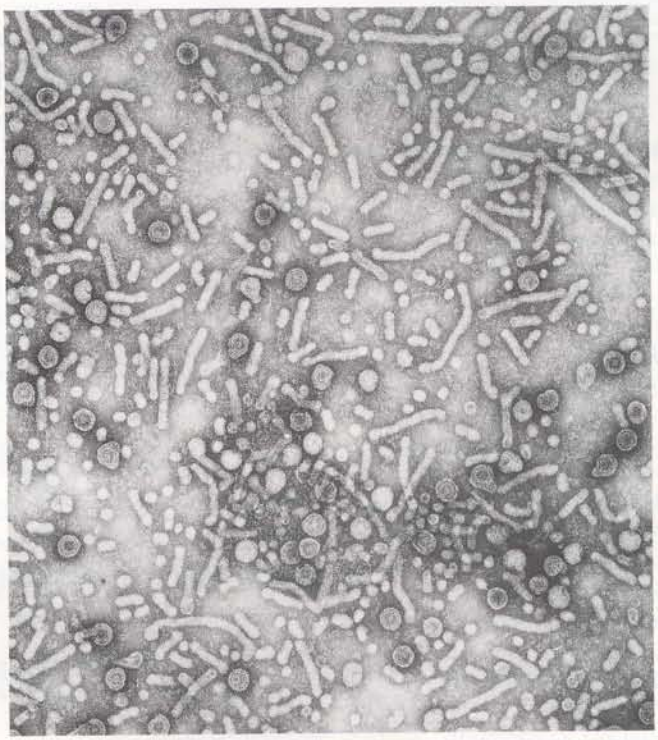


Fig. 1. Electron micrograph of HBV (×140,000).

While working with June, I studied hepatitis A and B viruses. Back then in 1973, hepatitis B virus had not long been discovered and its disease associations were being elucidated. Hepatitis B ε antigen had not yet been discovered and hepatitis B virus (HBV) infection was routinely diagnosed by gel immunodiffusion, immunoelectro-osmophoresis and electron microscopy. Fig. 1 shows an electron micrograph of HBV taken in 1975 as part of a collaborative study with Dr Jenny Heathcote at the Royal Free Hospital which established that HBV was more prevalent in homosexual men. Although the diagnostic methods for HBV detection were relatively insensitive, they were still good enough to use as screening assays for testing patients in renal dialysis units, as a result of which the transmission of HBV in these units was dramatically reduced. One of my roles in this period of my career was the development of a more sensitive HBsAg screening assay, an indirect haemagglutination assay employing turkey red blood cells (since they are nucleated, they settle more quickly, producing a more rapid test). Hepatest, as the test was named, could produce a result in less than half an hour. I have never quite understood why the red cell harvest from the turkeys always took place in mid-December! During this time I was seconded to the Middlesex Hospital to work with Dr David Dane who gave his name to the 'Dane Particle' – the 42 nm diameter double-shelled whole HBV particle.

Also during this period we worked at trying to visualize hepatitis A virus (HAV) in the electron microscope. Although we achieved this in 1976, we were pipped to the publication post by Al Kapikian's group in the USA. We knew from the Willowbrook school human experiments that HAV was in the faeces. The problem was that although we were working with bone fide faecal samples from patients with HAV infection, trying to increase the sensitivity by performing immune electron microscopy, what we didn't know then was that HAV is excreted in the two week period prior to the onset of symptoms. By the time the patient becomes symptomatic, the virus has virtually disappeared from the faeces!

After four years employment at The Wellcome Foundation I began to get itchy feet (the cream didn't help!). I wanted to do more clinically orientated virology research, having had a taste of it in collaborative projects and while working in David Dane's laboratory. This is where the NHS comes in. I was offered a job at Cambridge Public Health Laboratory at Addenbrooke's Hospital to work with Dr Jack Nagington on clinical virus research. I was really looking forward to that! Shortly after I arrived in Cambridge in 1977, there was the first outbreak of legionnaires' disease in the USA. It was some time before the causitive organism, *Legionella pneumophila*, was identified but shortly after that we were actively involved in this research. One day, one of the Cambridge histopathologists, Dr Janice Anderson, came up to our laboratory with a post-mortem lung sample from a patient who had died with community-acquired pneumonia. We saw some rather odd Gram-negative rods under the microscope in a Gram-stained touch preparation. Later that week, David Smith in our laboratory grew the first legionella isolate outside the USA. Later, we were to grow the first *Legionella pneumophila* type 5 from a human.

So, I had come to Cambridge to work with viruses and was now engaged full time in legionella studies – as a clinical microbiologist in the NHS anything can happen! I don't regret it! My moral is "keep digging until the gold seam runs out". In terms of choosing research topics to work on I have another piece of advice "always seek and fill the gaps in the published literature".

Just as that gold seam was running out, another two beckoned to me virologically. The heart transplant programme had begun in Papworth Hospital, near Cambridge, in the late 1970s. In the early days, these transplanted patients were receiving heavy immunosuppression so that their transplanted organs were not rejected. This meant that these patients were having severe herpesvirus infections – cytomegalovirus (CMV), herpes simplex virus and

varicella-zoster virus causing the worst problems. Patients were dying as a result of these infections and I worked on studying the risks of CMV infection acquired from the donor organ, which we found caused the most severe disease.

The second rich seam was work on developing ELISAs which I did with Dr Jim Gray in the 1980s. Many of these assays were developed as better antibody screening assays for transplant patients or for the detection of specific IgM to diagnose recent infection with treatable agents such as CMV and *Mycoplasma pneumoniae*.

Twenty years later, I am still working on CMV infections in transplant patients, but now the focus has changed to assessing the beneficial impact of prophylactic antivirals in reducing the burden of CMV infection and disease in these patients. Most noticeably, the laboratory techniques used to diagnose CMV and other viral infections have changed radically. Molecular tests which detect the viral DNA or RNA genome are now used frequently in place of antigen detection and antibody assays, particularly in immunocompromised patients and children who are at risk of trans-placental acquisition of infection. PCR is the molecular technique most frequently employed in diagnostic virology laboratories at the moment. These molecular tests consist of assays devised in our laboratories or commercially available kits. Other molecular tests include NASBA and branched DNA assays, and tests which can quantify viral DNA or RNA are becoming more popular because determination of a patient's viral load (e.g. for HIV, HBV and HCV) can influence antiviral treatment and provide important prognostic information.

This takes me back to the start of my virological career working on hepatitis viruses. None of the human hepatitis viruses, A, B, C, D, E, F or G, are diagnosed routinely by virus culture. We do not currently use gel diffusion or immunoelectro-osmophoresis or agglutination tests for their diagnosis. We have moved through a phase of employing ELISAs and other serological techniques for diagnosis into the current era which also utilizes PCR and other tests when this is beneficial for diagnosis. For HBV and HCV, this is often done to monitor the success of antiviral treatment or to assess the suitability of patients for antiviral treatment or liver transplantation. The products of a PCR reaction are run down a gel so that the characteristic bands associated with the set of primers used can be visualised and identified. Fig. 2 shows a PCR gel photograph of tests on serum samples from patients with HBV infection. One of the problems with tests such as PCR is that they can be designed to be very sensitive. Engineering the appropriate level of sensitivity of an assay to discriminate between those patients who will benefit from treatment and those who will not is a tricky business which has to be properly evaluated and assessed. Still, it could be worse – at least we now have the option we didn't have 20 years ago of tailoring the sensitivity of our virological assays to the clinical needs of patients – and we're still messing about with gels!

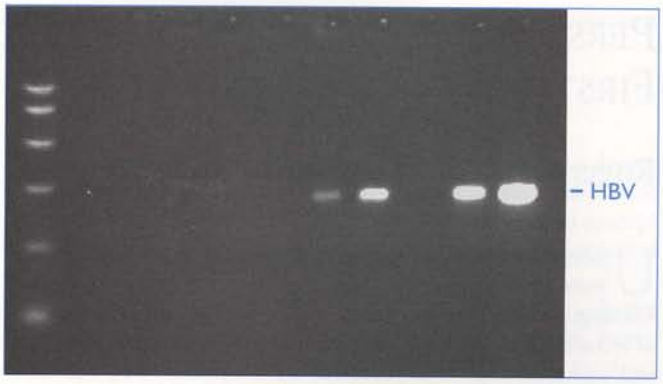


Fig. 2. PCR gel photograph of tests on serum samples from patients with HBV infection.

Dr Tim Wreghitt, Clinical Microbiology and Public Health Laboratory, Addenbrooke's Hospital, Cambridge CB2 2QW.

Personal Exploration of Science by First Year Undergraduates

Roger G. Sutcliffe and Erica McAteer

Attending lectures is not the only way for first year students to learn about microbiology. Student Directed Learning can offer an enjoyable alternative.

Undergraduate education aims to establish synergies between instruction and private study, leading to active styles of student learning. Yet this goal appears more remote when modular systems of lectures seem the only coherent response to stretched resources and increased class sizes. Lectures are a valuable tool, but their over-use encourages students into passive factual recall from lecture notes, detracting from student-centred exploration and integration of knowledge which, at the best of times, are skills that junior undergraduates find difficult to acquire. To counteract this trend, some institutions have replaced the lecture component of junior undergraduate courses with various programmes of student directed learning (SDL) to encourage students to express their inquisitiveness, and to exercise their skills of reasoning, initiative and teamwork.

As a consequence of the reorganization of Biomedical and Life Sciences (IBLS) at Glasgow University, we took the plunge and used SDL with our first year biological science class (550–800 students). The SDL Study Project *AIDS in Science and Society*, has run since 1995 and involves students in 30–40 hours of work over a 16 week period (Table 1). The staff time required to create and manage the project could only have been met from a staff group of the size of IBLS. It has been assisted by the reduction of our formal first year teaching in biology from 123 lectures in 1994 to 80 lectures in 1995. In addition, and crucially, the Level 1 biology course is supported by a team of three Associate Lecturers, who provide a modicum of facilitation in free-format SDL sessions.

Groups of 6–11 students work in autonomous study groups to explore resource material over 10 weeks. A printed handbook is issued which provides guidance notes, a schedule of study group meetings, and a set of key papers, newspaper articles and references in the class textbook. The *Greater Glasgow Health Board Report* under the AIDS Control Act is also made available in hard and in electronic copy. Using focus points in the handbook as a guide, study groups divide up their research according to their inclinations. There are no lectures on AIDS or on virology, although three guest lectures are provided on health care problems in Sub-Saharan Africa and on aspects of the pharmaceutical and biotechnology industries.

STRUCTURE OF THE STUDY: DEBATES AND ESSAYS

One of the problems in designing this type of work is to keep up the momentum. Consequently, we have divided the study period up into two parts, the first being exploration, culminating in inter-group debates; the second part is more focussed on extending knowledge so students can write their reports. Debates are chaired by a pair of neutral students, and three students from each group share a 15–20 minute presentation for each group. Other members of each group prepare and present illustrative material, contribute to the open discussion section of the debate, or provide neutral chairs for other debates. Study groups hold quite lengthy meetings to prepare for debates on the motions such as:

1. *There is no AIDS crisis.*
2. *Public health measures will defeat AIDS, not medical science.*
3. *Therapies against HIV/AIDS: we have the tools, we can now finish the job.*

The debates are lively, and motions appear to be won or lost by vote, according to the efforts of the individual groups. Absenteeism has been a problem in some groups, and in one instance staff joined in a debate to support the heroic lone student representative!

In 1996/7 students were also required to write a short essay of 750 words and a longer discursive essay of up to 1200 words, which gave scope for personal, detailed research into AIDS.

TABLE 1 STUDY PROJECT SCHEDULE

Week 10	Issue Group 1 articles
	3 week vacation
Week 11	Introductory lecture on aims and nature of Study Project
	First Study Group meeting: register and name group (3 hours) Issue Group 2 articles, posters of news cuttings Group arranges time of next meeting
Week 14	Second Study Group meeting (2 hours) Issue Group 3 articles, read posters Small prize for best study group name Group arranges time and place of further meetings
Weeks 15–17	Further Study Group meetings (in students' time) Study material and prepare for debates
Week 18	Debates (1 hour per debate; 3 debates per session)
	4 week vacation
Week 19	Students submit personal essay
Weeks 23–24	Tutorial feedback on essay and project work (1 hour tutorials)

Essay 1 *(in no more than 750 words. 35% of marks)*

A. Critically discuss the extent to which HIV fulfils each of Koch's postulates as the cause of AIDS.

B. Many haemophiliacs acquired AIDS from contaminated doses of clotting factor VIII. Explain to which of Koch's postulates this is relevant; does this prove that HIV causes AIDS?

C. With clearly labelled diagrams, explain what functions in the immune system become defective during HIV infection. How does this explain the symptoms of AIDS?

Two examples of Essay 2 *(limited to 1200 words. 65% of marks)*

A. *Therapeutic approaches to HIV*

Discuss the pros and cons of the main therapeutic approaches against HIV. From your understanding of HIV and AIDS, outline how each approach is designed to work.

B. *Report of the Chief Medical Officer of 'Auchencity'*

Auchencity is a typical Scottish city of 600,000 people. As its Chief Medical Officer, you are trained in virology. From 1990 to 1995, new diagnoses of HIV infection in Auchencity occurred at 20–40 per year. Your new data for 1996 reports 98 new cases. A press leak has appeared and you have a letter from the Secretary of State for Scotland, requesting your action plan within two weeks. "Just what", you reflect, "is an action plan?" You jot some notes. Are the results correct? Are they a statistical freak? How do you find good evidence to explain the rise in HIV incidence? Who are the new HIV-positive patients? What were the main sources of HIV infection in previous years; has a new source appeared this year? What is the experience in other Scottish cities? "We need a plan of active investigation", you ponder, "before we can define a plan of action to protect the local community."

Personal Exploration of Science by First Year Undergraduates

Roger G. Sutcliffe and Erica McAteer

Attending lectures is not the only way for first year students to learn about microbiology. Student Directed Learning can offer an enjoyable alternative.

Undergraduate education aims to establish synergies between instruction and private study, leading to active styles of student learning. Yet this goal appears more remote when modular systems of lectures seem the only coherent response to stretched resources and increased class sizes. Lectures are a valuable tool, but their over-use encourages students into passive factual recall from lecture notes, detracting from student-centred exploration and integration of knowledge which, at the best of times, are skills that junior undergraduates find difficult to acquire. To counteract this trend, some institutions have replaced the lecture component of junior undergraduate courses with various programmes of student directed learning (SDL) to encourage students to express their inquisitiveness, and to exercise their skills of reasoning, initiative and teamwork.

As a consequence of the reorganization of Biomedical and Life Sciences (IBLS) at Glasgow University, we took the plunge and used SDL with our first year biological science class (550–800 students). The SDL Study Project *AIDS in Science and Society*, has run since 1995 and involves students in 30–40 hours of work over a 16 week period (Table 1). The staff time required to create and manage the project could only have been met from a staff group of the size of IBLS. It has been assisted by the reduction of our formal first year teaching in biology from 123 lectures in 1994 to 80 lectures in 1995. In addition, and crucially, the Level 1 biology course is supported by a team of three Associate Lecturers, who provide a modicum of facilitation in free-format SDL sessions.

Groups of 6–11 students work in autonomous study groups to explore resource material over 10 weeks. A printed handbook is issued which provides guidance notes, a schedule of study group meetings, and a set of key papers, newspaper articles and references in the class textbook. The *Greater Glasgow Health Board Report* under the AIDS Control Act is also made available in hard and in electronic copy. Using focus points in the handbook as a guide, study groups divide up their research according to their inclinations. There are no lectures on AIDS or on virology, although three guest lectures are provided on health care problems in Sub-Saharan Africa and on aspects of the pharmaceutical and biotechnology industries.

STRUCTURE OF THE STUDY: DEBATES AND ESSAYS

One of the problems in designing this type of work is to keep up the momentum. Consequently, we have divided the study period up into two parts, the first being exploration, culminating in inter-group debates; the second part is more focussed on extending knowledge so students can write their reports. Debates are chaired by a pair of neutral students, and three students from each group share a 15–20 minute presentation for each group. Other members of each group prepare and present illustrative material, contribute to the open discussion section of the debate, or provide neutral chairs for other debates. Study groups hold quite lengthy meetings to prepare for debates on the motions such as:

1. *There is no AIDS crisis.*
2. *Public health measures will defeat AIDS, not medical science.*
3. *Therapies against HIV/AIDS: we have the tools, we can now finish the job.*

The debates are lively, and motions appear to be won or lost by vote, according to the efforts of the individual groups. Absenteeism has been a problem in some groups, and in one instance staff joined in a debate to support the heroic lone student representative!

In 1996/7 students were also required to write a short essay of 750 words and a longer discursive essay of up to 1200 words, which gave scope for personal, detailed research into AIDS.

TABLE 1 STUDY PROJECT SCHEDULE

Week 10	Issue Group 1 articles
	3 week vacation
Week 11	Introductory lecture on aims and nature of Study Project
	First Study Group meeting: register and name group (3 hours) Issue Group 2 articles, posters of news cuttings Group arranges time of next meeting
Week 14	Second Study Group meeting (2 hours) Issue Group 3 articles, read posters Small prize for best study group name Group arranges time and place of further meetings
Weeks 15–17	Further Study Group meetings (in students' time) Study material and prepare for debates
Week 18	Debates (1 hour per debate; 3 debates per session)
	4 week vacation
Week 19	Students submit personal essay
Weeks 23–24	Tutorial feedback on essay and project work (1 hour tutorials)

Essay 1 *(in no more than 750 words. 35% of marks)*

A. Critically discuss the extent to which HIV fulfils each of Koch's postulates as the cause of AIDS.

B. Many haemophiliacs acquired AIDS from contaminated doses of clotting factor VIII. Explain to which of Koch's postulates this is relevant; does this prove that HIV causes AIDS?

C. With clearly labelled diagrams, explain what functions in the immune system become defective during HIV infection. How does this explain the symptoms of AIDS?

Two examples of Essay 2 *(limited to 1200 words. 65% of marks)*

A. *Therapeutic approaches to HIV*

Discuss the pros and cons of the main therapeutic approaches against HIV. From your understanding of HIV and AIDS, outline how each approach is designed to work.

B. *Report of the Chief Medical Officer of 'Auchencity'*

Auchencity is a typical Scottish city of 600,000 people. As its Chief Medical Officer, you are trained in virology. From 1990 to 1995, new diagnoses of HIV infection in Auchencity occurred at 20–40 per year. Your new data for 1996 reports 98 new cases. A press leak has appeared and you have a letter from the Secretary of State for Scotland, requesting your action plan within two weeks. "Just what", you reflect, "is an action plan?" You jot some notes. Are the results correct? Are they a statistical freak? How do you find good evidence to explain the rise in HIV incidence? Who are the new HIV-positive patients? What were the main sources of HIV infection in previous years; has a new source appeared this year? What is the experience in other Scottish cities? "We need a plan of active investigation", you ponder, "before we can define a plan of action to protect the local community."

The final marks contribute to the grades for first-year biology and essays are marked by some 50 departmental faculty staff, who meet their study groups for a final feedback session. Student completion has been good, with 93% submitting essays/reports, mainly of a very acceptable standard. A total of 91% have been marked as 'pass' or better. Half of those that 'failed' were criticized by the marker for irrelevant material; so we still have basic skills to teach!

FEEDBACK FROM STAFF AND STUDENTS

Groups of students were interviewed in depth by one of us (E.M.) and these 'focus meetings' provided a guide for the formulation of questionnaires to which 90% of the class responded. Over the first two years, 89–92% of students agreed that the Study Project was a good way to learn; very few felt overwhelmed. By and large, the study group format has been effective. An unforeseen bonus for new students in a big class is that the groups provide a semi-social rôle. As planned, students had to seek out additional material that was not bound into the course manual and textbook (see Fig. 1). We hope to encourage students to seek out more information by mounting on our internal web site the covers and contents of relevant books that are on reserve in the University library. The students will also be able to comment on the books through links in the web site.

The debates are the main focus of the first part of the course and half the students complained about the lack of assessed credit for this work. A root of the student complaint may lie with the minority of students who failed to pull their weight in group work or to attend the debate. Staff worry about the workload and difficulties in assuring reliable assessments, and some feel that assessment of debates for course credit (rather than feedback) is probably not appropriate at first year. However, we will trial an assessment next year, with some marks based on peer-review of student attendance and effort.

There has been a lively staff debate on the extent to which the essays should focus on the molecular science of AIDS, as opposed to population biology, and views tend to be influenced by the scientific speciality of the tutor. Not all first-year students intend to devote themselves to a final degree course in biology, so it is unreasonable to expect all students to acquire the same molecular grasp of HIV and AIDS. Perhaps the most encouraging aspect of the staff's responses has been their positive stance and their willingness to continue as tutors.

TOWARD DEEPER UNDERSTANDING

Our next goal is to experiment with methods to reinforce a deeper understanding of the subject matter, be it molecular, cellular or organismal. This session Level 1 students were introduced to concept mapping and we would like to hear from others who have practical experience in its use.

Assessment also plays an important part in developing a deeper understanding in students, but marking essays makes heavy demands on staff time and it can be difficult to gauge the level of student understanding from first year work. We have now substituted *Essay 1*, on basic biological knowledge, with computer-marked objective questions. We were a bit nervous about this, since it could encourage students to focus upon factual recall and so deflect them from developing integrative and other skills. We believe this risk should be off-set by the absence of lectures and an emphasis on assessed creative writing in *Essay 2*. The authors and Dr Liz Leonard are trying out new styles of objective question to test for the application of logic, rather than simply for factual recall. It is now our practice to make computer-based objective question banks available to Level 1 students for self-testing support, and this should help next year's students to assess their basic level of comprehension of project material that is not supported by lectures. If we can continue to keep the students motivated, whilst offering these various methods of formative and summative assessment, then we may hope to see some evidence of a more mature approach by students.

Although the subject of AIDS has been particularly useful as a focus for the project, other topics in microbiology and virology are likely to be as valuable in this respect. These fields provide intrinsically interesting subjects for junior students by addressing aspects of biological science, public health and industry. As students spend over 90% of their first year studying a wide selection of other subjects that are not taught in an SDL style, the content of SDL material needs to be sufficiently compelling to encourage students to adopt the different system of learning and become intellectually engaged in the subject. A facilitated Study Project module on *Human Genetics* is now available at Level 1, involving role-play associated with commercial, biological and ethical aspects of screening for genetic disease. Other colleagues have offered a project in second year on *Circadian Rhythms*. We have a lot more to find out about this type of teaching, but we have discovered that we can trust our students to do this type of work without the regimentation associated with more formal classes for junior undergraduates.

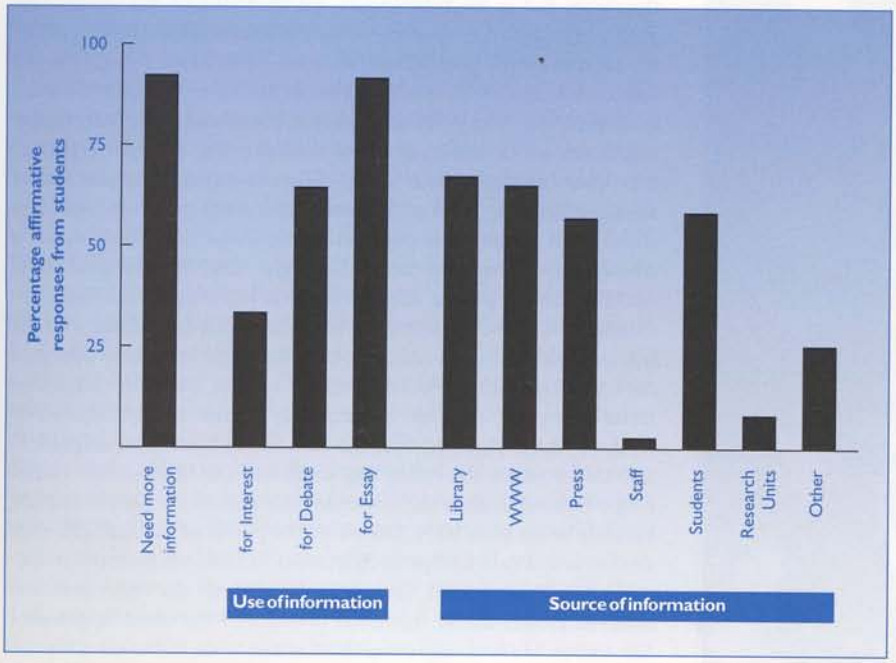


Fig. 1. Summary of the responses from 298 students who were asked about their need for information additional to that provided in the course handbook and in distributed reprints. Most needed additional information for class work. The principal sources of additional material are shown.

Roger G. Sutcliffe (to whom correspondence should be addressed), Division of Molecular Genetics, Institute of Biomedical and Life Sciences, Glasgow University, Robertson Building, 56 Dumbarton Road, Glasgow G11 6NU (r.sutcliffe@bio.gla.ac.uk).

Erica McAteer, Teaching and Learning Service, Glasgow University, Glasgow G12 8QQ.

FURTHER SOURCES

R.G. SUTCLIFFE, B. COGDELL, M.H. HANSELL & E. McATEER (1998). *Innovations in Education and Training International* (in press).

WWW SITE ON CONCEPT MAPPING: http://www.spjc.cc.fl.us/0/spns/lancraft/cmapping.html

Exploring the Unknown – Microbial Diversity

Elke Jaspers

Elke Jaspers, a German PhD student, describes her visit to the famous Woods Hole *Microbial Diversity* course run by Abigail Salyers and Ed Leadbetter.

Twenty students and scientists from all over the world, including myself, spent seven intense weeks exploring the world of microbes in June 1997 at the famous *Microbial Diversity* summer course at the Marine Biological Laboratory (MBL) in Woods Hole, MA, USA. Woods Hole in summer time is a community of international researchers (and tourists). Famous investigators, only known to us by their publications, are present. Additionally, scientists like Carl Woese, David Stahl, Jehuda Cohen and many more are invited to give talks or to stay with the course for a certain time – a great chance for us to meet them.

The course was tough. Lectures early in the morning and a quick lunch were followed by lab work in the afternoon until late at night. After three weeks of lab work organized by the staff, each student started a personal research project. We enriched and isolated many different kinds of bacteria from natural habitats, such as phototrophic bacteria from blue-coloured sand in the Great Sippewisset Salt Marsh and methane-producing bacteria from a swamp. We collected the samples ourselves. These were new and exciting experiences for me, a molecular biologist.

LIGHT MY FIRE ...

One night, we dressed up in our oldest clothes, stepped into the muddy swamp (Fig. 1) and trampled the mud under the water. Bubbles of methane produced by anaerobes in the sediment came up and we trapped them in garbage bags connected to sealed funnels. The most spectacular moment was when a sufficient amount of methane was trapped in the bags. One person operated a lighter, another carefully opened the funnel and, suddenly, the dark swamp was lit up by a big flame of burning methane! On our way home, I thought that this was one of the craziest things I ever did! Everybody brought some vials back to the lab, filled with swamp water or sediment. I collected some surface water to look for *Nevskia*-like bacteria which live on the interface between air and water. Next day we set up enrichments, still impressed by the night's experience and, for me at least, with a new feeling for what microbes do in nature.

Fig. 1.

Above: "Please keep in line!" Course students stepping into the muddy swamp.

Right: Setting fire to the methane.

Fig. 2. A microbial mat in the sand.

THE SIPPEWISSET SALT MARSH

Another field trip was to the Great Sippewisset Salt Marsh, about 8 miles north east from Woods Hole. Flooded by the Atlantic Ocean every 12 hours, a perfectly adapted microbiota has developed there which is unusual and most interesting, but still poorly investigated. Most of what is known so far has been discovered by students of the Woods Hole courses. Each year, the students explore this marsh a little further by doing their 3-week research projects on the microbiota.

When we entered the Marsh there was a terrible smell of rotten eggs, yet there were Horseshoe Crabs – living fossils – swimming in the water. But as microbiologists, we were looking for prokaryotic surprises, such as the beautifully coloured microbial mat hidden under the sand behind a pond (Fig. 2). Green, pink, black and grey layers contain bacteria which manage to live in this environment by forming a community. The green and purple layers contain phototrophic organisms which make use of the sunlight. The different pigments they contain enable them to use different wavelengths and not to shade each other. The cyanobacteria in the top green layer contain chlorophyll *a*, the same pigment as higher plants, which shows a strong red fluorescence under UV light (Fig. 3). The pink layer contains mainly purple sulphur bacteria pigmented with bacteriochlorophyll. These phototrophic bacteria form a food chain with the heterotrophic sulphate-reducing bacteria in the black layer and gain energy by oxidizing reduced organic carbon like fatty acids and transferring the electrons to sulphate. So the smelly sulphide is formed, which together with the iron forms black iron sulphide – and this is where the rotten egg smell and the black colour comes from! This sulphide is the favourite substrate of the purple sulphur bacteria in the pink layer. Driven by the power of the sunlight, they oxidize it and gain energy and electrons to build up their cell mass.

Six students, myself included, decided to do their personal research project on the microbial diversity of the Great Sippewisset Salt Marsh. We had only three short weeks to do it, but we got great support from the staff. There was a rule for our personal projects: we must have no previous experience of the topic. To me it was a scientific adventure to investigate things I knew nothing about and I decided to find out if cultivable, extremely halophilic Archaea exist in the salt marsh.

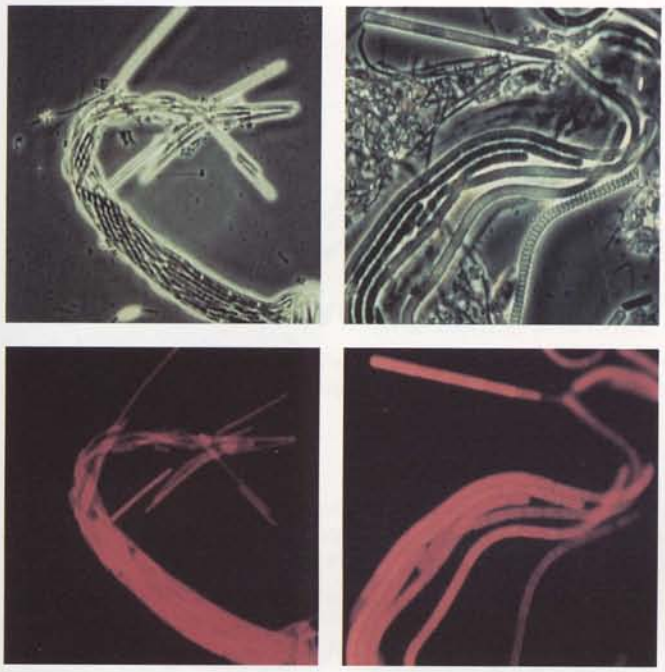


Fig. 3. Micrographs showing cyanobacteria under visible (top) and UV light (bottom).

Many Archaea are known to live in extreme habitats, such as near deep sea hydrothermal vents. The wonderful purple colour of the salt pines on the Californian coast is also caused by Archaea. These Archaea need up to 30% salt in their environment, yet sea water contains approx. 3% salt – and that already tastes very salty to us humans. But do Archaea also occur in moderate environments like the salt marsh?

I therefore attempted to cultivate extremophilic Archaea from non-extreme habitats. Despite the scepticism of my peers and to my own surprise, the results were promising and showed that further investigations might be worthwhile. I enriched for extremely halophilic Archaea by using media with 21% salt plus three different antibiotics to eliminate bacteria. I ended up with a culture that grew on solid medium containing 21% salt, suggesting that extremely halophilic Archaea can also be found unexpectedly in moderate environments. As yet I still lack a molecular proof of the identity of the isolate.

ORANGE MEANS IRON...?

Other students found unexpected microbes in the Great Sippewisset Salt Marsh. One attempted to cultivate Archaea from the lineage *Crenarchaeota* from salt-marsh sediments. Another isolated bright orange colonies in his enrichments. The unusual colour was due not to a pigment, but to a microbially catalysed process which has never been shown in a marine environment before: the oxidation of ferrous iron as an energy source. This process has so far been expected to occur only abiotically, since under oxic conditions and neutral pH the oxidation rate can result in half-lives for ferrous iron of the order of minutes. Additionally, the relatively small amount of free energy released upon oxidation makes this transformation a particularly challenging one for microbes to live on.

The experiment showed that microbes are more versatile than humans imagine. The fact that these bugs only grew in the primary enrichments inoculated with sediment, but refused to grow after being transferred to fresh media, suggests that interactions between bacteria might play an important role in this oxidation process. The principle is simple. The bacteria increase their energy yield from unfavourable substrates with the help of a partner which uses up their end-products, thus yielding more life sustaining energy than if the end-products were not removed. But if they lose their partner, they can run into serious problems. So this project opened up several opportunities for future research.

THE BERRIES

In some ponds in the marsh, pink-coloured aggregates exist – the berries – which can be fingernail size. Although the berry is such an unusual life form, it has not been investigated in much detail. A student from the 1992 course examined the berry from the physiological point of view. But a student on my course wanted to learn more about the organisms which formed the berry by using molecular tools. He revealed that the berry is a purple slime packet which is not only inhabited by bacteria, but, near the surface, by nematodes and other predators. Only the centre contains densely packed bacteria. The predators enter the berry through the porous, raspberry-like surface and presumably feed on the micro-organisms inside. Diatoms were also seen under the microscope. By using molecular tools and enrichment techniques, several bacterial members of the berry system were identified. The dominant bacteria – an anoxic phototrophic variety called purple sulphur bacteria – are responsible for the berry's eye-catching colour. Sulphate-reducing bacteria were also identified; these are the bacteria which are responsible for the rotten egg smell in the salt marsh! Additionally, bacteria belonging to the *Cytophaga* group and cyanobacteria were found.

So some of the berry's secrets were unravelled, and it was a great job to find out all this in such a short time. However, Ed Leadbetter has set a challenge to grow an entire berry. So far the prize of a bottle of wine is still available. Is anyone interested in taking up Ed's challenge? The *Microbial Diversity* course starts again in June 1998, and there will be a lot to explore besides how to cultivate berries.

Elke Jaspers is a PhD student at the University of Oldenburg, Schulweg 31, 26121 Oldenburg, Germany (Email E.Jaspers@palmikro.icbm.uni-oldenburg.de).

ILLUSTRATIONS

Some of the photographs were taken by Dr R. Schauder and S. Krause. Many of the interesting pictures we took on the course are available on the web at http://www.rz.uni-frankfurt.de/~schauder

SocietyNews

February Council Meeting

Future Strategy

COUNCIL RECEIVED a final report from the Strategy Planning Working Party set up last year, and supported the suggestion that implementation of new policy should follow a 'business plan' approach so that expenditure on agreed charitable objectives could be clearly identified. Among a number of recommendations concerning the role of the Society in public affairs, professional matters, education and services to members, it was agreed that some existing functions of the Professional Affairs Officer should be strengthened, with greater emphasis on publicity and media relations. This would be achieved by devolving responsibility for educational matters to a new Education Officer, with further measures to provide support from Society headquarters. A Special Resolution to create the post of Education Officer would be put to the Society AGM in September. Council members also noted with approval that senior officers had been invited to meet informally with officers of the Society for Applied Microbiology and were optimistic regarding future collaboration between the Societies.

Response to HEFCE Consultation

IN RESPONSE to consultation by HEFCE on the future conduct of the Research Assessment Exercise, Council approved a number of recommendations including a strong plea for assessment of microbiology separately from the mass of essentially multi-disciplinary biological sciences. In the last exercise, much university research in microbiology, of high quality and national and international importance, was pooled with efforts of variable quality in diverse other subjects. The tendency had been for biology as a whole to regress to a mean lower than was often felt to be merited by component microbiology groups. This had resulted in much UK university research in microbiology being funded at lower levels than, for example, biochemistry which had been separately assessed.

Meetings Policy

THE THORNY QUESTION of frequency and timing of scientific meetings was visited once more, and, as always, opinion was diverse, but members agreed that a future model of two major meetings per year, in spring and autumn, was most appropriate. This did not preclude the holding of separate Group meetings on specialist topics at other times, including a winter meeting, if there was a demand. Movement towards the new model would be a gradual evolutionary process over a number of years.

Charles Penn, General Secretary

SGM SYMPOSIUM VOLUMES

THE CONTRIBUTIONS to the March 1998 symposium on *Microbial Responses to Light and Time* are available as Volume 56 in the series. A review of the book appears on p. 85. As usual, there is a 60% discount to members buying their personal copies. The prices are as follows:

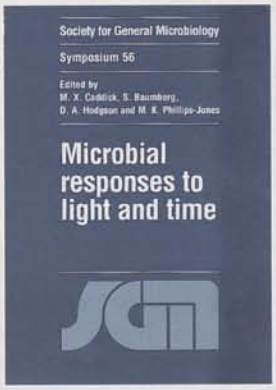
Members . . . . . £26.00/$46.00

Non-members . . . £65.00/$115

Student Members £16.00

The book can be ordered by post using the grey form in this issue of the *Quarterly*. This form can also be used to order any past Volumes that you missed at the time of publication.

Student Members wishing to purchase Symposium Volumes at the discount rate should write to the Grants Office at Marlborough House for a special order form.



SGM MEMBERSHIP SUBSCRIPTIONS 1998

All members receive the *SGM Quarterly*; in addition they may take any of the Society's journals.

ORDINARY MEMBER		
Membership Subscription (inc. *SGM Quarterly*)	£35.00	(US$60.00)
Additional subscriptions for publications:		
Microbiology	£56.00	(US$100.00)
JGV	£56.00	(US$100.00)
International Journal of Systematic Bacteriology	£45.00	(US$70.00)
STUDENT OR RETIRED MEMBER		
Membership Subscription (inc. *SGM Quarterly*)	£15.00	(US$25.00)
Additional subscriptions for publications:		
Microbiology	£28.00	(US$55.00)
JGV	£28.00	(US$55.00)

Notices

Annual General Meeting 1998

The Annual General Meeting of the Society will be held on **Tuesday, 8 September 1998** at the Society Meeting at the University of East Anglia. Agenda papers, including reports from Officers and Group Conveners, and the Accounts of the Society for 1997 will be circulated with the August issue of the *Quarterly*.

Kathleen Barton-Wright Lecture 1998

PROFESSOR Bruce W. Holloway of the University of Monash, Australia, has accepted the Society's invitation to deliver the Kathleen Barton-Wright Lecture for 1998. This will take place at the Society meeting at the University of East Anglia in September 1998. Further details will appear in the August issue of the *Quarterly*.

News of Members

Dr Karl Esser, Professor Emeritus of General Botany and retired Director of the Botanical Garden, Ruhr-Universität Bochum, Germany, has been appointed Doctor *honoris causa* by the Université des Sciences et Technologies de Lille, France, in honour of his life-work in biology and his long standing scientific relationship with French universities.

Professor Donald Ritchie, University of Liverpool, has been appointed as a member of the Board of the Environment Agency.

As of 9 March 1998, ***Dr Geraldine Schofield*** will be re-joining Unilever in a senior role as Regulatory Affairs Manager – Foods, based at Unilever Research Colworth (Tel. 01234 222131; Fax 01234 222539; Email geraldine.schofield@unilever.com).

The Society notes with regret the deaths of ***Dr J.C. Booth*** (member since 1965) and ***Dr N. Walker*** (an original member since 1944).

SocietyNews

Grants & Awards

Fund for Developments in Teaching 1998

ONLY THREE APPLICATIONS were received and the Award Panel agreed that all should be funded. Awards were made as follows.

Overseas Study Tour

Dr S. Watkinson, University of Oxford
Visit to Texas A&M University and Indiana University, USA in September 1998. £1028

Practical Teaching Aids

Dr K. Kavanagh, St Patrick's College, Maynooth
Candida albicans, a practical manual for studying the virulence attributes of an important human fungal pathogen. £1700

Dr C.W. Penn, University of Birmingham
Development of student-centred class experiments in bacterial physiology. £1120

Fund for Developments in Teaching 1999

COUNCIL HAS ESTABLISHED a further fund to provide grants in 1999 to support developments likely to lead to an improvement in the teaching of any aspect of microbiology relevant to secondary or tertiary (including postgraduate) education in the UK. It is also willing to provide financial support for tours to overseas higher education institutions to study methods of teaching large classes.

Examples of projects which might be funded include the provision of teaching materials (e.g. videos, slides, posters), the development of reliable, novel practical exercises, new approaches to teaching/learning familiar concepts (e.g. computer simulations or tutorials) or any other appropriate aspect. It is not intended that the Fund should subsidize normal departmental teaching practices; the Society wishes to encourage innovation.

Applications from members are now invited for either category of award.

Rules

1. Applicants must be members of the Society, currently residing in the UK or Republic of Ireland.
2. Practical Teaching Aids
   (a) Applicants may seek support, normally within the range £200–£3500, for:
   (i) Purchase of consumable materials, but not capital equipment.
   (ii) Short-term assistance, e.g. vacation employment of an undergraduate, or exceptionally a postgraduate after expiry of a studentship.
   (b) Successful applicants will be notified in February to facilitate forward planning for their project. They will normally be required to make the results of their work available to Society members, within 18 months of the award being made. This will include a presentation at a Society meeting and publication of a report in the *SGM Quarterly*. Physical materials, whether off-prints, videos, slides, computer programs, microbial strains or in other forms, should be readily available to Society members on free or low-cost loan or purchase for a period of at least five years after termination of the project.
   (c) The Society would encourage commercial or other dissemination of the results of the project to a wider public. All Intellectual Property Rights, including copyright and design rights, in any materials produced as a result of the grant will be vested in the Society.
3. Overseas Study Tour
   (a) Applicants may seek funding of no more than £1750 to undertake a short study tour (of no more than 4 weeks duration) to learn about microbiology teaching methods in higher education institutions outside the UK, with particular reference to the strategies of coping with large classes. The award will cover travel and accommodation expenses only, up to the prescribed limit.
   (b) Applicants must provide a detailed itinerary of the proposed tour, which it is anticipated will take place in 1999, and enclose written evidence of their invitations to the scheduled institutions.
   (c) Successful applicants will be notified in February to facilitate travel arrangements for the tour. A detailed report of the visit must be presented to the Society within 3 months of return to the UK. The findings of the tour will be disseminated as soon as possible to Society members, either by the presentation of a paper at a meeting and/or the publication of an article in the *Quarterly*.

Application Forms

Application forms are available from the Grants Office at SGM HQ (or on our web site). Please state clearly whether a form is required for a teaching aid or a study tour.

The closing date for applications is **30 October 1998**.

For application forms and details of any schemes contact the Grants Office, SGM, Marlborough House, Basingstoke Road, Spencers Wood, Reading RG7 1AE (Tel. 0118 988 1821; Fax 0118 988 5656; Email grants@socgenmicrobiol.org.uk).

GRANTS ON THE WEB!

Information on all of the Society's grant schemes is now available on the SGM website at http://www.socgenmicrobiol.org.uk

You can also download the application forms for some schemes. Click on the External Relations & Grants button for details.

SEMINAR SPEAKERS FUND 1998/99

THE PURPOSE of the Fund is to promote talks on microbiological topics in departmental seminar programmes. Applications are invited from higher education institutions where microbiology is taught for grants of up to £200 towards the travel, and if necessary, accommodation, expenses of an invited speaker. Applications will be dealt with on a first come, first served basis during the academic year. Written submissions should be sent to the Grants Office at SGM Headquarters for consideration.

Rules

1. The scheme is open to higher education institutions in the UK and Republic of Ireland where microbiology is taught. Normally only one department within an institution will be eligible for an award within each academic year, which is defined as running from September 1998 to June 1999. It is expected that departments will collaborate in selecting a seminar speaker.
2. Applications will only be accepted from departments, not from Student Microbiology Societies.
3. Up to two speakers may be funded each year, provided the total award to the institution does not normally exceed £200.
4. Seminars must be advertised regionally as sponsored by the Society.
5. Awards will be paid retrospectively on receipt of evidence of the actual expenses incurred.
6. Applications should contain the following information:
   (a) The names and addresses of the speaker(s) to be invited and the topic of the talk(s).
   (b) Evidence, in the form of a programme, that an active seminar programme is already established in the department(s). Where no previous programme exists, good reason should be given for the request, such as the establishment of a new department.
   (c) Details of any sponsorship for seminars that the department already has (or is anticipating).
   (d) An indication of the target audience for the seminar, which may include undergraduates and postgraduates.

SocietyNews

International Development Fund

COUNCIL AIMS TO ASSIST MICROBIOLOGISTS IN DEVELOPING COUNTRIES AND EASTERN EUROPE THROUGH THE INTERNATIONAL DEVELOPMENT FUND. AWARDS ARE MADE BY COMPETITION.

Purpose

1. Support visits (travel and accommodation) by members of the SGM to laboratories in countries where microbiology is inadequately developed but where its further development may assist education or the economy of these countries. The purpose of the visits must be to give short lecture courses and laboratory training in subjects designed to meet the needs of these countries. The countries may vary from time-to-time but at present these include many places in the Far East, Africa, South and Central America, the Indian sub-continent and Eastern and Central Europe. Host laboratories are usually expected to provide some evidence of local support for the courses.
2. Allow purchase of basic equipment essential for the needs of such training courses.
3. Provide Society journals, symposia and special publications to established libraries for a limited period of time at reduced or zero cost, especially when it can be shown that these publications are not currently reasonably available in the country concerned.
4. Support national microbiological facilities, e.g. culture collections (which underpin microbiology), where these run into temporary difficulties.
5. Support any other small project to assist in technology transfer from Western Europe to the areas mentioned above for which other sources of funding do not exist. This might include provision of equipment to a nominated centre at which a member is working permanently.

Guidelines

1. Applications for sums between £1000 and £5000 will be considered first. No applications above £7000 will be accepted.
2. Applicants must be members of the Society.
3. In making applications for support for giving short lecture courses or laboratory training, detailed information must be provided about the relevance and quality of the training course and the degree of local support for the course.
4. Each application must be accompanied by full supporting documents.
5. A condition of funding (except for provision of publications) is that a brief report, suitable for the *Quarterly*, be provided.

Applications to the Fund are now invited. Four copies, including full supporting documents, should be sent to the International Secretary, (Professor J.W. Almond, School of Animal & Microbial Sciences, University of Reading, PO Box 228, Whiteknights, Reading RG6 6AJ).

The closing date for applications is 25 September 1998.

THE WATANABE BOOK FUND

MEMBERS who are permanently resident in a developing country are reminded that they may apply for funding to acquire for their libraries books, or possibly journals, relating to microbiology. These annual awards are available as a result of a generous donation from Professor T. Watanabe of Japan.

Full details of the scheme were published on p.31 of the February issue of the *Quarterly*. The closing date for the receipt of applications, which should be made to the Grants Office at SGM Headquarters, is **3 October 1998**.

Staff News

Several changes in staff have taken place in recent months.

We are pleased to welcome new staff editor Joanna Coleman to the journals office where she will be working principally on *Microbiology*. Joanna, who has recently completed studies for her PhD at the University of Leicester, replaces Aidan Parte following his promotion late last year to Managing Editor of *International Journal of Systematic Bacteriology*.

Jane Perugia has joined the staff of JGV to provide extra secretarial assistance.

In the journal sales department Adrienne Jones, a long-serving member of staff, took early retirement on 31 March. Her place has been taken by Janine Wooldridge

Travel Grants for SGM Members

1999 IUMS International Congresses

Sydney Convention Centre, Australia

XIth International Congress of Virology	*9–13 August 1999*
IXth International Congress of Bacteriology & Applied Microbiology	*16–20 August 1999*
IXth International Congress of Mycology	*16–20 August 1999*

MEMBERS SHOULD BE AWARE that the Royal Society has discontinued its block grant system which has, in the past, earmarked a specific sum for travel to IUMS Congresses. Grants are still available from the Royal Society to attend these meetings but applications are now dealt with individually under the standard conference grants procedure. Applicants should be of at least PhD status and normally resident in the UK. Civil servants, employees of research councils, government-funded bodies and commercial concerns are ***not*** eligible for awards. Closing dates for the scheme are 1 March, 1 June, 1 October and 1 December each year.

Full details of the scheme and application forms are available on the Royal Society website (www.royalsoc.ac.uk) or from Sandra Goodall at the Royal Society, 6 Carlton House Terrace, London SW1Y 5AG (Tel. 0171 451 2540; Fax 0171 930 2170; Email conference.grants@royalsoc.ac.uk)

SGM has also established its own travel fund aimed, in the first instance, at Society members ineligible for a Royal Society award (e.g. postgraduate students, research assistants). Full details of the scheme will be announced in the August *Quarterly*, but anyone who is eligible for a Royal Society award should apply to them first. Ordinary Members applying to the SGM fund will have to provide evidence that their application to the Royal Society has been unsuccessful. Contact the SGM Grants Office for further information.

THE WELLCOME TRUST

Topics in International Health – *Help Wanted!*

THE TRUST IS DEVELOPING A SERIES of CD-ROMs on *Topics in International Health* as part of its Tropical Medicine Resource. This is a non-profit initiative for the benefit of health professionals in developed and developing countries. Each CD-ROM contains interactive tutorials and a comprehensive, searchable image collection and provides training in the control, epidemiology, diagnosis and treatment of the world's major diseases. Currently work is in hand on the Diarrhoeal Diseases CD, to be released in the autumn, and the compilers are keen to acquire appropriate, up-to-date photographic slides. There is no payment for images but donors will receive an honorarium for any time spent working with the project, together with a free copy of the CD-ROM. If you wish to help contact Stephen Lacey, Scientific Editor (Image Collection), The Wellcome Trust, 210 Euston Road, London NW1 2BE (Tel. 0171 611 8888; Fax 0171 611 8270; Email s.lacey@wellcome.ac.uk).

SGM Autumn Meeting 1998

The 141st Ordinary Meeting of the Society will take place at the University of East Anglia from Tuesday 8 September to Thursday 10 September 1998.

MAIN SYMPOSIUM JOINT WITH THE GENETICAL SOCIETY

(9–10 September)

PORTRAIT OF AN ORGANISM: THE GENETIC ANALYSIS OF STREPTOMYCES COELICOLOR A3(2) BIOLOGY

A Symposium to mark the retirement of Professor Sir David Hopwood FRS

J. DAVIES (Vancouver)	*Streptomycetes – the bugs with everything*
C. CHEN (Taipei)	*The streptomycete genome: from a circular genetic map to a linear chromosome and back*
J. ALTENBUCHNER (Stuttgart)	*Chromosomal instability in Streptomyces – huge deletions and gross amplifications*
S. COHEN (Stanford)	*Evolution and replication of Streptomyces linear plasmids*
T. KEISER (Norwich)	*DNA modification in streptomycetes*
M. SMITH (Nottingham)	*Actinophage χ31: the streptomycete lambda*
P. DYSON (Swansea)	*Transposon mutagenesis in Streptomyces*
P. MALPARTIDA (Madrid)	*The actinorhodin biosynthetic gene cluster from Streptomyces coelicolor A3(2)*
P. LEADLAY (Cambridge)	*Modular polyketide synthases*
R. BALTZ (Indianapolis)	*Genetics of antibiotic biosynthesis: applications to yield enhancement and to discovery of novel products*
R. HUTCHINSON (Madison)	*Pathway-specific regulation of antibiotic production in Streptomyces peucetius*
M. BIBB (Norwich)	*Pleiotropic regulation of antibiotic production in Streptomyces coelicolor*
J. DISTLER (Wuppertal)	*Regulation and physiology of streptomycin biosynthesis in Streptomyces griseus*
S. HORINOUICHI (Tokyo)	*Regulation of antibiotic production and sporulation by A factor*
C. SMITH (UMIST)	*Multiple regulatory mechanisms govern heat shock gene expression in Streptomyces coelicolor*
C. THOMPSON (Basel)	*Stress responses associated with the developmental transition in Streptomyces*
J. WESTPHELING (Georgia)	*Carbon utilization and morphogenesis in Streptomyces metabolite repression and morphogenesis*
R. LOSICK (Harvard)	*Cell–cell interactions in aerial mycelium formation*
K. CHATER (Norwich)	*The early stages of sporulation in Streptomyces coelicolor*
M. BUTTNER (Norwich)	*Control of the late stages of sporulation in Streptomyces coelicolor*

Education — 8 September
- *Teaching microbial and molecular genetics* (Symposium – joint meeting with the Genetical Society)

Environmental Microbiology — 10 September
- *Biosensors and indicator organisms* (Symposium)

Fermentation & Bioprocessing — 8 September
- *Mycelial fermentation* (Symposium)

Physiology, Biochemistry & Molecular Genetics — 8–9 September
- *Versatile pseudomonads* (Symposium)

SGM Promega Prize Competition — 9 September
- *Sponsored by Promega* (For further information, see p. 72)

For further information about Group Symposia, see *News from the Groups* (pp. 78–82).

OFFERED PAPERS

Offered Poster Papers are invited on any aspect of microbiology. Titles and authors (including full addresses) should be sent to the Meetings Administrator, Marlborough House, to arrive no later than **6 June 1998**. Abstracts will not be required at this stage, but authors will later be asked to complete an abstract form, sent out on receipt of the paper title, to be used as camera-ready copy, or to send their abstract by Email, for the Abstracts Booklet that will be available at the meeting.

Joint Meeting of the SGM Microbial Infection Group and the Pathological Society

University of Leicester, 1 July 1998

Non-microbial Antimicrobials

Further information can be obtained from the Pathological Society Website **http://www.pathsoc.org.uk** or from the SGM Meetings Office

Joint Meeting of the SGM Irish Branch and Virus Group

The Queen's University Belfast
2–4 September 1998

Microbial Neuropathogenesis

Further information can be obtained from Dr Louise Cosby **(L.Cosby@qub.ac.uk)** or the SGM Meetings Office

European Standards in Biotechnology

Chris Thurston

THE BRITISH STANDARDS INSTITUTE has now started to publish European standards in biotechnology, as listed below. There are about another 50 to follow.

BS EN 1619: 1997 *Biotechnology – Large-scale process and production – General requirements for management and organization for strain conservation procedures.*

BS EN 1620: 1997 *Biotechnology – Large-scale process and production – Plant building according to the degree of hazard.*

BS EN 1826: 1997 *Biotechnology – Large-scale process and production – Control procedures for raw materials.*

BS EN 12075: 1997 *Biotechnology – Large-scale process and production – Procedures for fermentation and downstream processes.*

BS EN 12306: 1998 *Biotechnology – Guidance for quality control of diagnostic kits used in agriculture, plant and animal pest and disease control and environmental contamination.*

BS EN 12305: 1998 *Biotechnology – Modified organisms for application in the environment – Guidance for sampling strategies for the deliberate releases of genetically modified plants.*

In addition to the Standards themselves, of which the above are examples, there are also Published Documents which can equally be used in the future as a basis for EU Directives, as far as I am able to judge. The following have been produced to date (16.2.98):

BSI PDI 6596: 1996 *Biotechnology – Micro-organisms – Further examination of organisms in support of the classification work carried out under directive 90/679/EEC.*

BSI PDI 6597: 1996 *Biotechnology – Micro-organisms – Examination of the various existing lists of plant pathogens and production of a report.*

BSI PDI 6613: 1997 *Biotechnology – Micro-organisms – Examination of the various existing lists of animal pathogens and production of a report.*

These documents are useful if you need a concise comparison of the hazard classification of a pathogen in different European countries, particularly Belgium, Holland, France, Germany and the UK.

Copies are available from: Customer Services, Sales Department, BSI, 389 Chiswick High Road, London W4 4AL (Tel. 0181 996 7111; Fax 0181 996 7048).

SAINSBURY MANAGEMENT FELLOWSHIPS IN THE LIFE SCIENCES

THE GATSBY CHARITABLE FOUNDATION has announced a new scheme to support young scientists of high career potential to undertake activities related to their Personal Development Plans. The objective is to improve the economic performance of the UK animal, plant and life science, bioscience and biotechnology industrial sectors by providing a human resource of highly trained and motivated scientists. It is expected that award holders will go on in due course to make a major contribution to the wealth of the nation. The bursaries could cover training, secondments, travel and conference attendance. Applicants must be UK citizens, hold a PhD in bioscience, be following a career compatible with the aims of the scheme and be aged between 26 and 38. Details are available from Ian Bowbrick, The Royal Academy of Engineering, 29 Great Peter Street, Westminster, London SW1P 3LW (Tel. 0171 227 0504; Email bowbricki@raeng.co.uk).

Science on the Underground!

LONDON TUBE PASSENGERS are being educated in science by a series of posters on underground trains. The aim of the four posters, which pose a scientific teaser for travellers to think about on their journey, is to improve their knowledge of chemistry, biology and physics. Four sets of posters will appear over 2 years and an educational pack for schools to support the project is available. London Transport Museum is currently developing other resources and complementary exhibits. Passengers can follow up their curiosity by phoning *Science Line* on 0345 600 44 or look up the website at www.mmu.ac.uk, or contact the Science on the Underground project office at Manchester Metropolitan University (Tel. 0161 247 5279).

CABI BIOSCIENCE

ON 1 JANUARY 1998 the four scientific institutes of CAB International were integrated into CABI Bioscience: International Institute of Biological Control, International Institute of Entomology, International Mycological Institute and International Institute of Parasitology. UK operations will be consolidated at two research and training facilities at Egham and Ascot. There are also five stations overseas. CABI Bioscience activities will be arranged in ten programmes in three sectors: Biodiversity & Biosystematics; Biological Pest Management; and Environment. Programmes of particular interest to microbiologists include: Biosystematics & Molecular Biology; Biotechnology – Utilization of Biodiversity; and Tropical (human) Parasitic Diseases. For further information visit the website at www.cabi.org or Email bioscience@cabi.org

BBSRC/MAFF *Amazing Micro-organisms Competition 1998*

IN A CHALLENGE TO STUDENTS to find out more about the amazing world of micro-organisms, BBSRC and MAFF joined forces to hold a competition for schools. The 8–12 year-old category had to design an A3-sized poster showing one example of a helpful microbe, one example of a harmful microbe and one micro-organism created from their own imagination. The poster was required to have an eye-catching design and offer clear, informative labelling. Ron Fraser, SGM Executive Secretary, and Dr Nuf Meah from MAFF Food and Veterinary Science Division had the difficult job of judging the 900+ individual posters which came in from 91 schools. The first-prize winners were amongst the youngest to enter, ranging from 7 to 9 years, and were pupils at Minsterworth C of E (Aided) School, near Gloucester.

Ron Fraser (right) and Dr Nuf Meah (left) judging the entries in the Amazing Micro-organisms Competition.

The challenge for the 12–16 year old group was to produce a short public information video (3 minutes maximum length) which looked at micro-organisms in relation to food safety together with a flyer giving further details, advice and useful addresses. A total of 18 videos were received, all produced by students between 12 and 13 years. The judges, Geoff Raison, Head of Film and Video, Central Office of Information and Dr Stephen Pugh from MAFF, awarded first prize to a group from Parkside Community College, Cambridge.

Tracey Reader, Schools Liaison Service, BBSRC

News From Student Microbiology Societies

Exeter University BIOSOC

The Biology Society is currently relatively small having been only recently reformed. It is a society run for students, by students and it relies on input from the members to select events to organize. The Society aims to provide social activities as well as informative and educational events such as seminars and organized visits to biologically biased businesses, such as the one planned to a local brewery, and fungal forays in the autumn. Other aims are to offer opportunities for members to broaden their horizons and to provide aids for learning.

Traveller's Diarrhoea – Getting the Priorities Right

Report on an SGM Sponsored Lecture by Professor Rodney Cartwright

Approximately 50 people attended the lecture; a mixture of undergraduates, postgraduates, postdocs and both academic and technical staff.

IT'S ALL IN THE WATER, or at least that's where most of the problem originates, according to Professor Cartwright.

The lecture started with a brief historical note about cholera in Exeter in 1832, which was brought to the port by people on a ship. This extreme example of 'Traveller's diarrhoea' illustrated the potential of the problem as well as showing that it can be local. 'Traveller's diarrhoea' was clearly and simply defined as diarrhoea and intestinal problems gained whilst on holiday in a foreign country. The bulk of the lecture was spent explaining the causes, with the emphasis being on unclean water. Seeing a slide of a restaurant kitchen toilet not looking much more hygienic than that from the film *Trainspotting* demonstrated clearly how microbes can be spread easily via flies. The comments accompanying this were amusing and caused general laughter.

Professor Cartwright highlighted several points on the treatment of water in some foreign countries. The overall conclusion was that public health infrastructure is what needs to be improved.

The lecture was well presented and stimulated further thought. It would have been interesting to hear more about the microbes, but overall a lot of information was presented. We did come away wondering, however, whether a holiday in Britain might just be that bit safer than one overseas.

John Howells and Caroline Polden (2nd Year BIOSOC representatives, Exeter University).

Edinburgh University Medical Microbiology Society (EUMMS)

From Soda Lakes to Salt Mines

Report of an SGM Sponsored Lecture by Professor Bill Grant, Leicester University

On a cold December evening our members were taken on a fascinating microbial safari, complete with BBC 'Life on One'-style video clips.

WE BEGAN OUR EXPEDITION in the north of the East African Rift Valley, some 200 km from Nairobi. The soda lakes in the floor of the valley are an extremely hostile and highly basic environment for many organisms. However, to many others, this habitat, one of the most alkaline places found naturally on earth, is home. Cyanobacteria form one group of bacteria that are tolerant of the environmental extremes of the soda lakes. They drive the microbial population and constitute a significant part of the food chain. Sampling of these soda lakes, followed by culturing, has revealed that many different types of pigmented bacteria also inhabit the lakes. 16S rRNAs are excellent ancient molecules for determining the origin of these bacteria, which include several *Bacillus* species.

Research into these alkaliphilic bacteria has important commercial links. The bacteria, particularly *Bacillus* species, produce enzymes that are valuable to the detergent industry, such as cellulase which is used as an additive in laundry detergents to remove stains, soften and brighten fabrics and generally make our smalls whiter than white! These enzymes have a high optimum pH and remain active at the alkaline pH of detergent solutions, as well as saving valuable energy by catalysing reactions at lower temperatures.

We were then taken south down the Rift Valley to visit extremely saline waters. The red coloration of the water indicates the massive growth (blooms) of halobacteria, the collective name for the halophilic Archaea. These prokaryotes have an extremely high salt requirement; some halophilic bacteria, such as *Natranococcus* spp., are particularly unusual in that they are additionally alkaliphilic. Halobacteria contain ether-linked lipids. The structures of these lipids can be employed, along with sequencing studies, to define eight or nine separate halophile groups. Interestingly, halobacteria can survive for long periods in the halite fluid inclusions of salt crystals. Ancient evaporite deposits have to be analysed to determine how long these micro-organisms can survive within rock salt.

The next stage of our journey, surprisingly, took us to two salt mines in Cheshire that are about 200 million years old. Halobacteria can be isolated from brine swimming pools within the rock salt sampled from these two sites. So far, results have been inconclusive and it has not been possible to determine whether these organisms have been trapped in time for millions of years, as some appear to be ancient bacteria whereas others have present day bacterial lineages.

Finally, our thoughts were led to a future microbial exploration of Mars and the space mission to take place early in the next century. Mars is known to have an alkaline surface and there is evidence of ancient water courses and, therefore, salt lakes. These salt lakes may have once harboured halobacteria, which could still reside inside rocks on the planet. Will future life detection sampling reveal the presence of these ancient evaporites? For the answer to this question we will have to wait a few years and see.

Rachel Stunt (Departmental Seminar Organizer)

Promega Young Life Scientist of the Year Award 1997

ARE YOU A PHD STUDENT OR FIRST POSTDOC UNDER 28? DO YOU FANCY GAINING VALUABLE EXPERIENCE PRESENTING YOUR RESEARCH TO A FAIR BUT CRITICAL AUDIENCE? DO YOU LIKE THE IDEA OF WINNING £2000 PRIZE MONEY AND A WONDERFUL GLASS TROPHY? IF THE ANSWER TO THESE QUESTIONS IS "YES" THEN READ ON ...

Promega sponsors an annual competition to encourage and promote young life scientists. Contestants are drawn from four scientific societies, including the SGM who recently hosted the 1997 competition at its spring meeting in Nottingham. The finalists are selected each year by their respective societies on the basis of poster or oral presentations and, with a cheque for £200 already in the bag, they go forward to the *Young Life Scientist* competition where they must give a ten minute presentation and answer questions from the floor.

The 1997 competition had twelve candidates drawn from the fields of genetics, biochemistry, immunology and microbiology. Molecular biology ruled the day with only a few exceptions. I am not sure why this should be the case – are molecular biologists generally better communicators or does this reflect the thrust of life science research today? That said, the projects were extremely diverse ranging from applied research, into areas such as biological pest control and human drug metabolism, through to fundamental research into areas such as yeast molecular genetics and development of neonates. All twelve researchers attained a high standard of presentation and were able to field questions with great panache. The winner was SGM member Colum Dunne, University of Cork, and deservedly so, for his excellent and clear presentation on his PhD research into evaluating and improving a biocontrol agent of fungal plant pathogens.

So, if you see yourself as the winner of the 1998 competition you may find the following tips useful.

1. Stick to the time limit when giving your presentation. Over-running by a few minutes can lose a good presentation vital points.
2. Pace yourself – if you have to talk too quickly to fit everything into ten minutes it might be a good idea to 'prune' the talk so you can take a more relaxed approach.

Colum Dunne, winner of the Young Life Scientist of the Year Award 1997.

3. Don't lose sight of the big picture – introduce your topic and remember to explain the project's significance in the wider context. Not all of the audience (or judges) are specialists in your subject area.
4. Remember it is your project – let your enthusiasm show through.
5. Make sure your slides are accurate and up-to-date.
6. Use colour wisely in slide presentations – what looks attractive on a computer screen can lose impact when projected in a large lecture theatre.
7. Still on the subject of slides, use a large font – at least 20 pt for text and 18 pt for legends.
8. Remember that bullet points should be brief and not extend over several lines of text.
9. Take your time when answering questions – a considered answer may take a few moments to formulate.

Jane Westwell
SGM External Relations Office

PROMEGA PRIZES 1998

THE SGM FINALS to decide the winners of the 1998 Promega Prizes will take place on the morning of Wednesday 9 September at the Society's meeting at the University of East Anglia. The two winners of this session will go forward to the next *Young Life Scientist of the Year* competition, to be held in 1999. Contact Mary Harwood, SGM Meetings Office, for details (Email meetings@socgenmicrobiol.org.uk).

The UK Young Life Scientist of the Year Award

FOOD MICROBES – THE GOOD, THE BAD & THE UGLY

Jane Westwell & Janet Hurst

Our theme for National Science Week in 1998 was food microbiology. Food poisoning is often in the headlines, but the general public is less aware of the importance of micro-organisms in the spoilage of foodstuffs and of the wide range of food and drink that is produced with the help of microbes. By running the events described below, we hoped to enlighten the people of the Thames Valley about the role of microbes in their diet.

PUBLIC MEETING

On the evening of Wednesday 11 March an audience made up of school pupils, pensioners, students, Women's Institute members and other members of the public were to be seen making their way to a lecture theatre at the University of Reading. They were greeted by SGM member Dr Lyndon Davies, Assistant Director of the Reading Laboratory of the Institute of Food Research, who showed examples of headlines from the tabloid press about food poisoning outbreaks and posed the question, "What are the real facts about food microbes?"

The activities of the 'good guys' were described by Dr Bob Rastall, a lecturer in the Department of Food Science and Technology at Reading University, who took us through a microbial menu, each course of which involved micro-organisms in its production. As well as covering the traditional fermentations by yeasts and lactic acid bacteria which provide the bread, alcoholic beverages and range of dairy products that we all enjoy, and the lesser known fermentations that assist the processing of olives, coffee and chocolate, Dr Rastall showed that microbes enter our diet in some surprising ways too. He outlined how microbial enzymes are used, such as in the manufacture of after dinner mints and the production of artificial sweeteners. In the future eating certain kinds of micro-organisms may even be the key to better health.

Dr Carol Phillips of Nene College then spoke on the hidden enemy in our food – the bacteria that cause illness such as *Salmonella*, *E. coli*, *Campylobacter* and *Listeria*. She outlined how changes in eating habits, such as the consumption of more ready-meals, the use of microwaves and an increase in dining out, together with improved methods of detection and recording, have produced the escalating numbers of reported food poisoning cases in recent years. She then went on to show how microbes enter the food chain and cause disease, illustrated with case studies of particular bacteria, and described which members of the population are most at risk. However, all is not doom and gloom, for there is much that people can do to protect themselves from food poisoning in the home by careful attention to food safety.

The 'ugly' role was filled by the fungi that cause food spoilage, resulting in tremendous economic losses worldwide. In developing countries over 20% of food is lost in this way. Despite all our efforts to preserve foods by drying, salting, curing, refrigeration, etc., it is impossible to protect food against all spoilage fungi. Expert mycologist Dr Zofia Lawrence of CABI Bioscience UK Centre described how fungi can not only impair the texture and appearance of food and make it taste bad, but also produce toxins which cannot

Adults and children enjoying the SGM exhibits and demonstrations during the Reading University Science Family Fun Weekend.

be detected visually and which remain in the food after it has been processed. For example certain *Aspergillus* species produce aflatoxins in nuts and cereals which are potent carcinogens. Cargoes of nuts are tested at the port of entry to the UK and sent back to their country of origin if mycotoxins are found, but, sadly, the product is still consumed there by people unable to afford a higher quality product. Slides of foodstuffs badly decayed by fungi led to cries of revulsion by the audience, although it was pointed out that species closely related to the spoilage organisms were used in the production of many delicious items of our diet such as cheese, soy sauce, mycoprotein, etc.

A round-table discussion concluded the lively session and the audience departed each clutching a 'goody bag' of biotechnology food products ranging from cheese, through yeast extract cubes, biscuits, Yakult and vinegar, to after dinner mints.

Our thanks are due to the speakers who gave freely of their time to prepare and deliver the talks and to SGM's Janice Meekings and her husband Barry for putting up the goody bags and acting as stewards at the event.

SCIENCE FAMILY FUN DAYS

During the second weekend of set98 the External Relations Office staff were to be found, with a small band of willing volunteers, at the Reading University Science Family Fun Days. The theme of our exhibition was food microbiology and the fun was mixed with a serious message about food safety in the home. The exhibition was sponsored by a generous grant from COPUS and our aim was to put across the message about food safety but at the same time show that microbes are essential for producing many of our favourite foods and beverages.

The focus of the exhibition was a food safety computer quiz, written in-house, which was aimed at the adults of the families attending the event. They were presented with a virtual buffet and asked to explore further and discover whether the foods had been prepared, stored and served safely. Most types of bacterial food poisoning were included and it is fair to say that most people learned something from the quiz. Although it was aimed at adults, many younger people had a go and it was particularly good to see children and their parents working together. Four computers were kindly lent by the the Department of Food Science & Technology (FS&T), Reading University, and were used non-stop for the full two days.

A display reinforced the general theme that food poisoning can be avoided and copies of the new SGM posters on food microbes plus a wide range of free literature on food safety were available to take away.

Dr Zofia Lawrence, from CABI Bioscience UK Centre, contributed enormously to the event by putting together a display on good, bad and ugly fungi. Visitors were able to see fungi growing in Petri dishes and compare them to photographs of spoiled food products or, in the case of the good, products of fungal fermentations. Continuing the theme of fungi, Kit Brownlee, from FS&T at Reading University, put together a display of micrographs, fungal cultures and food products under the banner *Fungal Friends and Foes*. A light microscope for close inspection of the fungi proved a great hit, with Kit on standby to help with the tricky art of focusing.

The good microbes were also very well represented in the exhibition. Matthew Kendall and Catherine Rycroft, PhD students in FS&T produced excellent posters about cassava fermentation and production of prebiotic oligosaccharides, respectively, subjects close to their hearts! A biotechnology shopping basket packed with food products brought home to people that biotechnology

is not only about Dolly the sheep and genetically engineered soya beans. Visitors also had the opportunity to win a bag of biotechnology food products in the Lucky Dip. John Schollar and Bene Watmore, from the National Centre for Biotechnology Education, ran regular workshops throughout the event and had an eager crowd of children using microscopes to look at mushrooms and blue cheeses, inoculating toilet rolls with oyster mushroom cultures and finding out about the wonderful properties of baker's yeast. Staff from Yakult UK Ltd were on hand to provide the fun and refreshment in the shape of hundreds of balloons and over 2000 pots of Yakult drink.

The science family fun days attracted an estimated crowd of over 9000 people of which we probably saw at least half. For those who manned the exhibition it was an exhausting but worthwhile experience. Our thanks are due to Mike Hurst, Zofia Lawrence, John Schollar, Bene Watmore, Yakult UK Ltd and from FS&T: Kit Brownlee, Catherine Rycroft, Matthew Kendall, David Owens, Alan Reynolds, Peter Swallow, Kostas Mountzouris and Bob Rastall.

A set of three posters on basic food microbiology for secondary schools is now available from the External Relations Office. These follow the theme of the set98 events, with one poster on food spoilage microbes, another on food poisoning organisms and the third on the role of microbes in food production. Acknowledgements are due to SGM members from the University of Nottingham: Cath Rees and Liz Sockett for help with illustrations and particularly to Chris Dodd for checking the text.

Microbiology on the Road

Jane Westwell & Janet Hurst

This title refers not to a new field of microbial ecology, but to the activities of the External Relations Office as they travel the length and breadth of Britain in an attempt to promote the science of microbiology.

ASSOCIATION FOR SCIENCE EDUCATION ANNUAL MEETING

Early January and it was cold, wet and windy on the campus of Liverpool University. In the midst of a deluge, we unloaded the van and set up a stand in the Living Science Exhibition, an area specially reserved for organizations promoting biological subjects. Along with our colleagues from BBSRC, ABPI, MRC, The Wellcome Trust, Biochemical Society, National Centre for Biotechnology Education, British Pharmacological Society, British Society for Immunology, Institute of Biology, NERC, Science and Plants for Schools, Glaxo–Wellcome and the Central Laboratories of the Research Councils, we were there to talk to the 4,000+ science teachers from around the world for whom the ASE Annual Meeting is the highlight of the year.

The 1998 Annual Meeting was a vast enterprise, with a packed programme of symposia, lectures and workshops running for three days, and exhibitors on every aspect of science education to be found in most buildings on the campus. The scientific educational publishers were a windswept five minutes walk away in the crypt of Liverpool Catholic Cathedral. In the evening there were social events.

This year we shared a stand with the Microbiology in Schools Advisory Committee (MISAC) for which SGM provides the secretariat. Large quantities of factsheets and posters were available for teachers to take away. Susan Isaac and her keen laboratory technician Dan Amey kindly set up a 'wet' display of culture plates and basic laboratory equipment and the display panels were designed to illustrate the theme *Starting and Finishing*, outlining safe practice in setting up microbiology investigations in schools, but also covering the all important topic of disposing of the material afterwards. MISAC members from as far away as East Anglia and Mid-Wales came along to take their turn in manning the stand and SGM's Dave Roberts, at the meeting wearing his Natural History Museum hat, also did his bit. Local MISAC member Margaret Whalley and her husband Tony, Treasurer of the British Mycological Society, also helped.

Attendance at the Annual Meeting is valuable not only for talking to teachers and school technicians, but for the opportunity it provides to see what other educational material is available, to liaise with colleagues in other organizations and find out what their latest projects are. Over dinner in the evenings potential collaborations can be explored and useful information exchanged. We are very grateful, therefore, for all the help in manning the stand which enabled us to visit other exhibitors on the site and to attend relevant lectures.

Next year the Annual Meeting is being held at the University of Reading. As locals, we have 'volunteered' to oversee the organization of the whole Living Science Exhibition. It will be hectic, but at least we will be able to go home every night! Anyone who is interested in helping on the SGM stand will be made very welcome and will find much to see and do.

CAREERS LIVE!

Early March and another wet and windy day, but at least this time we could unload the car under cover. Back at Birmingham NEC for the fifth year running, it was time to set up yet another stand – different panels! – and promote careers in microbiology to the GCSE and 16+ students of the Midlands. As usual we shared the stand with our colleagues from the Biochemical Society and the British

Janet Hurst providing microbiology careers advice for GCSE and 16+ students at the SGM Stand during 'Careers Live' in Birmingham.

John Schollar and his crowd-pulling 'biotechnology demonstrations' at 'Careers Live' in Birmingham.

Immunological Society under the *Life Science at Work* banner and this time we were also joined by representatives from the Institute of Biology. John Schollar of the NCBE, as ever, provided the crowd-pulling attraction with his biotechnology demonstrations. This year the unwary punter was treated to the sight of an orange which had been 'peeled' with the help of microbial pectinase and a display of yeast fermentations. To be with us on the first day, a Sunday, John had driven down from Scotland, leaving at 5.00 am!

The careers fair ran for three days and 19,500 people were recorded as attending. Most of these were busloads of school pupils and their teachers, but on the Sunday families and interested individuals came. We gave out reams of literature and talked ourselves hoarse, but hopefully the efforts were all worthwhile.

The next appearance of *Life Science at Work* will be at the Business Design Centre, Islington on 6 and 7 May, where UCAS are holding one of their *Next Step Education Conventions* for 16+ students. Why not visit the stand?

WHAT NEXT?

We will be back on the road soon at the following events.

14 April 1998

Edinburgh International Science Festival

A joint symposium with the Society for Applied Microbiology on *The Secrets of the Ploughman's Supper* – a session on the microbiology behind bread, cheese and beer.

3–5 July 1998

Life Science 2000 Returns

We will be holding a workshop and running a stand at this event for biology teachers at the University of Warwick, focusing on teaching resources for food microbiology. The new posters will be available and teachers will be able to try their hand at the food safety computer quiz that proved so popular in our set98 display. It is hoped to make the quiz freely available soon, both on disc and on the website.

7–8 July 1998

ASE Midland Area Meeting, Solihull College

The SGM is sponsoring a training course in basic microbiology techniques for school technicians at this event and we are having a stand in the exhibition.

FUTURE CAREERS ACTIVITIES BY LEARNED SOCIETIES

AN EXPLORATORY MEETING has taken place between representatives from a wide range of learned societies involved in life science to see if there is any potential for collaboration in the whole area of promoting careers. This was convened jointly by the Biochemical Society and the BSI. As a first step a leaflet listing contact names and addresses and brief details of each subject plus a useful bibliography will probably be published and distributed to all schools, careers services etc. At the schools level, *Life Science at Work* will continue in its present form for now, with perhaps more societies joining in, and the BSI will participate in the Saturday careers conferences for undergraduates, currently run by the Biochemical Society with input from SGM and BPS. These will take place in November, one in Scotland, another in London and the third in the Midlands. Now that this useful dialogue has been opened up, it is to be hoped that new initiatives will follow.

WHAT ELSE?

Off the road, other promotional activities continue.

- The MISAC annual competition this year is to produce a public information leaflet on the theme *Controlling Microbes*. The entries are already rolling in and the judging session at Marlborough House on 2 July promises to be as difficult as ever.
- The External Relations pages on the SGM website are being continually expanded. Extra information on careers is being planned, and it is hoped to get *Microbiology in the News* up soon, but this project has been beset by technical difficulties. The office has a dedicated email address now: info@socgenmicrobiol.org.uk
- A small team comprising Paul Wymer, Janet Hurst and Chris Thurston is hard at work compiling a booklet on micro-organisms aimed at the 12–16 age group. This will have 16 A4 pages and will be in full colour, to complement the existing careers booklet. Hopefully the booklet will be available in the autumn for distribution to schools.
- Sponsored by SGM, a working party of MISAC is busy revising the popular, but long out-of-print, teaching resource *Practical Microbiology for Schools*. It is hoped to launch this at the 1999 ASE Annual Meeting.

Many more exciting projects are under discussion. Watch this space ...

IJSB Launch Lunch

Aidan Parte

The launch day for the IJSB, Monday 16 March, came around very quickly following my last piece for the *Quarterly*. Since January, we've checked proofs, added the authors' corrections, polished up the design of the journal cover and visited the printers, Cambridge University Press (CUP), to make those important final checks. Even then, those last few nights before the journal arrived were fairly sleepless! As it turned out, I needn't have worried, because when the lorry arrived from CUP the journal looked great. There were plenty of comments like *What's that doily doing on the cover? ... It's a ceiling rose!*

Mike Adams from CUP arrived an hour after the lorry, and looked quite crestfallen when he realized he hadn't managed to beat the lorry down to Reading! The celebrations kicked off with a champagne reception at Marlborough House, with brilliant timing by Mike Edwardson (also from CUP), who turned up to the sound of popping corks. After a speech by Ron Fraser, the rest of the fizz was drained, and the CUP boys, Jeff Almond (representing the IUMS) and those SGM staff most closely involved with the journal went to a country house hotel for an excellent lunch.

There has been plenty of positive feedback since the launch of the first SGM issue of the IJSB. Thanks to everyone for all their efforts in acquiring, producing and selling it! The next big IJSB party should be to celebrate its relaunch as the *International Journal of Systematic and Evolutionary Microbiology* or its golden jubilee in 2000. I can hardly wait!

Aidan Parte, Managing Editor (Tel. 0118 988 1815; Fax 0118 988 1834; Email a.parte@socgenmicrobiol.org.uk).

Aidan Parte, Managing Editor, with the first issue of the new-look IJSB.

SGM staff and guests at the IJSB launch lunch.

From left to right:

Top: *Ron Fraser, Aidan Parte Melanie Scourfield, Susan Westgate*

Middle: *Mike Adams (CUP), Janet Hurst Ian Atherton, Mike Edwardson (CUP) Jeff Almond (IUMS)*

Bottom: *Chris Rowland, Kendra Waite Richard Noble, Duncan McGarva*

Where JGV Can Step In and Lend a Hand

Adam Collier

At the time of writing, the world outside my laboratory window is getting whiter and whiter, and colder and colder. What better time then to browse through the pages of JGV and attempt to broaden my horizons and put behind me the usual temptation to flick with unnatural haste through its pages in search of those papers with direct relevance to my work.

Two recent articles proved particularly successful in this respect, though both, I confess, regard the replication of positive-strand RNA viruses. The first, by Suopanki *et al.* (JGV **79**, 309–319), looks at the long-running and elegant story of the mechanisms of mRNA transcription regulation of alphaviruses. Alphaviruses, in this instance Semliki Forest virus (SFV), are enveloped, positive-strand RNA viruses within the family *Togaviridae*. Upon initial replication, the parental genome is transcribed into a 42S complementary negative strand which in turn serves as a template for 42S positive-strand synthesis. Following an 'exponential phase' of genome replication, negative-strand transcription is specifically shut off. The negative strands are then used as templates for continuous synthesis of 42S positive-strand RNAs and subgenomic 26S positive-strand RNAs transcribed from the 3′ third of the genome. Transcription of the 26S RNA is initiated by a minimal promoter of 24 nt. The non-structural proteins nsP1, nsP2 and nsP4, encoded at the 5′ end of the genome, constitute the viral RNA polymerase activity.

Previously, Saraste *et al.* (JGV **37**, 399–406) and Kääriäinen *et al.* (JGV **39**, 463–473) identified a reversibly temperature-sensitive SFV mutant, ts4, which transcribed normal amounts of both 42S and 26S RNA at the permissive temperature of 28 °C but failed to transcribe the 26S RNA at 39 °C. In this study the cause of the defect was identified as an amino acid change at the carboxy terminus of nsP2. This was achieved by transferring the region encoding this protein into an infectious SFV cDNA clone and studying the phenotype compared to a wild-type infectious clone as well as a ts4 revertant. The conclusions from the work were that nsP2 is an essential component in transcription of the 42S and 26S RNA and that the ts4 mutation is not only responsible for shut-off of 26S RNA transcription, possibly by detaching from the promoter at 39 °C, but also inhibition of the processing of the precursor protein, P1234, and inhibition of normal shut-off of negative-strand synthesis.

The second paper, by Zoll *et al.* (JGV **79**, 17–25), investigates the role of the 2A protein in the replication of mengovirus, a member of the genus *Cardiovirus* of the *Picornaviridae*. In other picornavirus genera, such as the enteroviruses, rhinoviruses and aphthoviruses, the role of 2A is fairly well established. In these viruses 2A is directly involved in the early stages of polyprotein processing and also the proteolytic degradation of eukaryotic initiation factor 4G, which leads to the shut-down of host-cell protein synthesis. In cardioviruses, however, the role of 2A is not clear. In this study, deletions were introduced within the 2A peptide of mengovirus. In addition the whole 2A coding sequence was replaced by the 2A coding sequence from Theiler's murine encephalomyelitis virus (TMEV) or coxsackievirus B3 (CBV3). The effect of these mutations on polyprotein processing, virus growth and protein synthesis was then assessed. The results of the work highlight the intricate differences in replication strategy between closely related viruses. One observation was that the correct sequential processing of the precursor proteins, specifically the capsid and regulatory proteins in regions P1 and P2, by the 2A and 3C proteases, is essential to the viability of the virus. This is most clearly demonstrated by replacement of the mengovirus 2A protein with that from CBV3. In this instance, polyprotein processing takes place efficiently at the VP1–2A and L–P1 sites but processing is halted thereafter as the resulting capsid precursor, P1, is presumably in the incorrect conformation for further processing by the 3C protease. The conclusion is that the correct temporal release of 2A is essential for subsequent cleavage events and thus correct protein production. Another interesting observation was that the 2A proteins from mengovirus and TMEV were not interchangeable, as might be expected given the life cycle and genome organization of the two. In a chimeric mengovirus which encodes the TMEV 2A protein, viral RNA and protein syntheses were severely reduced. From this, it can be inferred that 2A plays a role in either virus translation or replication and that cardiovirus 2A functions in a virus-specific manner.

Both of these papers reinforce my view that though many single-strand RNA viruses appear to have a relatively simple life cycle, the mechanisms by which their RNA and protein expression is regulated can be intriguingly subtle and will continue to be a source of much interesting data.

At the time of reading, I trust that I will be experiencing the first glimpses of another gloriously hot British summer. I hope that in the sweltering heat, those of us at the sharp end of virology research do not forget that new ideas on how to proceed in our work are not necessarily restricted to those papers which are directly applicable to 'our' virus. This is precisely where JGV can step in and lend a hand.

Adam Collier is a postdoctoral fellow in the laboratory of Professor Richard Elliott (JGV Editor), Institute of Virology, University of Glasgow, Church Street, Glasgow G11 5JR (Tel. 0141 330 4017; Fax 0141 337 2236; Email a.collier@bio.gla.ac.uk).

Cells & Cell Surfaces

Warwick, 5–7 January 1999

A one-day symposium entitled *Microbial Host Interactions at Mucosal Surfaces* will be held on 6 January. This will complement the associated two-day symposium on *Respiratory Pathogens* being organized by the Microbial Infection, Clinical Virology and Systematics & Evolution Groups. Proposed speakers (with provisional titles) are: T. Hirst (Bristol), *V. cholerae* and cell permeability; M. Donnenberg (Baltimore), EPEC and signalling; V. Fischetti (New York), Streptococci and epithelial cells; D. Taylor-Robinson (London), Genito-urinary infection; M. Kilian (Aarhus), Microbial IgA1 proteases; M. Virji (Bristol), Meningococcal adhesion and invasion; C. Kelly (London), Immune responses to oral bacterial antigens. Poster papers relevant to the symposium are encouraged with titles and abstracts due **by 2 October 1998**. Suggestions or queries may be made to the symposium organizers H.F. Jenkinson or I. Sutcliffe (iain.sutcliffe@sunderland.ac.uk).

Future Meetings

The committee is planning future one-day symposia at Edinburgh (13–16 April 1999) and Leeds (7–9 September 1999). Topics under consideration are *Stress Response*, *Adhesive Structures* and *Proteases, Proteolysis and Control.*

Suggestions for symposia topics and speakers are always welcome from SGM Members: please contact any committee member or the Convener.

Committee Membership

We welcomed Martin Woodward (CVL, Addlestone) on to the committee at the end of 1997. Four Members of the committee retired at the end of their terms at Easter. Our thanks for their contributions go to Jenny Broome-Smith (Sussex), Mark Egerton (Zeneca Pharmaceuticals) and Katherine Smart (Oxford). Special thanks are extended to Alan Wheals for 8 years hard work on the Group committee, the last 5 years as Convener.

Convener:
Professor 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 (DD)
0117 928 4304/5 (Office)
Fax 0117 928 4428
Email howard.jenkinson@bristol.ac.uk

Clinical Virology

Warwick, 5–7 January 1999

The Group will be combining with the Microbial Infection and Systematics & Evolution Groups to present a symposium on *Respiratory Pathogens*. Dr E. Boxall is representing the Group on the organizing committee. Speakers will include: Dr P. Cane, The evolution of respiratory syncytial virus; Dr G. Taylor, Novel treatments for respiratory infections; Prof J. Oxford, Novel treatments for influenza. Further information can be found under the Systematics & Evolution Group news. The Group also invites offered papers on the subject of *Clinical Respiratory Pathogens*. Abstracts should be sent to the Convener **by 31 May**. There will also be a debate entitled 'Should the UK introduce universal antenatal screening for HIV?'

Future Meetings

The Group is planning to attend the 143rd meeting in Edinburgh and also to hold a joint meeting with the European Society for Clinical Virology in January 2000.

Convener:
Dr Philip P. Mortimer
PHLS Virus Reference Division
Central Public Health Laboratory
61 Colindale Avenue
London NW9 5HT
Tel. 0181 200 4400
Fax 0181 200 1569

Education

East Anglia, 8–10 September 1998

Alan Jacob (Manchester) is organizing a symposium jointly with the Genetical Society on *Innovations in the Teaching of Molecular Biology* on 8 September. This will be a full-day symposium and will cover practical molecular biology for schools, the role of CAL, how to get the best value for money out of 'wet' practicals and, by comparison, the use of 'virtual' practicals and molecular biology on the internet. The place of bioinformatics in molecular biology will also be covered. This should appeal to postgraduate tutors as well as undergraduate teachers. Something for everybody!

Edinburgh, 13–16 April 1999

Liz Sockett (Nottingham) is organizing a symposium on *Novel Microbiology Teaching and Learning Outside the Laboratory*. We will be including novel examples of classroom teaching, tutorials and non-standard projects which make microbiology students think and learn. CAL is welcome, but is not the main focus of the symposium. We need SPEAKERS! What novel things are you doing with your

Convener:
Dr Peter Wyn-Jones
School of Health Sciences
Darwin Building
University of Sunderland
Wharncliffe Street
Sunderland SR1 3SD
Tel. 0191 515 2520
Email
peter.wyn-jones@sunderland.ac.uk

lectures, projects or tutorials? How do you assess such novel learning? Don't be shy, share your ideas!

Leeds, 7–9 September 1999

We anticipate a general event on *Microbiology for Non-microbiologists!* Perhaps not the first thing you'd think of at the SGM, but it is surprising how many scientists of all kinds make use of microbiology without knowing a great deal about it (have we heard this before?). Helen O'Sullivan (Liverpool Hope) will be organizing this and we trust that contributors will demonstrate their powers of lateral thought!

Warwick, 9–13 April 2000

We will be tying in with the Main Symposium on *Fighting Infection in the 21st Century*, and will be presenting our own perspective on education of the public about infection.

Environmental Microbiology

Convener:
Dr Hilary M. Lappin-Scott
Department of Biological Sciences
Exeter University
Hatherly Laboratories
Prince of Wales Road
Exeter EX4 4PS
Tel. 01392 263263
Fax 01392 263700
Email H.M.Lappin-Scott@exeter.ac.uk

East Anglia, 8–10 September 1998

The details of the invited papers for the Group's one-day symposium on *Biosensors* are nearing completion. The speakers and topics are: G. Sayler (USA), Developments and field use of bioluminescent bioreporter strains in bioremediation processes; S. Molin (Denmark), Green fluorescent proteins for monitoring microbial activities in complex communities; A. Hill (Oxford), Novel electrochemically based sensors; and A. Porter (Aberdeen), Antibody fragments as biosensors. If any additional information is required about this meeting please contact Mark Bailey (mbj@mail.nerc-oxford.ac.uk). There is room for many more offered papers. Postgraduate students and young scientists are particularly encouraged to offer papers and posters.

Warwick, 5–7 January 1999

The programme for this Main Symposium on *Behaviour of Pathogens in the Environment* is now complete. The Group organizer is Keith Jones (Lancaster University) who will be chairing the symposium and speaking on animal and bird vectors. The other speakers and topics include: J. Rogers (CAMR), The role of biofilms in the protection and survival of pathogens; M. Bonten (Chicago), Colonization of patients and environment with vancomycin-resistant enterococci; E. Anaissie (Little Rock), Growth of *Aspergillus* in water in hospital environments; C. Fricker (Thames Water), Growth and survival of pathogens during water treatment; A. Chapman (Sheffield), Survival of *E. coli* O157 in the farm and abattoir; C. Rees (Nottingham), Behaviour of *Listeria monocytogenes* in soil, water and in association with plants; J. Isaac-Renton (Canada), Survival of *Cryptosporidium* and *Giardia* in water catchments.

Edinburgh, 13–16 April 1999

A two-day joint meeting is being planned with the Systematics & Evolution Group on *The Detection of Bacteria in Natural Environments.* Topics currently being considered include: Development of probes, either direct sequencing or cloning from mixed PCR products; Applications to aquatic environments, applications of phylogenetic or process based probes; Applications to terrestrial environments, use of probes to assess perturbations from pollution; Use of epidemiological and related studies, food poisoning, travel stories and plant pathology. If you wish to contribute any ideas to the programme please contact either Chris Clegg (cclegg@scri.sari.ac.uk), or Grant Burgess (J.G.Burgess@hw.ac.uk). Further details will appear in the next issue of the *Quarterly*.

Leeds, 7–9 September 1999

A joint meeting with the Geology Society Marine Studies Group is planned for September 1999 at Leeds University. There will be a mixture of invited and offered papers, covering microbiology, geology and geochemistry. Some of the topics to be covered within microbiology include: A review of bacteria in the deep sub-surface; Bacteria, hot and under pressure; A deep hot biosphere in oil reservoirs. Topics within the geology sphere include: Geochemistry of microbial basalt weathering; Microbial role in concretion formation; High temperature synthesis of organic bacterial substrates at depth. This meeting is being organized by Rachel Mills from Southampton Oceanographic Centre and John Parkes from Bristol University from whom further details may be obtained (J.Parkes@bristol.ac.uk). Additionally, anyone wishing to offer a paper at this exciting meeting should contact John Parkes in the first instance.

Irish Branch

University College, Cork, 25–27 June 1998

2nd International Symposium on Propionibacteria. For details contact Prof. Seamus Condon, Department of Microbiology, University College, Cork, Ireland (Tel. +353 21 902396; Fax +353 21903101) or Dr Tim Cogan, Dairy Products Research Centre, Fermoy, Ireland (Tel. +353 25 42222; Fax +353 25 42340; Email tcogan@dpc.teagasc.ie).

Queen's University Belfast, 2–4 September 1998

A joint Symposium on *Microbial Neuropathogenesis* is being organized with the Virus Group. For details please see the Virus Group News on p. 82. For further information contact Dr Louise Cosby, School of Biology & Biochemistry, Medical Biology Centre, Queen's University of Belfast, 97 Lisburn Road, Belfast BT9 7BL (Tel 01232 272127; Fax 01232 236505; Email L.Cosby@qub.ac.uk).

University College, Cork, 7–8 January 1999

Microbial Pathogenesis: Current Trends. For further information contact Dr Alan Dobson, University College, Cork, Ireland (Tel. +353 21 902743; Fax +353 21 903101; email a.dobson@ucc.ie).

Convener:
Dr Martin A. Collins
Department of Food Science
Agriculture and Food Science Centre
The Queen's University of Belfast
Newforge Lane
Belfast BT9 5PX
Tel. 01232 255314
Fax 01232 668376
Email m.collins@qub.ac.uk

Fermentation & Bioprocessing

East Anglia, 8–10 September 1998

The Group will be holding a one-day meeting on *Mycelial Fermentations* organized by Dave Langley (Glaxo-Wellcome) and Glyn Hobbs (Liverpool John Moores) on behalf of the Group. Invited speakers include, G. Robson (Manchester), Production of recombinant proteins; P. Butler (UMIST), Growth rate control of mycelial morphology in *Streptomyces coelicolor*; M. Bushell (Surrey), Enhancing bioreactor performance of antibiotic-producing cultures; J. Smith (Strathclyde), Filamentous fungi in solid-state fermentations; N. Connors (Merck, USA), Production of pneumocandins; J. Nielson (Lyngby), Enzyme production by *Aspergillus*; K. Falkner (Stuttgart), Quantitative morphological characterization of actinomycetes with on-line digital image analysis. If you are interested in presenting a poster (postgraduate students are particularly encouraged), please contact the Convener in the first instance **before 1 June 1998**.

Future Meetings

The committee is planning a two-day meeting on *Archaea* at Edinburgh in 1999. The symposium will be organized by Rod Herbert (Dundee) on behalf of the Group. A one-day meeting on aspects of bioprocessing is being planned for Leeds in September 1999 and is being organized by Rob Cumming (Teeside). More details of both meetings will appear in a future issue of the *Quarterly*. The committee would welcome suggestions from any SGM member for topics of symposia within the area of fermentation and bioprocessing. Please contact the Convener or any committee member.

Convener:
Dr Reg R. England
Department of Applied Biology
University of Central Lancashire
Corporation Street
Preston PR1 2HE
Tel. 01772 893513
Fax 01772 892929
Email r.england@uclan.ac.uk

Microbial Infection

Leicester, 1–2 July 1998

The first of a series of joint meetings between the Microbial Infection Group and the Microbiology Section of The Pathological Society will be held at the Pathological Society meeting at the University of Leicester. The meeting will take the form of a one-day symposium on *Prospects for Non-Microbial Antimicrobials* followed by a day of offered papers. Our co-organizer is Peter Andrew (Leicester) from whom registration forms can be obtained. Forms can also be obtained from the SGM Meetings Office or from The Pathological Society, 2 Carlton House Terrace, London SW1Y 5AF.

Warwick, 5–7 January 1999

A two-day meeting on *Respiratory Pathogens* will be held. This meeting will be held jointly with the Systematics & Evolution and Clinical Virology Groups. The MI Group organizer is Tim Mitchell (University of Glasgow). Please send titles and abstracts of offered papers and posters to Tim Mitchell (t.mitchell@bio.gla.ac.uk) by **30 September 1998**.

Convener:
Professor Peter Andrew
Department of Microbiology and Immunology
University of Leicester
Medical Sciences Building
PO Box 138
University Road
Leicester LE1 9HN
Tel. 0116 252 2941
Fax 0116 252 5030
Email pwa@le.ac.uk

Edinburgh, 13–16 April 1999

A three-day meeting on *Evasion of the Immune Response* is being planned jointly with the Virus Group. Our organizers are Petra Oyston (CBDE, Porton Down) and Brian Henderson (Eastman Dental Institute). Please contact Brian Henderson (b.henderson@eastman.ucl.ac.uk) if you have any suggestions for invited speakers and titles. There will be an opportunity to present offered papers and posters.

Leeds, 7–9 September 1999

A large meeting on *Food-spoilage and Food-borne Diseases* is being planned as the topic for the next joint meeting with The Pathological Society. This meeting also will be a joint effort with Physiology, Biochemistry & Molecular Genetics and Systematics & Evolution Groups. Our organizer is Ian Poxton (Edinburgh; i.r.poxton@ed.ac.uk); he will be very happy to receive any views that you may have on this meeting.

Future Meetings

Ideas for symposium topics and speakers for future meetings are always welcome. Topics under consideration are *Vaccine Delivery* and *Genetics of Susceptibility to Infection*. Please contact the Convener or any committee member if you have any comments.

Physiology, Biochemistry & Molecular Genetics

East Anglia, 8–10 September 1998

The Group will hold a symposium on *Versatile Pseudomonads* on Tuesday/Wednesday 8/9 September. The organizer is Dieter Haas (Lausanne, Switzerland). The speakers are John Govan (Edinburgh), Mike Vasil (Denver, Colorado, USA), Wim Quax (Delft, Netherlands), Mark Bailey (Oxford), Huw Williams (London), Peter Williams (Bangor), Paul Williams (Nottingham), Rob Drew (London), Christoph Keel (Lausanne, Switzerland) and Carol Bender (Stillwater, Oklahoma, USA).

Offered contributions are requested for inclusion in the symposium and as posters. Please send titles and abstracts to the Convener. Abstract forms can be requested from the Convener or Marlborough House. The last submission date is **12 June 1998**.

Convener:
Dr David A. Hodgson
Department of Biological Sciences
University of Warwick
Coventry CV4 7AL
Tel. 01203 523559
Fax 01203 523701
Email dm@dna.bio.warwick.ac.uk

Edinburgh, 13–16 April 1999

The Group will hold a symposium on *Regulation of Complex Processes in Bacteria* at this meeting. The organizer is George Salmond (Cambridge).

The Group will be assessing posters for inclusion in the Promega Prize at this meeting. Qualifying candidates please identify which posters are to be assessed by our judging panel when the abstract is submitted to Marlborough House. Posters do not have to be directly relevant to any of the Group's symposia to be included in the assessment.

Leeds, 7–9 September 1999

The Group will hold a symposium on *Molecular Machines: Mobile Protein Complexes in Micro-organisms* at this meeting. The organizer is Liz Sockett (Nottingham). There will also be a joint symposium with the Microbial Infection Group and the Pathological Society on *Food-spoilage and Food-borne Diseases*. The PB&MG co-organizer is Simon Foster (Sheffield) and the Microbial Infection Group organizer is Ian Poxton (Edinburgh).

Future Meetings

The Group committee is always receptive to suggestions for topics for symposia, workshops, etc., within its remit from any SGM member. Please contact the Convener or any member of the Group committee.

Systematics & Evolution

Warwick, 5–7 January 1999

The Group is holding a collaborative symposium with the Microbial Infection and Clinical Virology Groups at this venue on the subject of *Respiratory Pathogens*. We have planned two days of prestigious speakers covering many important areas in relation to respiratory tract infection – colonization, immunology, mechanisms of damage, novel treatments and vaccines – plus a number of talks about important respiratory pathogens (hantaviruses, evolution of respiratory syncytial and influenza viruses, evolution and population genetics of Group A streptococci, evolutionary implications of the *Mycobacterium tuberculosis* genome sequence, selfish DNA in mycobacteria, pneumococcal evolution, *Chlamydia pneumoniae*). We hope to include a number of complementary short oral contributions or posters. Please forward titles and draft abstracts of any proposals for contributions to the Convener as soon as possible, but **before 2 October 1998**. The deadline for finalized abstracts will be **30 November 1998**.

Edinburgh, 13–16 April 1999

The Group is developing an extensive and topical two-day joint programme with the Environmental Microbiology Group – *Detection of Microbes in the Natural Environment*. Please contact the SEG organizer, Grant Burgess (j.g.burgess@hw.ac.uk), if you have good ideas for topics or speakers. The symposium is planned for 15 and 16 April and detailed information will follow in the next issue of the *Quarterly*.

Leeds, 7–9 September 1999

The Group is in the early stages of planning a large and exciting joint symposium with the Microbial Infection and the Physiology, Biochemistry & Molecular Genetics Groups along with the Pathological Society on *Food Spoilage and Food-Borne Diseases*. More information will follow in the next issue of the *Quarterly*.

Future Meetings

The Group is already planning symposia into 2000 and hopes to hold a Group symposium on *Molecular Epidemiology: Infrasubspecific Classification and Identification* during the Easter 2000 Society meeting. However, we are always happy to accept ideas from members so do please send any ideas for symposia, workshops or relevant activities to the Convener over the next few months, or contact any committee member and we will discuss your ideas at our next committee meeting.

Convener:
Professor Grace Alderson
Department of Biomedical Sciences
University of Bradford
Bradford BD7 1DP
Tel. 01274 383564
Fax 01274 386210
Email g.alderson@bradford.ac.uk

Virus

Belfast, 2–4 September 1998

The Virus Group will be holding a meeting with the Irish Branch on *Microbial Neuropathogenesis*. Please note the correct date for this meeting (*not* 1–3 September as previously stated). The meeting will run over three days with plenary sessions each morning and open paper sessions on the first two afternoons. There will also be a poster session. Speakers include: I.V. Allen (R&D Office, Northern Ireland), V. ter Meulen (Würzburg, Germany), M. Vandevelde (Berne, Switzerland), L. Enquist (Princeton, USA), T. Hill (Bristol), P. Talbot (Laval, Canada), H. Ludwig (Berlin, Germany), L. Bode (Berlin, Germany), G. Atkins (Dublin), C. Bangham (London), C. Bostock (Compton) and M. Virji (Bristol). Those wishing to present an open paper or poster should send a title and abstract (maximum 150 words) to the Convener **by 31 May 1998**.

Edinburgh, 13–16 April 1999

The Virus Group is holding a joint symposium together with the Microbial Infection Group on *Microbial Evasion of the Immune Response*. For details see Microbial Infection Group news. Further details to be announced in the next issue of the *Quarterly*.

Convener:
Professor Geoffrey L. Smith
Sir William Dunn School of Pathology
University of Oxford
South Parks Road
Oxford OX1 3RE
Tel. 01865 275521 (direct)
01865 275524 (secretary)
Fax 01865 275501
Email glsmith@molbiol.ox.ac.uk

Book Reviews

Yeasts in Natural and Artificial Habitats

Edited by J.F.T. Spencer & D.M. Spencer.
Published by Springer-Verlag GmbH & Co. KG (1997).
DM198.00/öS1,445.40/sFr173.00/£81.50/US$130.00
pp. 381 *ISBN: 3-540-56820-4*

This book is for the most part written by the two Editors (11 of 16 chapters) and deals with the taxonomy, ecology, cell biology and industrial use of yeast species. When this book tries to compete with other contemporary texts dealing with cellular and molecular aspects of the growth of model yeasts such as *Saccharomyces cerevisiae* it looks incomplete and dated but it has its own niche when dealing with the ecology of yeasts and applications of yeasts to industrial processes. Many of the diagrams are very poorly drawn and listed references are often out-of-date. Since the underlying focus of the book is weighted towards ecology and fermentation technology it may be seen as a useful, but expensive reference book in the mycological section of the library. However, its uneven coverage, poor presentation and price prevent its recommendation as a general course text.

Neil. A.R. Gow, University of Aberdeen

An Introduction to Molecular Biology

By R.C. Tait.
Published by Horizon Scientific Press (1997).
£34.99 *pp. 350* *ISBN: 1-898486-08-5*

This book is a short introduction to the principles and methods of recombinant DNA techniques that is suited to undergraduates or postgraduates who need a summary of the important experimental procedures involved in recombinant DNA work. Key concepts are summarized at the end of each chapter. The text is written in a succinct and easy-to-understand style aided by many informative diagrams. The theory part of the book is followed by a series of class laboratory exercises, complete with detailed instructions and ordering information. These will be familiar to teachers who run molecular biology classes and, although they are written for the class instructor, the expected results are noted and interpreted and will therefore serve as a useful reference for a student undertaking the exercises. The price is high for an individual student, but the book would be a useful addition to a reference library.

John Coote, University of Glasgow

Mechanisms in the Pathogenesis of Enteric Diseases Advances in Experimental Medicine & Biology Vol. 412

Edited by P.S. Paul, D.H. Francis & D.A. Benfield.
Published by Plenum Press (1997).
US$125.00 *pp. 439* *ISBN: 0-306-45519-6*

This book, published in 1997, is a report of the *First International Rushmore Conference on Mechanisms in the Pathogenesis of Enteric Diseases*, held in September 1995 at Rapid City, South Dakota. It contains 68 papers, ranging from long review articles to very short research reports. A wide range of subjects is covered, including histopathology, toxin studies, DNA-based studies and immunity. A similarly wide selection of pathogens is included, with most of the important viruses and bacteria in this field covered. As with most books of this nature, the gap between the conference and publication is quite long and therefore there are some papers that are not bang up-to-date. A further criticism is that the papers are not presented in a sensible, logical order. The book will be of some use to experts in the field, but at US$125 per copy I will not be recommending it to my students!

Duncan Maskell, University of Cambridge

Basic Cell Culture Protocols, Second Edition. Methods in Molecular Biology, Vol 75

Edited by J.W. Pollard & J.M. Walker.
Published by Humana Press (1997).
US$69.50 *pp. 504* *ISBN: 0-89603-384-8*

This spiral-bound A5-size book is intended to be used primarily as a manual, although it does provide a wealth of references to more theoretical works, including the 'classics' by Professors Paul and Freshney. The updated and revised second edition gives a concise but thorough guide to basic cell culture techniques in the first chapter with sections on media, cell counting, karyotyping and quality control. This is followed by 36 individual chapters dealing with a specific cell type, application or technique. There are, for example, chapters on the culture of muscle cells, the production of heterologous proteins in baculovirus/insect cell systems and fluorescent *in situ* hybridization (FISH). Each chapter is well referenced and accompanied by good quality illustrations where appropriate. It is unlikely that any single laboratory would make use of all the chapters but any laboratory involved in cell culture will find this book of use.

Alan Trudgett, Belfast

Differential Display Methods and Protocols. Methods in Molecular Biology, Vol. 85

Edited by P. Liang & A.B. Pardee.
Published by Humana Press (1997).
US$64.50 *pp. 320* *ISBN: 0-89603-405-4*

It is a mark of the specialized nature of molecular biology in general and the intense interest in Differential Display (DD) in particular that an entire protocol book has now been devoted to a technique developed within the last 6 years. The book is a thorough collection of basic DD protocols combined with examples of its application to a wide range of biological problems making it an ideal resource for any research group interested in using DD. Although there is a chapter comparing a single cDNA subtraction method to DD, this book does not deal generally with all means of examining gene expression and restricts itself solely to variations on the use of DD. Despite some repetition and one or two chapters that do not strictly belong to a methods publication, most of the protocols, figures and trouble-shooting sections are clear and well thought out.

Ged Brady, University of Manchester

Landmarks in Gene Regulation

Edited by D.S. Latchman.
Published by Portland Press (1997).
£20.00/US$34.00 *pp. 310* *ISBN: 1-85578-109-3*

At first glance this book appears to consist simply of a selection of papers, some dating back as far as 1976, which demonstrates technical and conceptual advances in higher eukaryote gene regulation. However, each of the 14 sections is introduced by a short, readable and well illustrated commentary which puts the two or three papers into context and explains their significance. It thus provides a valuable resource for introducing students to seminal papers from which they can learn both style and scientific facts. The topics chosen range from analysis of RNA distribution in differentiated tissues, splicing and stability, through chromatin structure, to transcriptional control factors, their molecular architecture and their means of activation. The commentaries are referenced and there is a short index to locate sections covering particular genes, proteins, molecular motifs or techniques. Overall, a very useful book for under- or postgraduate teaching or just catching up on the background to our current knowledge.

Chris Thomas, University of Birmingham

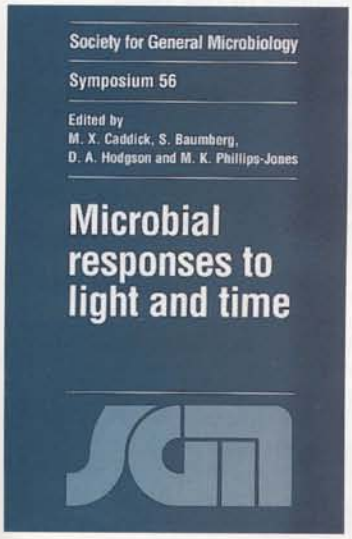
Book Reviews

Microbial Responses to Light and Time. SGM Symposium Volume 56

Edited by M.X. Caddick, S. Baumberg, D.A. Hodgson & M.K. Phillips-Jones.
Published by Cambridge University Press (1998).

£26.00/US$46.00 (Members); £65.00/US$115.00 (Non-members); £16.00 (Student Members)
pp. 330 *ISBN: 0-521-62286-7*

The Light Fantastic. No, not the title of a Terry Pratchett Discworld novel, but an apt description of the latest SGM Symposium volume following the recent meeting at Nottingham in March. Being a cyanobacteriophile myself I am well aware that the organisms I study are intrinsically linked with their light environment. Moreover, through the work of Golden and colleagues it has become more clear how these organisms can anticipate the natural daily light–dark cycle through possession of a circadian clock with properties essentially the same as described for eukaryotic organisms. After reading this volume though you will become aware of the importance for many organisms of responding to a light environment in a time-predictive manner. Not only is there an up-to-date account of circadian rhythms in cyanobacteria, but also comparative reviews of the circadian clocks of a dinoflagellate, a fungus and the fruit fly. In addition there is an excellent account of the temporal organization of the eukaryotic cell cycle. Coupled with this are chapters covering phototaxis in Archaea and photosynthetic bacteria, light regulation of gene expression, development from mosses to *Myxococcus*, the structure of photosynthetic reaction centres and time-resolved events of light harvesting. Thus, we have a book that encompasses much, whilst written in a highly readable way by an international cast. I thoroughly recommend it.



Dave Scanlan, University of Warwick

Prion Diseases of Mammals and Yeast: Molecular Mechanisms and Genetic Features. Medical Intelligence Unit Series

By R.B. Wickner.
Published by Springer-Verlag GmbH & Co. KG (1997).

DM154.00/öS1,124.20/sFr134.00/£63.50/US$96.25
pp. 126 *ISBN: 3-540-62453-8*

This is a very readable summary of the essentials of the Transmissible Spongiform Encephalopathies (TSEs) set alongside recent developments that suggest that yeasts too have prions. Wickner covers a brief history of spongiform encephalopathies, including BSE, and outlines the protein only, 'prion' hypothesis and the evidence supporting it. He then goes on to summarize the evidence that prion-like mechanisms account for the URE3 and PSI phenotypes in yeast. Discussing yeast and mammalian prions together in one text allows the reader to see interesting parallels that provide a persuasive case that prions do indeed exist and that they may well provide the complete explanation for TSE diseases (although Wickner is careful to provide a balanced assessment). This book is a useful and easy read for those who don't have time to keep abreast of the primary literature.

Jeff Almond, University of Reading

Evolution of Hydrothermal Ecosystems on Earth (and Mars?)

By G.R. Bock & J.A. Goode.
Published by John Wiley & Sons (1996).

US$84.95 *pp. 334* *ISBN: 0-471-96509-X*

A hydrothermal origin of life has recently been the subject of a Ciba Symposium chaired by Malcolm Walter, from which this is the proceedings, which brought together biologists and geologists to focus their attention on looking for traces of life on Mars. If the book is anything to go by they had an excellent and productive meeting.

The book characterizes terrestrial hydrothermal systems, and how they might have contributed to the origin of life, and then applies this knowledge to looking for such ecosystems on Mars. The chapters are well written and contain an excellent list of references. As with many Ciba Foundation conference proceedings each chapter ends with the discussion that followed the presentation – providing more in-depth commentary. The book is well illustrated throughout.

I found the book immensely informative and those interested in hydrothermal ecosystems and specifically the search for life on Mars will find the book an absolute must.

Julian Hiscox, Institute for Animal Health, Compton

Biological Indicators of Soil Health

Edited by C. Pankhurst, B.M. Doube & V.V.S.R. Gupta.
Published by CAB International (1997).

£60.00/US$110.00 *pp. 464* *ISBN: 0-85199-158-0*

This book contains 17 chapters dealing with the biological assessment of soil health. Many of the contributors are distinguished soil specialists and each has provided an authoritative review of the subject with reference to his or her particular field of interest. Some of the chapters deal with specific groups of organisms as indicators, while others treat broader concepts (e.g. biodiversity as an indicator) or particular contaminants (e.g. heavy metals). Therefore, there is inevitably some degree of overlap between chapters. One pleasing feature is that each topic is treated critically with due consideration being given to the problems, as well as the advantages, of using biological indicators for assessing soil health. Overall, this volume constitutes a well balanced, comprehensive and up-to-date synthesis of current knowledge and promises to be a valuable resource for soil scientists, agronomists and ecologists for years to come.

Alan Warren, Natural History Museum, London & John Darbyshire, MLURI, Aberdeen

Microbial Enzymes and Biotechnology. 2nd Edition

Edited by W.M. Fogarty & C.T. Kelly.
Published by Blackie A & P (1990).

£110.00/US$161.50 *pp. 472* *ISBN: 1-85166-486-6*

This second edition is a collection of useful and authoritative reviews of some of the most important areas of enzyme biotechnology. The book largely adopts an enzyme-centred view and concentrates on areas of enzyme biotechnology that have achieved industrial application. The volume will most probably be of use to postgraduate students and other new researchers in enzyme biotechnology and it will form a valuable addition to any institutional library.

The chapters are intended to be a recent review of developments in the field, or an overview of the state-of-the-art in new, expanding areas. However, this edition is now seven years old (is there a third edition around the corner?) and many of the fields reviewed here have progressed significantly in the years since 1990, particularly those identified by the Editors as 'emerging'.

Bob Rastall, Reading

Book Reviews

Medical Microbiology. A Guide to Microbial Infections: Pathogenesis, Immunity, Laboratory Diagnosis and Control. 15th Edition

Edited by D. Greenwood, R.C.B. Slack & J.F. Peutherer.
Published by Churchill Livingstone (1997).

£30.00 *pp. 690* *ISBN: 0-443-05454-1*

It is increasingly difficult to provide a comprehensive overview of medical microbiology in one volume. However, this updated 15th edition does just that in an interesting and user-friendly format. Perhaps not surprisingly in a book of this scope, there are a small number of deficiencies in detail and coverage, such as the omission of *Fusobacterium necrophorum* as a rare but important cause of necrobacillosis and the limitations of the iodine stain in the laboratory diagnosis of *Chlamydia trachomatis*. There are many useful tables and figures; for the latter, those of parasites and electron micrographs of viruses are of high quality. In contrast, the chapters on Bacterial Pathogenicity and Fungi are rather deficient in figures and could be made more interesting by their inclusion.

Despite the current trend in medical education for a system-based approach to teaching, this systematically arranged book should appeal to medical students and other healthcare professionals. At £30.00 it is a reasonable purchase for individuals, as well as being a must for institutions.

Adrian Eley, University of Sheffield

Molecular Pathology, Modules in Life Sciences

Edited by J.R. Salisbury.
Published by Taylor & Francis (1997).

£12.95 *pp. 177* *ISBN: 0-7484-0571-2*

This book is one of a series designed for undergraduates taking modular degree courses, to introduce the students to molecular pathology defined as the investigation of disease processes at the level of nucleic acids.

Chapters 1 (An Introduction to Molecular Pathology), 6 (Molecular Histopathology) and 8 (Disease and Genetic Polymorphism) are of the highest quality and alone make buying this book worthwhile.

Chapter 4 (Haemoglobinopathies: a Paradigm of Molecular Disease) is worthy but perhaps assumes a greater knowledge, in terms of molecular pathology, than other chapters. The remaining chapters are well written and interesting, though they make only passing reference to the subject of molecular pathology.

Overall, this is an interesting little book containing a lot of useful information. My only concern is that some of the chapters do not live up to the title. Nevertheless, as an introduction to the subject it is interesting and well worth reading.

Tony Freemont, Manchester

Plant–Microbe Symbiosis: Molecular Approaches

Edited by A.H. Fitter & D.P. Stribley.
Published by Cambridge University Press (1996).

£19.95/US$29.95 *pp. 197* *ISBN: 0-521-58718-2*

Symbiosis between microbes and plants has long been seen to be a major factor in ecology and evolution, but the intricacies of the complex interrelationships have been an almost closed book to us. The advent of molecular techniques, however, has revolutionized this field, and this volume presents aspects of recent progress in our understanding. It documents the *First New Phytologist Symposium*, re-published from a special issue of that journal. This form of publishing is to be applauded. It has given us a well edited publication at a much lower cost than most proceedings of meetings or equivalent monographs. The coverage is refreshingly eclectic, with the major single emphasis concerning the obligately symbiotic arbuscular mycorrhizal fungi.

The other contributions are worthwhile current accounts of more well researched areas; other mycorrhizas, rhizobium symbioses and aspects of plant disease.

This worthwhile publication is well within reach of anyone with any interest in plant–microbe symbioses.

Graham Gooday, Aberdeen

The Molecular and Cellular Biology of the Yeast *Saccharomyces*. Vol. 3, Cell Cycle and Cell Biology

Edited by J.R. Pringle, J.R. Broach & E.W. Jones.
Published by Cold Spring Harbor Laboratory Press (1997).

US$75.00 *pp. 1131* *ISBN: 0-87969-364-9*

This book follows some 15 years after the original two volumes, a time in which quantum changes have been made in understanding, and which has seen publication of the *Saccharomyces cerevisiae* genome. It is a monumental effort, essentially building a yeast cell from the individual genes up.

Because of the wealth of data contained here, this is not an easy read. However, each chapter is well structured, containing many excellent figures and useful tables of relevant genes. The coverage also reflects areas of active research, rather than being comprehensive; e.g. mitochondria are not covered. Surprisingly under this title, three excellent chapters on the fission yeast, *Schizosaccharomyces pombe* make an interesting comparison. Rapid advances in this area mean that the book is likely to date quickly, perhaps reflected by its paperback format.

Overall, this is an excellent book for those interested in yeast, eukaryotic cell biology or the cell cycle.

Malcolm Stratford, Unilever Research, Sharnbrook & Andrew Carter, Institute of Food Research, Norwich

Ecology of Pathogenic Bacteria. Molecular and Evolutionary Aspects

Edited by B.A.M. van der Zeijst, W.P.M. Hoekstra, J.D.A. van Embden & A.J.W. van Alphen.
Published by The Royal Netherlands Academy of Arts and Sciences (1997).

Dfl.95.00 *pp. 293* *ISBN: 0-444-85802-4*

This book is essentially the proceedings of a colloquium on the ecology of pathogenic bacteria held in early 1995. There are about 20 full articles by leading authorities on bacterial evolution and genetic exchange, host–parasite interactions, population genetics and clonal spread of bacteria, together with the abstracts of accompanying posters. The quality of the full articles is generally very good and the content has not suffered too greatly given the lapse since the meeting that spawned the book. Although authors adopt the normal cagey approach to publishing their work in unrefereed media, there are some novel and thoughtful insights provided. The predominant theme of this book is the impact of molecular techniques on the analysis of bacterial populations and their interactions with human and animal hosts.

This is a very valuable addition to the libraries of those researching into bacterial pathogens or their population genetics

Jon Saunders, Liverpool

Book Reviews

Seventeenth Symposium on Biotechnology for Fuels and Chemicals. Applied Biochemistry and Biotechnology, Vols 57/58

Edited by C.E. Wyman & B.H. Davison.
Published by Thomson Science & Professional (1996).
£129.00/US$175.00 *pp. 1030* *ISBN: 0-89603-474-7*

This substantial text contains 100 papers reflecting the current interests of a predominantly academic research community dedicated to renewable resource technologies.

Interest still remains with the mild acid (sulphuric or phosphoric) hydrolysis of various lignocellulosic materials (particularly bagasse) to produce fermentable sugars. Useful contributions address hydrolysate quality, removing metal ions and toxic materials prior to the microbial processes. The most popular final product is ethanol, although lactic acid and xylitol, together with hydrolytic and fermentative enzymes appear frequently. Some bioreactor studies are included but economic data and analysis are scarce.

The biodegradation of a wide range of chemicals, from hydrocarbons to antibiotics, and inhibitory effects on environmental technologies contribute an unexpected but worthwhile addition to the contents.

The presentation of this book is to a very high standard. It contains large amounts of well-documented experimental results, a mine of information for biotechnology researchers, but purchased preferably by their libraries!

Donald Brown, Cranfield University

Fungal Biotechnology

Edited by T. Anke.
Published by Chapman & Hall (1997).
£29.95 *pp. 409* *ISBN: 3-8261-0090-5*

I have often found it difficult to locate up-to-date, readily available information for students of microbial biotechnology. This book goes a long way towards fulfilling this need. Although it is limited to fungal examples, these range across a wide spectrum of systems. There are worthwhile brief accounts of the traditional products of fermented foods and mushrooms; use of fungi for control of insects, nematodes, weeds and fungal pathogens; vitamins and amino acids; antibiotics; drugs, including the multi-billion dollar mevinic acids; agrochemicals, including the Editor's speciality, strobilurins; ligninolysis; genetics and heterologous expression; mycotoxins; and bioremediation. Then follows an account of biotransformations, which at 100 pages is grossly overdetailed in comparison with what has come before it. In summary, however, this volume is a good and generally readable compilation of the current commercial uses of fungi. It will provide a useful aid in learning the subject.

Graham Gooday, Aberdeen

Book Received

The Genosphere: the Genetic System of the Biosphere

By U.K. Sauchanka.
Published by The Parthenon Publishing Group (1997).
£35.00/US$62.00 *pp. 160* *ISBN: 1-85070-657-3*

DIARY

Diary

SGM MEETINGS

***Joint meeting of the SGM Microbial Infection Group and the Microbiology Section of the Pathological Society:* Prospects for Non-microbial Antimicrobials**
University of Leicester
1–2 July 1998

***Joint meeting with The Genetical Society – a symposium to mark the retirement of Professor Sir David Hopwood FRCS:* Portrait of an Organism: The Genetic Analysis of *Streptomyces coelicolor* A3(2) Biology**
University of East Anglia
8–10 September 1998

Behaviour of Pathogens in the Environment
University of Warwick
5–7 January 1999

Microbial Signalling and Communication
University of Edinburgh
13–16 April 1999

How Do Molecules Cross Microbial Membranes?
University of Leeds
7–9 September 1999

Contact: Meetings Administrator, SGM, Marlborough House, Basingstoke Road, Spencers Wood, Reading RG7 1AE (Tel. 0118 988 1805; Fax 0118 988 5656; Email meetings@socgenmicrobiol.org.uk; Web http://www.socgenmicrobiol.org.uk/meetings.htm)

See pp. 78–82.

JUNE 1998

Microbiology for the Non-Microbiologist (*Conf. No. E6-6298*)
Harrington Hall, London, 5 June 1998

The Food Standards Agency (*Conf. No. E6-8198*)
London, 30 June 1998
Contact: Management Forum Ltd, 48 Woodbridge Road, Guildford, Surrey GU1 4RJ (Tel. 01483 570099; Fax 01483 536424; Email: management_forum@psilink.co.uk; http://www.management-forum.co.uk)

JULY 1998

MICRO 98: International Microscopy Conference & Exhibition
Novotel, Hammersmith, London
7–9 July 1998
Contact: RMS, 37/38 St Clements, Oxford OX4 1AJ (Tel. 01865 248768; Fax 01865 791237; Email info@rms.org.uk; http://www.rms.org.uk)

The Biochemical Society Meeting
University of Sheffield
29–31 July 1998
Contact: The Meetings Office, 59 Portland Place, London W1N 3AJ (Tel. 0171 580 3481; Fax 0171 637 7626; Email meetings@biochemsoc.org.uk; http://www.biochemsoc.org.uk)

AUGUST–SEPT. 1998

European Society for Clinical Virology. Progress in Clinical Virology IV
Hamburg, Germany
30 August–2 September 1998
Contact: Organization Secretariat: KIT GmbH, Convention & Incentive Organization, Karl-Liebnecht-Strasse 5, 10178 Berlin, Germany (Fax +49 30 2382 6940; Email virus@kit.de; www.bni.uni-hamburg.de/escv-meeting)

SEPTEMBER 1998

Introductory Techniques in Molecular Biology: Nucleic Acids Practical Workshop
Hatfield, Hertfordshire
2–4 September 1998
(This course will be repeated on 9–11 September 1998)

Introductory Techniques in Molecular Biology: Microbiology Practical Workshop
Hatfield, Hertfordshire
7–8 September 1998

Introductory Techniques in Molecular Biology: Proteins Practical Workshop
Hatfield, Hertfordshire
7–8 September 1998
(This course will be repeated on 14–15 September 1998)
Contact: Vera Jones, Faculty of Natural Sciences, University of Hertfordshire, Hatfield AL10 9AB (Tel. 01707 284590; Fax 01707 286137; Email v.g.jones@herts.ac.uk; www.herts.ac.uk.natsci/STC)

Thermophiles '98
Brest, France
6–11 September 1998
Contact: Dr Watrin Laurent, Thermophiles '98, Station Biologique – BP 74, 29682 Roscoff Cedex, France (Fax +33 2 98 29 23 24; Email thermo98@sb-roscoff.fr; http://www.sb-roscoff.fr/Bact/T98/)

3rd International Conference on Anthrax. Organized by the Chemical and Biological Defence Sector, Porton Down, and the Society for Applied Microbiology
University of Plymouth
7–10 September 1998
Contact: The Society for Applied Microbiology, The Blore Tower, The Harpur Centre, Bedford MK40 1TQ (Tel. 01234 326661; Fax 01234 326678; Email sfam@btinternet.com)

Gene Transcription in Yeast: Role of Chromatin and Transcription Factors
Granada, Spain
11–16 September 1998
Contact: Head of EURESCO Unit: Dr J. Hendekovic, European Science Foundation, 1 quai Lezay-Marnésia, 67080 Strasbourg Cedex, France (Tel. +33 388 76 71 35; Fax +33 388 36 69 87; Email euresco@esf.org; http://www.esf.org/euresco)

Biomembranes and Molecular Medicine
Cluj-Napoca, Romania
14–26 September 1998
Contact: Prof. Gheorghe Benga, 'Iuliu Hatieganu' University of Medicine and Pharmacy, Department of Cell & Molecular Biology, 6 Pasteur Street, 3400 Cluj-Napoca, Romania (Fax +40 64 194373/197257)

Molecular Probes in Diagnostics – One-day Conference
University of Hertfordshire
15 September 1998
Contact: Dr Ralph Rapley, Department of Biosciences, University of Hertfordshire, Hatfield, Herts AL10 9AB (Email r.rapley@herts.ac.uk)

The Biochemical Society Meeting
University of Leicester
21–23 September 1998
Contact: The Meetings Office, 59 Portland Place, London W1N 3AJ (Tel. 0171 580 3481; Fax 0171 637 7626; Email meetings@biochemsoc.org.uk; http://www.biochemsoc.org.uk)

SEPT.–OCTOBER 1998

The Australian Society for Microbiology Inc., 1998 Annual Scientific Meeting & Exhibition: 'Microbes To The Max'
Wrest Point Hotel Casino
Hobart, TAS 7000
27 September–2 October 1998
Contact: ASM Secretariat, Unit 23, 20 Commercial Road, Melbourne VIC 3004, Australia (Tel. +61 3 9867 8699; Fax +61 3 9867 8722; Email ASMConference@clari.net.au; http://www.vicnet.net.au/~asm)

OCTOBER 1998

50th DGHM & 25th DGI Congress: Microbial Evolution & Infection
Haus am Köllnischen Park, Berlin
4–9 October 1998
Contact: Doris Ruttkowski, P&R Kongresse GmbH, Bleibtreustraße 12A, D-10623 Berlin, Germany (Tel. +49 30 88 51 008; Fax +49 30 88 51 029; Email info@pr-kongresse.de; http://www.pr-kongresse.de/dghm)

5th IUBMB Conference on The Biochemistry of Health and Diseases
Jerusalem, Israel
18–22 October 1998
Contact: Kenes Ltd, Sharon Barnett, PO Box 50006, Tel Aviv 61500, Israel (Tel. +972 3 514 0000; Fax +972 3 517 5674; Email IUBMB@kenes.com)

The Misuse and Abuse of Medicines (*Conf. No. E10-1198*)
London, 19–20 October 1998
Contact: Management Forum Ltd, 48 Woodbridge Road, Guildford, Surrey GU1 4RJ (Tel. 01483 570099; Fax 01483 536424; Email management_forum@psilink.co.uk; http://www.management-forum.co.uk)

Modern Techniques in the Identification of Bacteria and Filamentous Fungi (Course)
IMI, Egham, 19–30 October 1998
Contact: Mrs Stephanie Groundwater, IMI, Bakeham Lane, Egham, Surrey TW20 9TY (Tel. 01784 470111; Fax 01784 470909; Email s.groundwater@cabi.org)

Current Trends in Microbial Technology for a Sustainable Environment
Kuala Lumpur, Malaysia
October 1998
Contact: Dr Sabaratnam Vikineswary, Institute of Postgraduate Studies & Research (IPSP), University Malaya, 50603 Kuala Lumpur, Malaysia (Fax +60 3 756 8940)

NOVEMBER 1998

Isolation & Identification of Fungi from Natural Habitats (Course)
IMI, Egham, 26–30 November 1998
Contact: Mrs Stephanie Groundwater, IMI, Bakeham Lane, Egham, Surrey TW20 9TY (Tel. 01784 470111; Fax 01784 470909; Email s.groundwater@cabi.org)

APRIL 1999

WAM 99 – Wessex Applied Microbiologists 7th Symposium
Novotel, Southampton
16–18 April 1999
Contact: Jane Pike, 10 Fairlawn Close, Rownhams, Southampton SO16 8DT (Tel. 01703 902619)

SEPTEMBER 1999

EURECO '99 – 8th European Ecological Congress. The European Dimension in Ecology: Perspectives & Challenges for the 21st Century
Halkidiki, Greece
18–23 September 1999
Contact: Secretariat EURECO '99, UPB 119, Department of Ecology, School of Biology, Aristotle University, GR-540 06 Thessaloniki, Greece (Tel. +30 31 998316/998254; Fax +30 31 998379; Email registration@eureco99.auth.gr)

JULY 2000

18th International Congress of Biochemistry and Molecular Biology. Beyond the Genome: Understanding and Exploiting Molecules in the Third Millennium. FEBS
International Convention Centre, Birmingham, 16–20 July 2000
Contact: IUBMB 2000, 59 Portland Place, London W1N 3AJ (Tel. 0171 580 5530; Fax 0171 637 7626; Email info@iubmb2000.org)