Microbiology education special

Foot-and-mouth disease

Women in science

Public Library of Science – SGM policy
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Erratum
In the February 2001 issue (vol 28, part 1) the first sentence in the article ‘Salmonella in Domestic Animals’ on p. 41 should read ‘Salmonellosis, not ‘mycoplasmosis’;

Above: Glasgow Science Centre, Courtesy Glasgow Science Centre/Keith Hunter

Vol. 28, Part 2, May 2001

In this bumper issue we look at the many facets of microbiology education. Education Officer Liz Sackett introduces the themes by emphasizing that education is for life (p. 51), following this with some facts and figures about microbiology first degree course content and recruitment (p. 54-56). Peter Widy Prize Lecturer Alan Cann considers that students have to learn outside the science (pp. 52-53) and Ron Bishop and Adrian Eley ponder on the knotty problem of teaching them maths (pp. 62-63).

At postgraduate level, the student/supervisor relationship is crucial, as Adrian Eley describes (pp. 58-59). Studying overseas has its pros and cons. Here wecover the experiences of a UK microbiology undergraduate at a French university and what’s involved in postdoctoring in the USA (pp. 64-65). Meanwhile on p. 72 Martin Collins passes on his knowledge by running a training course in Mexico.

The resources and help available to microbiology educators are surveyed by Heather Sears (pp. 68-69), Yolande Knight (p. 70), Joanna Verran (p. 71) and Peter Robinson (p. 66).

A wide range of teaching aids is also described by the innovative recipients of SGM Education Fund awards (pp. 77-80).

Developments in post-16 education in UK schools are discussed by Daniel Burdass, whilst Ian Sutherland describes the biotechnology summer school held annually for Scottish teachers (pp. 74-75). Leigh Fish explores the facilities available to the public to learn about microbiology at the new Millennium Science Centres (pp. 60-61).

Leigh Fish explores the facilities available to the public to learn about microbiology at the new Millennium Science Centres (pp. 60-61).

Other important topics covered include the UK foot-and-mouth disease outbreak (pp. 82-83) and the SGM stance on the Public Library of Science (p. 60).

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

The Public Library of Science campaign: a statement of policy by SGM Council

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Photo 2001
The Public Library of Science campaign: a statement of policy by SGM Council

Recently, a letter has been circulating urging life scientists to boycott journals, as authors, editors or referees, which do not:

- allow free on-line access to full-text articles from 6 months after publication
- deposit all content in public repositories such as PubMed Central.

The proposal has caused considerable debate and responses are appearing in various media. SGM Council has considered the matter and wishes to draw certain matters to the attention of members and other interested parties.

The objective of the Society for General Microbiology is to promote the science of microbiology. We do this by:

- publishing three journals, with quality ensured by rigorous peer review and editorial standards, and high production standards, including an excellent level of service to authors, readers, editors and referees
- supporting the career development of members, especially in the early stages
- holding a successful and enjoyable programme of scientific meetings
- organizing a number of educational and outreach activities to foster the wider understanding of microbiology. These include initiatives aimed at countering uninformed attacks on science; such attacks constitute at least as great a threat to the future of research as does a limitation on access to the published literature.

The income from subscriptions to SGM journals is used to cover the considerable costs of the peer review and production processes, including on-line publication. The modest surplus remaining is used entirely to support the wider charitable activities listed above.

Free on-line access to back issues

As scientists and scientific publishers, we recognize the merit of making full-text articles as freely available as possible. Access to the tables of contents and abstracts of the SGM journals at HighWire Press (www.sgmjournals.org) is free to all for current and all past issues. Full-text articles are currently made freely available to non-subscribers 12 months after publication.

This access control period will be kept under review, but it has to be said that many learned society, non-profit publishers are seriously concerned that making information freely available after only 6 months could seriously compromise income from journals, and hence place their economic viability and survival in doubt.

It is notable that the small number of journals that have moved to free availability after 6 months are largely those which support production costs by imposing page charges, which SGM does not. Several are published by large US societies which subsidize their activities by levying registration charges for meetings, which SGM does not.

So far, the large commercial publishers have made few moves to make any back issues freely available. It has indeed been suggested (Nature 410, 502) that they may relish the attack by Public Library of Science on the low cost journals produced by learned societies, as a means of seeing off the competition.

Overall, Council feels that any moves to increase free access to the Society's journals need to be approached cautiously and in the context of the activities and business model of the Society as a whole.

Deposition of content on PubMed Central and other public servers

The Society's electronic journals at HighWire Press have advanced features, either available now or under implementation, which make them amongst the most sophisticated in the world. These features include simultaneous searching across the 250 titles on HighWire, toll-free linking to cited articles, and soon linking to journals in other databases through the CrossRef scheme. Increasingly, our articles on HighWire can be 'pointed to' from other databases, to give seamless access.

Yet the main proponents of Public Library of Science have set great store in trying to coerce learned society publishers to deposit their data on PubMed Central and have been roundly criticized from many quarters on the grounds of impracticality, costs, lack of added value and more. Some of the main criticisms include:

- Technical difficulties and costs. Processing text and graphics files for mounting on different systems is complex, expensive and difficult.
- Why do it when the material is already available? SGM cannot afford to duplicate the costs it incurs at HighWire and in house.
- Technical difficulties at PubMed Central have meant that even though the site has been live for over a year, it still contains very few journals and some journals still lack basics such as a search facility. The Public Library of Science proposal for one or more central repositories may at present be a goal that is very difficult to achieve.
- Keeping material on a publisher's site enables the publisher to take responsibility for the reliability and maintenance of the data, including corrigenda, and to administer the copyright to protect the interests of authors. SGM is currently participating in two long-term archiving experiments, LOCKSS and Dark Cave, to secure data in perpetuity.
- Scientific magazine (published by the American Association for the Advancement of Science) has expressed severe reservations about depositing a large proportion of the quality biomedical literature on PubMed Central, which is ultimately under the control of the US Government, and would effectively create a monopoly.

SGM Council recommends that members give very careful consideration to these drawbacks before considering whether to support the Public Library of Science campaign.
Microbiology – a lifetime’s education
Liz Sockett

This issue of Microbiology Today covers microbiology education in the broadest sense of the words. Its contents range from the public educational opportunities at Millennium Science Centres, to the educational experiences of postdoctoral study in the USA and the pleasures and pitfalls of supervising postgraduates through their higher degrees. We examine the microbiology education that is to be had on bachelor's degree courses and in schools in the UK. Even the book review section is widened to take in the fun side of children's microbiology education to be found in the Horrible Science paperback series.

Education has often been seen in the past as a Cinderella activity for practising scientists. Indeed in 1998, when I took up the newly created role of Education Officer on SGM Council, the predominant sentiment of my academic peers was one of astonishment that I would take on a 'spare-time' task that does not count for the RAE! My experience to date as Education Officer has shown me that the highest echelons of government and commerce take education very seriously and that ‘the ground’ is moving very quickly. I'm convinced that we scientists all need to engage with education matters to ensure both a continued flow of qualified researchers into our field and continued public support and confidence in our work.

So these days I would suggest that education is the new mantra word for the 21st century. One of the incoming slogans of the current UK government was 'education' and the current Green Paper (Schools: Building on Success) from the DfEE speaks of the great need for 'education with character'. As anyone who has gone through a PhD in microbiology can attest, getting educated in our discipline is most certainly character-building. With the advent of genomics, bioinformatics and web-based courses, there have been never been more reasons for the microbiologist to interface with education.

As active microbiology researchers we may see education as something that takes place in a classroom, but our everyday lab experiences are all part of our own continuing education and of those we supervise or work alongside. At the recent Spring Meeting in Heriot-Watt University almost a quarter of our total membership thronged the halls and poster sessions in an act of mass education, all telling themselves that they were there to 'keep up with research developments'. This meeting also highlighted several important educational issues for the microbiologist.

First, the particular importance of education in microbiology in the context of the social and public impacts of our subject. This was shown when Dr Nick Knowles from IAH at Pembroke briefed a packed auditorium on the foot-and-mouth disease epidemic. We SGM members, all 'microbiology experts' in our own right, keenly soaked up the real scientific details underlying the news headlines. Outside the auditorium, the public at large are fearful of micro-organisms, hearing much of their negative impacts and little of the essential life-support mechanisms that they provide. As the majority of our research is still publicly funded, we owe it to the tax payers of the UK to put our educational hats and to explain our own balanced views of the risks and benefits of micro-organisms and of the need for ongoing research.

The second educational aspect of the Heriot-Watt meeting was also based upon public accountability. This time it was the accountability of university educators to deliver ‘quality’ education to our students which is good value for money for the government. The SGM Education Group ran a very timely benchmarking symposium in which representatives from the QAA, the Benchmarking Panel and heads of university biological sciences departments discussed the means by which our microbiology degree level teaching will be assessed against a generic set of biosciences benchmark statements in future. Like it or not this kind of scrutiny is here to stay in higher education. The draft biosciences benchmark was released for consultation only days before the SGM meeting. The good news is that we are all invited to enter the consultation process so that the final benchmark produced is one we can accept. Find it at www.biobhub.org.uk.

Third, the need for lifelong learning was highlighted, by a Young Members Workshop, presented by members of the Sanger Centre. It outlined the utility of a suite of bioinformatic programmes for genome interrogation, including Artemis and ACT. Many of the ‘young members’ sneaking in were decidedly long in the tooth and it was quite rightly pointed out that many microbiology academics would welcome training in these areas so they can apply these programmes to their research and teaching. I will be looking to see how SGM can best help members with this need in future.

Finally, the Heriot-Watt meeting was the venue for the inaugural Peter Wildy Prize Lecture for Microbiology Education. This is the SGM’s way of acknowledging the value of microbiology educators in disseminating the outcomes of their researches to schools, students, other professionals or to the public at large. The first winner, Dr Alan Cann, excels in web-based microbiology higher education and he contributes to this issue. In future years I am sure that we will be honouring microbiology educators in many different fields. The very nature of microbiology and the impacts that it has on human and animal health, means that there will always be pupils and members of the public wanting to know more about the microscopic and molecular world which we explore.

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My Lords, Ladies and Gentlemen,
Welcome to the Educational Heavyweight Championship of Great Britain!

In the red corner:
David 'Bomber' Blunkett,
Secretary of State for Education & Employment and his henchmen,
The Campaign for Learning (www.campaign-for-learning.org.uk)

In the blue corner:
Chris 'I could have been a contender' Woodhead,
former OFSTED Chief Inspector of Schools

'Everybody gets so much information all day long that they lose their common sense.' — Gertrude Stein

A vigorous debate has been raging in the UK recently between the exponents of key skills ('learnacy' — the ability of students to manage their own learning) and the exponents of 'knowledge' — the old 5 'R's. After simmering for some time, debate boiled over after an article in the Daily Telegraph on 1 March 2001 which launched Chris Woodhead's media career with an attack on 'a misguided emphasis on utilitarian skills'.

What might these 'skills' be? There is no universally accepted definition, but a typical set of 'key' or 'transferable' skills designed to promote career achievement would be something like:
- Communication
- Application of number
- Information technology
- Working with others
- Improving learning performance ('learnacy')

Does that sound awfully like common sense? How do you teach that?

So what works best?

Warning! Controversial statement follows:

'Microbiology as a discipline is almost devoid of theory.'

Once students have grasped the concept of asepsis and the universality of micro-organisms, all the rest is simply cramming facts. OK, so I'm exaggerating. Slightly. But compared with maths, physics and even chemistry, we are a knowledge-based subject. Yet few of us would maintain that we do not need to equip our graduates and postgraduates with the necessary skills to succeed in the job market — how many of them will need to know the difference between a Prokaryote and a eukaryote after they graduate? So many bugs, so little time... The only consequences immediately following the response decreases its future likelihood. No, we are not talking electric shocks here! Assessment outcomes are a powerful motivating force for most students. The difficulty with these ideas is that the reinforcement is often far divorced from the behaviour which elicited it — how long does it take you to mark your exam papers?

These difficulties gave rise to the alternative cognitive theories of learning — the preferred ways in which individuals process information. Kolb's 'experiential learning' model and Schon's 'reflective-practice' approach stress the importance of individual involvement in learning and subsequent critical reflection to build knowledge and understanding. From these, and simply from looking at the students we teach, we get the concept of 'deep' and 'superficial' learners. These alternative approaches are not inherently good or bad, they are merely alternative strategies students adopt.

How did we get into this mess?

The reasons are buried deep in educational theory. The work of behaviourists such as Pavlov and Skinner gave rise to a school of thought that learning is a modification of behaviour patterns which can be induced by conditioning. 'Operant conditioning' occurs when reinforcing consequences immediately following a particular response increases its future likelihood and aversive consequences immediately following the response decreases its future likelihood. No, we are not talking electric shocks here! Assessment outcomes are a powerful motivating force for most students. The difficulty with these ideas is that the reinforcement is often far divorced from the behaviour which elicited it — how long does it take you to mark your exam papers?

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solution I have been able to come up with is to try to integrate key skills into subject-specific materials.

**Communication.** Written, verbal and electronic communication skills are all vital to professional success. Writing an essay on bacterial endospores is fine if you are heading for a career writing papers for *Spores* or whatever the latest obscure research journal is, less useful if you are destined to become a teacher or a sales rep. Conducting interviews with scientists is popular in the United States, as my groaning email inbox testifies (no, please, don’t…). One of the exercises I use is to try to tie academic content to current media concerns gathered from the Microbiology Newsroom (http://www-micro.msb.le.ac.uk/tutorials/news/micronews.html).

**Application of number.** OK, so our students are maths-phobic – that’s why they’re microbiologists rather than biochemists! To overcome this, we must teach them microbiology, not maths. Forget the theory and how all the equations are derived (yes, I know it’s difficult, but you’ve got to let go – you can always supply this information to the high achievers if you feel you must). Start with *How many bugs make three?* if necessary and move on to the probability theory behind calculating multiplicity of infection.

**Information technology.** Integration is the key. Communicate with them by email, bulletin boards and discussion groups as well as face to face. Insist on word processors essays containing graphics and that practical data is returned as a spreadsheet. Don’t teach them IT – teach them microbiology, using IT.

**Working with others.** Truly collaborative practical and data collection/analysis exercises where students do not just work in cozy pairs but must first organize appropriate group structures and responsibilities, and then rely on group data for a successful outcome.

**Improving learning performance (‘learnacy’).** I suggest that teaching for 6 or 7 months followed by a 3 hour exam is not the best way to promote optimum learning skills for the majority of students. Neither is a degree where continuous assessment is the sole measure of achievement. Goals, targets and deadlines must be set, possibly by negotiation, monitored, met and rewarded appropriately.

So what should we tell Messrs Blankett and Woodhead or our Head of Department when they ask us what we are doing about key skills?

- That we have always taught key skills, we just didn’t know we were doing it.
- That our students registered for a degree in microbiology/biology, not ‘key skills’, but we recognize that they want a job at the end of it.
- That usable skills come from experience, and that knowledge and experience cannot be separated.

‘It is a very sad thing that nowadays there is so little useless information.’

**Disclaimer**

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BSc microbiology degrees in the UK
Liz Sockett

An interrogation of the UCAS statistics for 2001 (www.ucas.ac.uk) reveals 199 UK first degree programmes that include the word 'microbiology' in their title, of which 51 are single-subject microbiology degrees. In the remainder microbiology is offered in combination with subjects including French, German, psychology, computing, food science, immunology and ophthalmic dispensing.

The range of UK institutions offering these degrees is shown in Fig. 1. Some others, not listed, offer microbiology within biotechnology programmes.

Despite the plethora of institutions offering degrees, the total number of students entering bachelors degrees with a C5 microbiology code in the UK is only around 500. As the histogram in Fig. 2 illustrates, this number is similar to that for genetics, but considerably less than for biochemistry, chemistry and biology degrees. As Fig. 2 shows, recruitment to microbiology degrees is approximately one-quarter of that to media studies degrees. If only microbiological media were as attractive as the news media!

As can be seen in Fig. 3, recruitment onto microbiology degrees has remained steady or even slightly increased over the last 5 years with the exception of 2000 where a downturn was experienced. Whether the 2000 figure turns out to be an anomaly, only time will tell. The picture is similar for biochemistry and genetics degrees.

For degrees in biology and chemistry a moderate downturn in recruitment is seen, but this is from a pool of student places that is eight to ten times bigger. This recruitment picture is set against an approximately 7% increase in total student numbers entering university over the same 5 year period. The comparative figures for media studies help to explain where those students are going.

What these recruitment figures clearly show is the value of explaining the interesting careers that a degree in microbiology offers to even a small group of local school pupils. Speaking to just five pupils one could be addressing 70% of all entrants to microbiology degrees in a year! The SGM External Relations staff put a great deal of effort into attending careers fairs for pupils who are deciding which GCSEs to take or which degree to study. Our careers leaflets and posters, Microbiologists make a difference (as shown above), explain which school subjects give pupils access to microbiology degrees and dispel some of the specialization myths that abound. All SGM members running any sort of schools open days are welcome to have a supply of the leaflets by contacting careers@sgm.ac.uk

Once again we are all busy with our research but taking time to do a bit of recruiting for our subject is a positive alternative to bemoaning the paucity...
Microbiology can encompass a diverse set of subjects and the content of microbiology degrees depends upon the research interests of the academic staff and upon the requirements for co-teaching of classes with other bioscience students, especially in the early years. As we are specializing in microbiology education in this issue of Microbiology Today, I have tried to compile a very small snapshot of degree content kindly supplied to me by some members of SGM Council. The degree courses were chosen purely arbitrarily based on the supply of usable material to me. I do not provide these data as any sort of statistically reliable view of current BSc microbiology courses, but it strikes me that as an educational community, we know little of the diversity of degree courses in our neighbours' institutions. Further surveys of degree course content in all institutions can be found in the CR,LC Degree Course Guide: Microbiology, Immunology and Biotechnology and I will not be volunteering to expand upon the tables presented here!

Although the snapshot is very small and does not include a diversity of old and new universities, it is good to see that the research project and literature review, or dissertation, are alive and well. It is also interesting to note the varying levels of provision made for mycology in different degree schemes, supporting the comments made by Professor Tony Trinci about the dearth of university mycologists in the August 2000 issue of Microbiology Today. In addition we can see that some universities have already decided to incorporate bioethics or microbiology and society modules into their degree courses. With pressures for transparent public accountability in scientists rising, this may be a trend that is set to continue. Interestingly, training in ethical issues is listed in the draft Bioscience Benchmark.

Another feature of the degree schemes is the reassuringly high microbiology content. With the amalgamation of many former microbiology departments into super-schools of molecular biology or life and health sciences, it is pleasing to see that a BSc in microbiology has not become simply a degree in molecular biology with slight lip-service paid to the organisms in which genes are manipulated. Molecular biology techniques are very useful, but in the post-genomic era, now that we are trying to assign function to gene products, we need young scientists who can understand the diverse physiologies, behaviours and community interactions of micro-organisms. While on the subject of microbial communities, it is interesting to note that not many of our snapshot courses explicitly teach biofilm biology – a shortcoming identified in American degree courses that was addressed by visiting ASM members Bill Costerton and John Lennox at an evening educational workshop at the Exeter SGM Meeting in 2000. Maybe our biofilm biology is embedded into relevant courses on medical and environmental microbiology.
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<th>Year 2 Core</th>
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<td>Research Project 2x</td>
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<tr>
<td>Manchester</td>
<td>Library Project</td>
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<tr>
<td>Sheffield</td>
<td>Molecular Virology</td>
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<tr>
<td>Edinburgh</td>
<td>Honours Year of Yearly Topics Blocks</td>
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**Five OPTIONS from:**

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<td>Six 1x Courses from:</td>
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<tr>
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<td>Manchester</td>
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<td>Three Immunology Courses +</td>
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<td>Bacterial Sensing</td>
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<td>Animal Viruses</td>
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**Four OPTIONS from:**

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<td>Edinburgh</td>
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**Microbial Sensing**

- *Edinburgh runs to the Scottish 4 year system, so only the last 3 years of this degree are tabulated. The first year includes courses such as: origin and diversity of life, quantitative biology, physics in the life sciences, chemistry for life sciences, environmental and community biology, molecules and cells. As the table shows, many of these topics are covered in the English system in year 1.*

**Table Notes**

Tables show only approximate degree contents as a great deal of information has been summarized to fit. I am grateful to colleagues for supplying module information and apologetic to those whose module book complexities defeated my tabulating powers!

'2x' indicates a module that is two times the length of others in that column. Options choices numbers relate to single size modules. Different degree courses operate different course lengths within them and sometimes different course sizes across different years. Not recorded on the tables is the option for students to take single external modules in languages, etc.

In conclusion, I hope that the quality and diversity of microbiology degrees that we have in the UK will be maintained with the advent of degree benchmarking and possibly entirely web-based degree courses. Maybe we should take another snapshot in a few years time to check?

**Further Reading**

C RAC Degree Course Guides: Microbiology, Immunology and Biotechnology 2001/2002. Hobsons. Available from Biblios, Star Road, Partridge Green, West Sussex RH15 1LD (Tel. 01403 710851).

Dr Liz Sackett is Education Officer of the SGM and can be contacted at Genetics Division, School of Clinical Laboratory Sciences, Queen’s Medical Centre, University of Nottingham, Nottingham NG7 2UH. Tel. 0115 919 4496; Fax 0115 970 9906 email liz.sackett@nottingham.ac.uk
The last few years have seen an increase in the number of postgraduate students from the UK and from overseas. As a result, more academic staff have supervisory responsibilities, often to a greater extent than before. This increase has been accompanied by external pressures from funding bodies for successful and rapid completion of research degrees and for early publication of research work in good quality journals. These changes are occurring at a time of increasing pressures on academic staff with regard to their teaching and administrative duties. The combination of all these factors could be bad news for the quality of graduate supervision. If academic staff are to carry out their new or increased supervisory responsibilities effectively, there is likely to be a need for increased staff development, as individuals may need support if they are to successfully supervise and support postgraduate students through a research degree programme. The question is, do we really need more supervisor training, or is this just an increase in bureaucracy that we really haven't got time for?

The supervisor-student relationship is all important!

What do supervisors do?
The term 'supervision' means many things to many people, depending largely on their own experiences as either student or supervisor or both. Essentially, supervision should be the process of training the student to become a successful researcher and for this to be suitably recognized by the award of a doctorate (or other research degree). The student should not just be regarded as 'a pair of hands', a means of generating research data for the supervisor to use.

The problem is that to be a good supervisor - a good research trainer - one has to be successful in many roles. As Phillips & Pugh have described, students expect their supervisors to:
- read their work well in advance
- be available when needed
- be friendly, open and supportive
- be constructively critical
- have a good knowledge of the research area
- structure meetings so that it is relatively easy to exchange ideas
- have sufficient interest in their research to put more information in the student's path
- be sufficiently involved in their success to help them get a good job at the end of it all

It is clear therefore, that the demands on a supervisor can be high and that the supervisor-student relationship is fundamental to the supervision process. Many problems that arise with supervision can be traced back to the two parties' attitudes towards this key relationship.

Problem areas

Common problems for students
A lack of:
- resources and facilities
- student rights and entitlements
- clarity over supervisory roles
- attention to process (e.g. methodology, evaluation of data, etc.)
- attention to the 'whole person'
- attention to monitoring and support mechanisms

Common problems for supervisors
Students not:
- being independent enough
- producing written work of a high standard
- being honest about their progress
- following the supervisor's advice
- realizing how much work is involved
- making a real commitment to their research

Even the best supervisor will no doubt admit to making mistakes in supervising as each student is different and potentially needs managing in a different sort of way. However, there can be tragic consequences if things do go terribly wrong as shown by the suicide of an American graduate student in 1998. This case highlighted the need to consider a different system of monitoring the quality of a graduate student's supervision. It was also evident that this was not just a one-off case and that others were known.

So if we all know that problems do occur, what can we do about them?
**Solutions**

Unfortunately, there are no simple solutions. The nature of academic research inevitably leads to a self-perpetuating system: one generation of specialist researchers trains the next and so on. When students themselves eventually become supervisors they usually have a very limited number of role models to turn to for guidance. If their supervisors were not particularly effective, students may often not have other points of reference to help them develop better practice for themselves. Therefore, if nothing is done to change the status quo, it is difficult to see how things can improve.

This is where the idea of supervisor training has emerged from, in an attempt to change bad practice into good practice and break the cycle of new supervisors replicating the processes that they themselves experienced.

Training has been introduced in many institutions to help academics develop their supervisory roles more effectively and avoid or resolve problems in the supervisory relationship. It often takes the form of discussion groups and may include topics such as exchanging good practice, refining the role of the supervisor and finding practical ways to improve standards. However, not all academics consider supervisor training to be useful, or even necessary, and this view seems to be coloured by two main problems. The first is terminological: using the word 'training' in this context may suggest that supervisors are not carrying out their supervisory duties correctly. This can create a negative perception of training programmes, particularly among more experienced staff who have supervised research students and are reluctant to admit that they might need 'training' to do something which they are already supposed to know how to do.

Programmes that focus on awareness of current issues and enhancing the development of supervisory skills – and be able to demonstrate that we have done so. Some type of research supervisor training or development programme could help us to achieve this goal. As a first step, if you would like to find out more about this issue, why not come along to the SGM Education Group sessions at UEA in September 2001. There will be two events, including a symposium on Research Supervision: How to Get it Right and a workshop on Problems in the Supervisor–Student Relationship. Supervisors and students are welcome to attend and I look forward to seeing you there.

**Further reading**


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Millennium science centres and life sciences education

Leigh Fish

Where can the public go to be educated about biological science? Leigh Fish describes the current Science Centre Scene.

The next generation of science centres is opening across the UK offering exciting learning opportunities in microbiology, biotechnology and genetics. These new centres aim to enthuse and motivate visitors about science and technology through exhibitions, science shows, information technology (IT) facilities, IMAX cinemas and more traditional practicals and workshops. The unique combination of learning formats and trained science communicators in these inspiring environments is already proving popular with a wide range of audiences.

The National Lottery’s Millennium Commission, the Wellcome Trust and public and private sector funding partnerships bequeathed the network of new science centres. These have built on best practice from established centres like the Exploratory (now replaced by At-Bristol), Techniquest in Cardiff and the Science Museum’s Launch Pad (London). They are acting as hub organizations and forging links with universities, industry, learned societies and research funders and are working towards some of the targets expressed in the Science and Society House of Lords Select Committee report. Science centres target members of the public and community groups, pre-school children, schools and colleges, further and higher education establishments offering post-16 vocational and non-vocational courses, and lifelong learners. They offer carefully designed programmes using exhibitions, laboratories, classrooms and discovery environments and it is in these venues that both formal and informal learning are flourishing.

There are currently 51 science centres listed by the British Interactive Group, so it should not be hard to find a science centre near you — many are also offering outreach activities and in-service education training (INSET) for teachers. Each centre is different, with distinct foci on the areas of science covered, although these often include the life sciences. The Wellcome Trust has played a major role in funding seven of the new centres and it is these facilities that feature most biotechnology, microbiology and genetics. Of the centres not already open, most will be complete in early summer (Birmingham Thinktank follows in late September), with pilot programmes already offered by many to educational groups and the public.

Of the many and varied programmes on offer, microorganisms are specifically explored by At-Bristol and Life Interactive World, with Glasgow Science Centre planning to offer real time gold-coating and scanning electron microscopy of samples when they open fully in the summer. Techniquest in Cardiff, one of the long established science centres, excels at providing microbiology workshops in partnership with the local Public Health Laboratory Service where visitors aim to find the source of food poisoning at a wedding. Biotechnology is also represented with a plant power game show (audience participation obligatory) and Science and Plants for Schools (SAPS) protocols.

Genetics workshops on offer not only explore chromosomes, nature/nurture and evolution, but also feature practical activities, often using protocols from the National Centre for Biotechnology Education (NCBE) at Reading. These include solving a crime using a ‘suspect’s’ DNA and restriction enzymes, simulated ‘pre-natal screening of embryos’ using the same techniques, or extracting DNA from plant tissues. Life Interactive World is closely linked with the research genetics centre of the
Science Centre features a multimedia theatre and virtual science theatre powered by a powerful Silicon Graphics computer which allows data from microscopy and medical imaging technologies like magnetic resonance imaging, ultrasound and the 'visible human' project to be explored in real time interactively. The running of educational programmes specifically designed for these new media (Glasgow houses the only other theatre outside Japan) allows in-depth exploration and coverage specifically tailored to the needs of each educational group.

Many of the new centres are equipped with IT facilities which allow visitor-focused research and learning, in addition to offering training in computing skills and acting as a showcase for software. IT will increasingly be used for video conferencing and debating, to allow visitor opinions and views to be shared nationwide and for combined multimedia presentations across the centres - visits by real scientists will be shared by science centres, giving more effective use of scientists' time and a bigger audience.

Science centres have the potential to bring science closer to its public and these are truly interesting times.

Further reading
British Interactive Group list of UK science centres: http://www.big.uk.com/centres/index.htm
House of Lords Select Committee 3rd Report full text: http://www.parliament.the-stationery-office.co.uk/pa/ld199900/ldselect/discotech/38/38v01.htm

Acknowledgements
Thank you to all the staff at the science centres listed above who provided information for this article.

Dr Leigh Fish worked as content manager on the Get Connected! Gallery for At-Bristol before moving on to Glasgow Science Centre where he is currently a staff scientist involved in the ongoing operations of laboratories and IT suites. He can be contacted at Glasgow Science Centre, 50 Pacific Quay, Glasgow, G51 1EA.
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nearby University of Newcastle and its programmes strongly feature genetics, including DNA subspecies identification and 'genetic engineering for beginners' with transformation of cells. The polymerase chain reaction (PCR) is used at Techniquest, At-Bristol, Glasgow Science Centre, Life Interactive World and the Manchester Museum of Science and Industry to amplify mitochondrial DNA from cheek cells and show the power of this technique in detection and diagnosis.

In addition to the basic skills learned by participants in these programmes (developing observation, considering evidence and drawing conclusions) the activities are extended to use real scientific techniques and are, often linked to the ethics involved in applying that science. In considering the use of PCR to detect genetically modified crops, hepatitis C contaminated blood or foot-and-mouth disease, visitors achieve a greater understanding of the type of work scientists do and are more able to examine and understand some of the ethical implications. Debates at Glasgow Science Centre, At-Bristol and Birmingham Thinktank encourage visitors to draw their own conclusions and to be more confident in interpreting newspaper articles and TV programmes.

At many of the new centres, the exhibitions feature current hot topics in science and canvas the opinions and views of visitors. The education programmes are closely tied in with the exhibitions, each reinforcing messages and content in the other. Although most of the centres have laboratories and classrooms, several of the larger institutions have brought together diverse tools to assist with their communication aims and have linked these to the education programmes. Increasingly, planetaria are being used as 360 degree projection spaces and feature journeys through the body as well as star fields. Glasgow...
Microbiologists and maths
Ron Bishop & Adrian Eley

Most microbiology students are scared of maths. Ron Bishop and Adrian Eley share some resources and strategies developed to combat those fears and give confidence to the innumerate.

Biologists, of course, are traditionally hopeless at maths, but nowadays the term 'hopeless' seems to have acquired new depth of meaning. Why are many of today's microbiology students, at least in the UK, so completely incapable of handling numbers properly? Almost every microbiology tutor, usually no great shakes mathematically themselves, despairs at student attempts to manipulate data and understand quantitative concepts. A recent symposium of the Society's Education Group (Developing Mathematical Skills in Microbiologists at Exeter last September) explored the problem.

Scared of maths
Why are we so scared of maths? Roseanne Benn, of the Institute of Lifelong Learning at the University of Exeter, has studied the attitudes and experiences of English adults. She has shown that people in general can and do cope quite well with numbers (betting, numerical and logical quizzes, money), but only by abandoning 'school maths' and developing their own roundabout methods.

Maths help
Clearly, microbiology students are coming into tertiary education sharing many of these attitudes. Tutors find that they need to spend large amounts of time repetitively going over very basic points with individual students, and discussion throughout the symposium reinforced the benefit of as nearly as possible one-to-one remedial tutorials. But the days are long since gone when we could find the time or resources to do this routinely. Money helps, though, as was impressively shown by Helen Robert of the University of North London. UCL is institutionally a strong supporter of the 'capability curriculum' concept and is prepared to devote some institutional funding to non-specialist maths and numeracy support. Helen and her colleagues in the School of Communications Technology & Mathematical Sciences, advised by a university-wide Maths Group, developed 'Data analysis' and 'Maths through IT' modules that are really needed by biology students and these are developed in the on-line tutorial sections, again linking the exercises to course and module content by using subject-specific examples.

Numeracy package
Several microbiologists around the country have started their own initiatives. Kay Hack of the School of Biomedical Sciences, University of Ulster, was able to get funding to develop a complete numeracy package for entry-level students. It is CAL-based to facilitate independent learning and to build in assessment. A diagnostic section identifies strengths and weaknesses and can plot changes in skill level throughout the student's career. A wide range of colleagues was surveyed to define the mathematical skills that are really needed by life sciences students and these are developed in the on-line tutorial sections, again linking the exercises to course and module content by using subject-specific examples.

Workbook
Traditionally, we would have told students with a maths problem to get a good book and work through it. Indeed, there are several on the market aimed particularly at biologists. One, with the seductive title of Easy Mathematics for Biologists, seemed in particular to live up to its claim, so its author, Peter Foster of the University of Central Lancashire, was asked to outline the origins and rationale of the book. It started from the common observation that students were unable to do the very simplest of calculations, such as dilutions or concentrations. Concerned staff in the Biological Sciences Department at Central Lancashire tried to develop a skills module including...
numerator to improve students' ability to do simple calculations and to interpret graphs. Initially, the conventional module structure of lectures and worked examples proved largely ineffective as students differed so much in their abilities and speed of understanding that the pace suited nobody. The approach was altered to allow students to identify their particular deficiencies with a diagnostic test. This mostly showed the difficulties to be in applying their existing basic mathematical knowledge (which was usually, if not always, there) to actual practical problems. A workbook of eight sequential sections was developed, covering procedures like ratios, exponential expressions, and graphs that are basic to all biologists. First the concept is introduced, followed by worked 'pure' examples and then worked applications. Students study at their own pace but with an hour a week of small(ish) group tutorial contact with staff. Various forms of assessment have been used, all showing most students to make significant improvements. The workbook was published commercially in 1998.

The Internet

The internet is often seen by those who haven't really tried to use it as the answer to all pedagogical problems. Inevitably, it isn't; but it can certainly help and students feel increasingly comfortable with it. No-one who searches the web for microbiology education resources gets far without coming across material from Alan Cann of the Department of Microbiology and Immunology at the University of Leicester. Alan's PowerPoint presentation is on his website. It describes the development of a web-based first year numeracy module at Leicester. Since the 1960s, staff had tried to promote relevant numeracy skills in a first year 'Quantitative Biology' course, but the evidence suggested it remained of little value to the students despite its many modifications. In 1999, in accord with the university's Learning and Teaching Strategy, a new module 'Numeracy and computer skills for biologists' was developed. It aims to promote not only subject-specific and transferable knowledge and understanding, but also student planning skills and time management through the use of continuous assessment and electronic submission of assignments. The underlying ideas are to fuse the acquisition of numeracy and IT skills by computer-based delivery and assessment of both topics via the web, to use computer-based learning to overcome biologists' traditional negativity towards maths and to reduce staff time spent on repetitive marking of weekly assignments by 95% so that the effort can be redirected to individual student support.

His presentation outlined the implementation of hands-on computer sessions and how lectures describing mathematical and statistical techniques were followed with a URL providing a set of relevant problems to be completed and submitted over the web for computer-marking. Problem clinics were open to all, but were compulsory for those who failed or did not submit the problem answers. The numeracy syllabus covers concentrations and dilutions, units, indices and exponentials, area and volumes of manipulating numbers. Statistics and IT syllabuses are also very straightforward and relevant, and all the applications covered in the latter are used directly to carry out and submit the coursework. Much of the staff-student communication is by email. The results and student feedback, both positive and negative, from the first running of the module are shown on the website. The first cycle of module redesign in the light of this feedback includes abandonment of the peer support mechanism which seemed ineffective, enhanced feedback emphasizing methods of calculation rather than just the correct answer and some modification of the problem clinics. There are still some uncertainties, though, not least of how to motivate and reward the high achievers who found it all too easy!

So do not despair! There are still no simple or perfect answers to the thorny problem of developing mathematical skills in our students. But these and several other microbiologists (e.g. Alastair Wardlaw at Glasgow University and Vicky Tariq at Queen's University Belfast) have worked very hard to develop good practice and the rest of us can learn a great deal that is useful from their achievements. As Alan Cann's well known motto says, 'Education costs money — ignorance costs more'!

Further reading


Useful websites

http://www.ulst.ac.uk/ctma/mathhelp/
http://www.ulst.ac.uk/resources/numeracy
http://www.micro.meds.le.ac.uk/AJC/talks.html

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Dr Adrian Eley is Senior Lecturer in Medical Microbiology, Division of Genomic Medicine, University of Sheffield Medical School, Sheffield S10 2RX. Tel: 0114 271 2335; Fax: 0114 273 9926 email a.r.eley@sheffield.ac.uk
Home thoughts from abroad

Some personal views of microbiology education overseas

Sun, sea and science on California’s Biotech’ Beach

Keith Stephenson

My scientific research career started in my home town at the University of Newcastle upon Tyne where, after a PhD and postdoc with Dr Colin Harwood, investigating protein secretion from Bacillus subtilis, I was offered a research position at The Scripps Research Institute, commencing June 1999. Scripps is located in La Jolla on the Pacific coast just north of San Diego in southern California and is surrounded by numerous research institutes and biotechnology companies (hence San Diego’s suitably tacky nickname of ‘Biotech’ Beach’). My new lab was to be that of Prof. James A. Hoch who is a world renowned scientist in the field of bacterial signal transduction. The international reputation of Scripps combined with that of my potential boss meant that the job offer was hard to turn down and a move to the USA would, I hoped, facilitate my scientific education and my long-term goal of a good academic position back in the UK.

As might be expected the labs within Scripps are very well funded and the institute provides a great platform to conduct stimulating research. Since there is no formal teaching, Scripps is organized for pure research and supported by on-site core facilities that take care of every scientific service that might possibly be required. I went to the States with the intention of working hard but the major difference between being a postdoc at a UK university and at an institution in the USA is the high level of work that is demanded in the latter. This was reinforced on my first encounter with my new boss when it was politely (not!) pointed out to me that ‘postdocs work six days a week in my lab’. A typical work day for a postdoc in the lab starts at 8 am and finishes after 7 pm with a brief period somewhere in the middle to inhale lunch (no long lunches in the pub for me anymore!). Furthermore, with two lab meetings per week there is constant pressure to generate new data to present to the boss and the rest of the research group. A postdoctoral position in the USA is regarded as a training position and consequently the salary can often be less than that of a technician with significantly less experience and qualifications. However, this aside, the salary is still better than the UK (in my experience at least) and as a consequence trips south of the border to Mexico and to the bright lights of Las Vegas are regular events.

In general, the day-to-day operation of the labs at Scripps seems to proceed in a similar manner to those in the UK, complete with the usual minor problems and petty annoyances of a busy lab environment. From a purely academic point of view I have learnt a tremendous amount from my time in the USA and I have been able to build on my knowledge of molecular microbiology and extend it into the previously unknown realms of biochemistry and structural biology. The attitude towards research in the USA centres around working hard and efficiently in an independent manner and accumulating publication quality data in the shortest possible time. I firmly believe that this attitude is one of the most important things that I will take away from Scripps. Furthermore, the education I have gained has broadened my scientific horizons and prepared me for future phases of my research career.

These are my personal thoughts and experiences and they are limited to the research environment of The Scripps Research Institute. To anybody considering a postdoc in the States I can honestly recommend it for the experience and the education, but go prepared to work hard. There seem to be a lot more opportunities for biological scientists in the States and particularly in San Diego. These opportunities, combined with the better salary, the weather and the great Scuba diving, make the decision to return to the UK a difficult one for me. I am in hope of a shake up in the British educational system which would allow better salaries and contracts for academic research scientists in the UK. This would help reduce the brain drain and ultimately make my decision to return to home soil a lot easier. After all, San Diego is a long way away from the bars of the Newcastle Quayside and the sacred turf of St James’ Park.

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Keith’s career path

BSc (Hons) Microbiology, 1992
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PhD Molecular Microbiology, 1996
University of Newcastle upon Tyne, UK
Postdoctoral Research Associate, 1996–1999
University of Newcastle upon Tyne, UK
Postdoctoral Research Associate, 1999–Present
The Scripps Research Institute, CA, USA
Stephanie Hunter, a fourth year sandwich student, spent last year at Marseille University, France.

One of the primary concerns of anyone contemplating study abroad must be their ability to cope with the language, and the British with our stereotypical ineptitude for languages epitomize this. However, Stephanie Hunter is one of a growing number of UK students who have chosen to include a placement abroad as part of their biological science degree. 'I already had A/S level French and took extra French units as part of my degree course in Birmingham so I wasn't too worried about making myself understood. I did find the lectures hard going. Not only were they 4 hours long, with a short break after 2 hours, but also the tutors dictated notes. Luckily, I was able to borrow notes from a friend to make sure that I didn't miss anything. The days themselves were long too; we studied from 8 in the morning to 6 at night.'

'The course in Marseille was lecture-based and there was no laboratory project. There wasn’t much course work either as most of the marks went on exams. I was a little disappointed with the content of the programme because it contained more general biology than my course in Birmingham.'

'That I liked about studying in France was the attitude of the French to studying. It is a lot more relaxed compared to the UK. There was less pressure on me also as I only had to get 20 credits to pass the year. However, things didn’t always run smoothly. There is generally a lot more bureaucracy under the French system and this made it difficult, for example when I wanted to change certain modules.'

'Marseille was a great place to study. There weren’t many Brits there so I was forced to get on with everyday life in France, but I was glad to do this, my French and my confidence have improved because of it. I’d definitely recommend this experience to other students both to experience living in another country and the different culture. It has also opened up a number of opportunities to me as employers frequently ask for fluency in a second language. I might also consider returning to study for a PhD in France.'

The Marseille contract
Tracey Duncombe

Those who are still interested in continuing their studies after their third year would go on to take a Masters-type course.’

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Time abroad

The University of Birmingham participates in the SOCRATES scheme which allows students to spend a year studying biology, language and culture in a European university – thereby extending their biological science degree to 4 years.

Many other UK universities offer biological science courses which include either a period of full-time study in an overseas institution or work experience abroad. For details see The Official UCAS Guide or the CRAC Degree Course Guide: Microbiology, Immunology and Biotechnology (Hobsons, 2001).
Nowadays, the launch of a new website is generally little to 'write home about'. However, when the University of Central Lancashire launched its Biology4ALL.com site in September 2000 this was another significant step towards bridging the gap between biology schoolteachers and the academics in universities and research establishments.

The Biology4ALL project actually began some years earlier, in March 1998, staff at the University of Central Lancashire launched a free email discussion list (called BIOTUTOR-L) specifically for biology teachers in local schools around the Preston area. Teachers could email problems and requests to the discussion list and then either university staff or other teachers could email a response. A rather unusual feature of this list – and perhaps a key reason for its success – was that it was private, with subscription being restricted to teachers or others with a professional interest in biology. This meant that teachers could discuss real problems without fear of their pupils 'listening in'. Thus, whilst similar discussion lists, bulletin boards and chat rooms have struggled to achieve significant interest, the BIOTUTOR-L list quickly outgrew its local roots and achieved national coverage within its first six months of operation. Currently, there are about 350 schools subscribed to the service, mainly from the UK but also from Australia, New Zealand, Zimbabwe, the US, Austria, Denmark and the Philippines. Last year the Listserver in Preston distributed over 200,000 emails to members of the group. Indeed the list has proved so successful that a second list (SCITECH-L) has been set up to provide a similar service for science technicians in schools. Within eight months SCITECH-L has also grown to have over 300 subscribers and has generated a staggering 500,000 email deliveries.

The BIOTUTOR-L discussion list thus provides an excellent forum for biology teachers to share good practice and resolve problems. It is also increasingly being used by learned societies and universities to advertise events and projects that may be of interest to schoolteachers and their pupils. As well as the SGM, the Institute of Biology, Society for Experimental Biology, the Biochemical Society, Physiological Society, Science Museum, BBSRC, BBC (Education) and Royal Society of Chemistry have all used the service over the past year.

Email discussion lists are, however, not necessarily the best way of disseminating complex information such as practical schedules – as most people who have tried to send an email attachment to multiple recipients will generally confirm! Consequently, the University of Central Lancashire developed and launched the Biology4ALL.com website (http://www.biology4all.com). This houses a resources library where teachers can both retrieve and deposit practical schedules, lesson notes, spreadsheets, PowerPoint presentations and images. This website is now listed on all major web search engines and currently receives over 700 visitors per week (generating 3,000 page impressions per week). The resources library welcomes contributions from SGM members who have information which they feel may be useful for GCSE and post-16 teachers and (very importantly) which is free from copyright restrictions.

The website also provides information for those interested in studying biology at university and houses a links page to all 250 UK university bioscience departments (including medical, dental and veterinary schools). A jobs page also enables visitors to find employment in the field of biological sciences. The site also acts to help advertise the schools liaison events of UK universities and a list of university lecturers prepared to visit schools to give talks is expanding steadily.

The recent endorsement of Biology4ALL.com by the UK Life Sciences Committee was another pleasing step in the development of this project and should hopefully encourage wider interest in the project from the UK higher education community. Should anyone wish to subscribe to either of the two discussion lists, or if anyone feels that they have either content or expertise that could help in the development of this project, please contact me.

Dr. Peter K. Robinson can be contacted at Department of Biological Sciences, University of Central Lancashire, Preston PR1 2HE. Tel. 01772 893911; Fax 01772 892929. email pkrobinson@uclan.ac.uk
Where do HE educators find advice and resources to support bioscience teaching? The Learning and Teaching Support Network aims to meet this need.

Academic staff simply do not have the time to wade through the alphabet soup of acronyms adopted by the numerous projects and national initiatives in learning and teaching. Consequently, the wheel has been reinvented many times, with the duplication of projects and inadequate dissemination of results. Fortunately, the LTSN (yes, another acronym!), has been established to co-ordinate and share information in a coherent and accessible form within higher education. LTSN stands for the Learning and Teaching Support Network, a national network of 24 subject centres distributed at universities around the United Kingdom and a generic centre, based at the network headquarters in York. The LTSN Centre for Bioscience, based at the University of Leeds, is the subject centre for the life, food and agricultural sciences.

The diverse range of subjects that falls under the bioscience umbrella certainly has its own unique challenges. Bioscientists identify most closely with their particular discipline (what's your response to 'So what is it you actually do?' Probably not 'Well actually, I'm a biologist'). Biologists also tend to be more receptive to ideas when they are talking to their own species. That's why LTSN Bioscience has three Subject Specialists (all biologists, with different backgrounds and expertise), to act as discipline-specific contacts. Our experiences in research and teaching means that we are only too aware that many academic staff work in a research-driven climate, where teaching excellence often goes unrecognized.

Teaching ideas and material; practical, solid and tangible

One of our first activities was to survey the community, asking what our priorities should be. The overall response is summarized from one of the replies: 'Teaching ideas and material; practical, solid and tangible'. Here are the most popular requests and what we're doing about them.

Digital image bank. Microbiologists are fortunate that the ASM already hosts an excellent bank of high quality images that are cleared for non-profit educational use (www.microbelibrary.org) but other disciplines are less lucky. The images that are available are distributed across innumerable individuals and organizations. We are currently collating existing material and defining areas of high priority. Many lecturers take a risk in using copyright material in lectures and handouts – we aim to make images freely available for educational use.
Compendium of good practice and innovation.
Case studies are a useful and quick means of deciding which methods and techniques established elsewhere could be applied to your own teaching. Thus, we are collecting case studies of good practice and innovation in learning and teaching from across the sector. In addition, we aim to provide a central repository of tried and tested practical classes, including evaluated alternatives to traditional laboratory exercises, as this vital component of a life science degree is under considerable pressure due to reduced funding, increased student numbers and diversity of student abilities.

Assessment. Increasing student numbers have also put pressure on the assessment process. LTSN Bioscience has considerable expertise in alternative assessment methods such as peer assessment and is sharing it in a series of workshops and articles. We are also part of a major project, headed by the LTSN Generic Centre, looking at various aspects of assessment.

Special interest groups. We will shortly be forming our first special interest groups to address and develop specific topics from a biology perspective. Following on from the issues raised above, unsurprisingly, the most requested topic for discussion is assessment!

The Knowledgebase. Where are all the resources going to be stored? In our on-line information service, the 'Knowledgebase', accessed through our website. Now developed and ready to grow, users will have rapid access to evaluated information on a wide range of learning, teaching and assessment strategies and products.

We need your help!
Although we can provide information, resources and advice, it is up to you to decide to share your expertise and experience with others. You might be surprised to find that your normal practice is another's innovation and vice versa. The first step is to register with the Centre to find out more about the services that we can offer you and your colleagues. We look forward to working with you.

Dr Heather Sears is a Subject Specialist at the LTSN Centre for Bioscience and can be contacted at LTSN Centre for Bioscience, School of Biochemistry & Molecular Biology, University of Leeds, Leeds LS2 9JT.
Tel. 0113 233 3001; Fax 0113 233 3167
email itsnbioscience@bmb.leeds.ac.uk
website http://bio.ltsn.ac.uk/
From Anabaena to zoonoses: electronic microbial education resources at your fingertips

Yolande Knight

Yolande Knight of the LTSN describes some useful websites for microbiology teaching.

Whether we like it or not, the internet and web are revolutionizing information exchange, with enormous implications for the academic community in the arenas of research and education. The sheer scale of this information mountain can overwhelm even the most enthusiastic of surfers. In December 1997 it was estimated that at least 320 million pages of information existed on the web. If you are a teacher interested in incorporating electronic resources into your module material, the time required to search out decent material can be frustrating and may result in a dented monitor and some fancy explaining to your department's computing service.

At LTSN Bioscience we aim to ease this process, providing information and links to useful websites and inviting reviews from users. Some examples of microbiologically relevant websites for learning and teaching are described below (see Table 1). An expanded list of resources relevant to this article can be found in Resource News on our website.

Websites

As a first port of call for the microbiological surfer, we would recommend three major websites, all of which provide reviewed links. BIOME is a gateway which provides a searchable catalogue of internet sites and resources covering the health and life sciences and is a great way for cutting down your search time. The American Society for Microbiology's MicrobeLibrary, is a peer-reviewed, web-based collection of academic resources for microbiology educators. Its contents include images, curriculum activities and the society's new journal Microbiology Education. Email discussion lists are also available and extremely active! Merlot Biology (Multimedia Educational Resource for Learning & Online Teaching) is a free and open resource designed for teachers and students in higher education.

Thousands of subject-specific websites can also be found by the determined. The links mentioned previously provide gateways to a number of these sites. For example, within the pages of All Virology on the web you will find educational resources, including on-line course notes and tutorials, links to specific virus sites and the Big Picture Book of Viruses which contains an extensive collection of searchable virus pictures. The Digital Learning Centre for Microbial Ecology aims to use computers and network technologies to provide students and teachers interested in microbiology and microbial ecology with resources that may aid their learning and teaching. This includes the Microbe Zoo (with guests able to visit 'Poo Corner' and 'Redox Mine Shaft' to name but two) and Microbe of the Month.

Generic learning and teaching sites are often hard to access through subject-specific gateways, but it is worth persevering, as with imagination they are every bit as valuable to the inventive teacher. The Castle Project provides a free toolkit for the development of on-line interactive multiple choice questions, with tips on good practice in test and question design. The Resource Discovery Network (RDN), which links to BIOME, also provides free 'teach yourself' tutorials such as 'Internet Medic'. These tutorials are aimed at providing both students and teachers with the skills to not only search the web, but decide on the quality of the information found. 'Internet Bioresearcher' will be available from May 2001.

Table 1. Useful websites (referred to in this article)

<table>
<thead>
<tr>
<th>Website</th>
<th>Link</th>
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</thead>
<tbody>
<tr>
<td>LTSN Centre for Bioscience</td>
<td><a href="http://bio.ltsn.ac.uk">http://bio.ltsn.ac.uk</a></td>
</tr>
<tr>
<td>BIOME</td>
<td><a href="http://www.biome.ac.uk">http://www.biome.ac.uk</a></td>
</tr>
<tr>
<td>American Society for Microbiology MicrobeLibrary</td>
<td><a href="http://www.microbelibrary.org/">http://www.microbelibrary.org/</a></td>
</tr>
<tr>
<td>Merlot Biology</td>
<td><a href="http://biology.merlot.org/9100/microbe.co">http://biology.merlot.org/9100/microbe.co</a></td>
</tr>
<tr>
<td>All Virology</td>
<td><a href="http://www.virology.net/garryfaure/html">http://www.virology.net/garryfaure/html</a></td>
</tr>
<tr>
<td>Digital Learning Centre for Microbial Ecology</td>
<td><a href="http://comfort.shef.ac.uk/sites/dlc-mo">http://comfort.shef.ac.uk/sites/dlc-mo</a></td>
</tr>
<tr>
<td>Castle Project</td>
<td><a href="http://www.lancs.ac.uk/ce/tg/castle/">http://www.lancs.ac.uk/ce/tg/castle/</a></td>
</tr>
<tr>
<td>RDN</td>
<td><a href="http://www.rdn.ac.uk">http://www.rdn.ac.uk</a></td>
</tr>
</tbody>
</table>
A further aid to teaching from the electronic resource stable is that of videos and video-streaming. A number of projects are underway to provide video material for use in learning and teaching of the biosciences. Shortlist Video Resources for Higher Education provide subject-specific teaching video materials available at minimal cost to all UK educational establishments. The LIFESIGN project aims to identify and develop a collection of video resources in the life sciences and deliver these across the internet to users. The project seeks active teaching academics in the life sciences keen to use streaming video within their courses and has set up a demonstration site to illustrate examples of what is possible and to seek input into what individuals require for their teaching.

Certain videos have also been produced specifically for the microbiology educators’ market. For example, An Introduction to Practical Microbiology (priced £28.50, available from Joanna Verran) has been recommended as support for Curriculum 2000. Another video, Microbiology Laboratory Procedure covers topics such as aseptic techniques, safety and using a microscope. It is available from A. Vilkins, AVS, Medical Sciences Building, University of Leicester, University Road, Leicester LE1 9HN (price £30, incl. VAT + p&p). Following this microbiological theme, a set of videos entitled Intimate Strangers has been produced by the American Society for Microbiology based on a US television series. Designed to support microbiology education in schools and colleges, it uses information and footage supplemented with further academic learning resources. A group of staff at the Manchester Metropolitan University is currently evaluating both the TV series and the teaching package with a view to incorporation into their undergraduate curriculum. Dissemination of the findings through the SGM is likely.

Please contact Dr Joanna Verran (j.verran@mmu.ac.uk) for further information on the Intimate Strangers videos.

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Optimizing learning and teaching: Video teaching aids

Joanna Verran

A further aid to teaching from the electronic resource stable is that of videos and video-streaming. A number of projects are underway to provide video material for use in learning and teaching of the biosciences. Shortlist Video Resources for Higher Education provide subject-specific teaching video materials available at minimal cost to all UK educational establishments. The LIFESIGN project aims to identify and develop a collection of video resources in the life sciences and deliver these across the internet to users. The project seeks active teaching academics in the life sciences keen to use streaming video within their courses and has set up a demonstration site to illustrate examples of what is possible and to seek input into what individuals require for their teaching.

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Please contact Dr Joanna Verran (j.verran@mmu.ac.uk) for further information on the Intimate Strangers videos.
A web search for Universities in Mexico will reveal a listing of some 102 publically and privately funded universities and polytechnics spread throughout the country (http://geowww.uibk.ac.at/uni/). These vary markedly in size and the range of courses offered with virtually a complete absence of named degrees or departments of microbiology. However, microbiology is an integral component of many degree or Licentiateship courses spanning medicine, biology, molecular genetics, food technology and more, whilst microbiological research is active in many departments throughout the country. By far the largest and oldest university is the Universidad Nacional Autónoma de México, located in Mexico City, with about 300,000 registered students. Another publicly funded university in the capital is the Universidad Autónoma Metropolitana (UAM) with which I have been associated for the last 10 years through a variety of British Council and EU-funded initiatives. UAM comprises three separate campuses in different parts of the city. UAM-Iztapalapa (about 13,000 students) is situated in an industrial area and amongst its specialities are biology, hydrobiology, biochemistry and food technology, and engineering. Its organization of microbiology teaching typifies that in many Mexican universities and polytechnics. A major course in microbiology is taught in the second year of study and is common to several degree programmes, thus classes are large and practicals a major feat of organization. More specialist courses such as food microbiology are taught in the third year to smaller sized groups. Further specialization and a major project are undertaken in the final year. Thus it is possible for students to graduate in several named degrees having gained quite a range of experience in microbiology. Such experiences may be extended through postgraduate MSc courses, again under inclusive titles, e.g. biotechnology.

Visiting staff from UK and elsewhere may be involved in various aspects of these courses. Certainly those of us from Queen's University Belfast (QUB) have taught courses ranging from food poisoning to microbial molecular genetics, language rarely being a problem due mainly to the linguistic skills of the students! On one memorable occasion a course for industry on microbiology and the development of organoleptic characteristics of yoghurt was jointly organized and run by colleagues from UAM, Huddersfield, Nottingham and QUB.

Postgraduate students and staff at UAM are encouraged to make use of International University links and interactions typified by QUB-UAM links in which a succession of students and staff from UAM spend some time working in the Department in Belfast and those from QUB spend time working on joint research and teaching in UAM.

Dr Martin A. Collins can be contacted at Department of Food Science, Agriculture and Food Science Centre, The Queen's University of Belfast, Newforge Lane, Belfast BT9 5PX. Tel. 028 90 255314; Fax 028 90 668376 email m.collins@qub.ac.uk

Microbiology education in Mexico
Martin Collins

Above: The Stock Exchange in Mexico City in the Zona Rosa (the 'west end', not the 'red light district').

Right: An expedition from the lab in the UAM Department of Biotechnology in 1997. We visited a colonial style town about 50 km outside Mexico City, well away from the pollution.

Photos courtesy Martin Collins.
Teaching teachers microbiology and much more: a biotechnology summer school

Ian Sutherland

For the last three years, the Institute of Cell and Molecular Biology (ICMB) at Edinburgh University has hosted a summer school for biology teachers involved in the new Scottish syllabi. Last year the focus was on the Advanced Higher 'biotechnology' programme. Although labelled 'biotechnology' much of this syllabus, especially at the practical level, focuses on microbiology. Our courses have taken 50 teachers each year from a wide geographical spread of Scottish schools and FE colleges. They spend five days living in university halls of residence and attending a mix of lectures and practical sessions. The opening lectures, following registration on a Monday morning, have updated the teachers on molecular biology or have covered a wider range of biological topics. The aim of these has always been to present a modern view of biology at a level suitable for teachers for whom much has changed since they obtained their initial degrees.

The Monday afternoon is spent on microbiology practical work. Here it has to be remembered that with the current age profile of teachers, many will not have handled bacterial cultures before. The teachers are also subject to the very restrictive protocols required in schools. What would seem a simple undergraduate practical has to include very detailed safety instructions, before we can start to look at a number of fairly simple isolation procedures. As nitrogen fixation features strongly in the syllabus, we place considerable emphasis on free-living and symbiotic nitrogen fixers and the spacing of the practical sessions is deliberately aimed at giving time for the isolates to develop.

In the following days, there is a mix of lectures and practical sessions with one day devoted to 'industrial' visits. It was especially appropriate that last year, in the week when the results of the Human Genome Project were announced, the guest lecturers were from the MRC Human Genetics Unit and the Medical Genetics Section, based at the Edinburgh Western General Hospital. Their lectures covered the Human Genome Project, genetic disorders and gene sequences. A further lecture in this area discussed the use of monoclonal antibodies in human therapeutics.

Evening sessions held in the halls of residence included a showing of the video The Gift. This has been produced by the Wellcome Trust as part of its educational programme and deals with inherited human genetic disorders. A representative of the Wellcome Trust outlined some of their projects and initiatives in the area of education and this was followed by an extended discussion on the ethical problems posed by modern human genetics and the ways in which they might be handled within the school curriculum.

A half-day visit to the Scottish National Blood Transfusion Service allowed an insight into the applications of therapeutic proteins and diagnostic products. In previous years visits have included the 'Quest' yeasts production facility and a meeting with 'Dolly' the sheep at the Moredun Research Institute. Last year we were able to include another highlight with a guided tour of the 'Frontiers of Science Exhibition' at the Royal Society of Edinburgh. One problem which faces us when organizing visits is that of finding suitable venues within easy travelling range of Edinburgh. We are just too far away from antibiotic production plants in the west of Scotland and several other suitable sites.

The practical sessions in the laboratory have ranged from elementary handling of micro-organisms to DNA extraction and transformation. In these we are fortunate that we currently host a full-time development officer and technician in ICMB, funded by the Science and Plants for Schools (SAPS) programme of the Gatsby Foundation. Another teacher is seconded part-time to develop practical protocols to illustrate the new syllabi. These teachers travel widely within Scotland (and further afield) training teachers and technicians in schools. We have also been able to call on the services of the National Centre for Biotechnology Education (NCBE) at Reading and our attendees have been educated and entertained by Dean Madden and John Schollar.

While the teachers certainly spend an exhausting time catching up with recent advances in these areas of biology, all have found it a worthwhile experience as well as an opportunity to make contact with Edinburgh University. A few even managed to spend some time in the University Library, reading up the background to the material they were working on.

The Summer Schools have been made possible through the financial support of the Wellcome Trust, Unilever plc and ICI plc, for which the attendees and organizers are most grateful. Summer schools such as this enable Scottish teachers to learn of developments in rapidly advancing fields such as genetics and biotechnology. The course also provides a very useful link between Edinburgh University and some of the Scottish schools and FE colleges from which it draws its students.
Feedback from participants has been very positive — "this event has started the process of producing better informed and more ethically aware students, by doing the same for 50 fortunate teachers".

Running the Summer Schools has involved a steep learning curve. It draws on a planning committee from Edinburgh University, the Learning and Teaching Scotland Agency, the two development officers, and local school science advisers. It relies heavily on the voluntary input of individuals. This also means that as far as possible, we use local resources. Hopefully in the future, the Scottish Executive will lend its financial support to this key element in the continuing professional development of a section of the teaching profession in Scotland. Our sponsors are also keen that such opportunities should be extended to other parts of the UK. Although we also invite small groups of school pupils to spend a day in the laboratory, by targeting the teachers we hope that we can spread expertise more rapidly and effectively.

Professor Ian Sutherland is in the Institute of Cell & Molecular Biology, Edinburgh University, Rutherford Building, Mayfield Road, Edinburgh EH9 3JH. Tel. 0131 650 5331 Fax 0131 650 5392 email i.w.sutherland@ed.ac.uk

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Microbiology for General

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Recent changes to the structure and content of UK post-16 qualifications will affect the knowledge and skills that students will have when they enter university or employment. Dariel Burdass describes the new system.

Changes to post-16 qualifications in England, Wales and Northern Ireland came into effect in September 2000. The new and revised post-16 qualifications are located within the new National Qualifications Framework, which has been developed by the regulatory authorities: the Quality and Curriculum Authority; Qualifications, Curriculum and Assessment Authority for Wales; and Northern Ireland Council for the Curriculum, Examinations and Assessment (see Table 1).

The aim of the changes to the post-16 qualifications is to:
- Ensure that all qualifications are valued and are equally worthwhile
- Encourage a broader programme of study without sacrificing depth
- Raise and widen levels of student participation, retention and achievement
- Provide a greater opportunity to mix general and vocational qualifications and to transfer from one programme to another

The three broad categories of qualifications are:
- General (previously termed academic), e.g. Advanced GCE (A level (A2)) and the new Advanced Subsidiary GCE (AS).
- Vocation-related, e.g. Vocational A level (formerly Advanced GNVQ) and Vocationally Advanced Subsidiary.
- Occupational, e.g. National Vocational Qualification (NVQ)

Advanced GCE and Advanced Subsidiary GCE

Most Advanced GCEs will have six units (previously called modules).

The Advanced Subsidiary (AS) GCE will have three units and will be a qualification in its own right as well as being the first half of Advanced GCE. It has been designed to bridge some of the gaps between GCSE and Advanced level studies and also to provide extra breadth in the curriculum. The second half of the Advanced GCE, known as A2, will also have three units but will not represent a qualification as such, but form the second half of study for Advanced GCE. It is thought that students may take four to five AS qualifications in their first year of sixth form study and reduce this to three A2s in their second year.

Most applicants to higher education are likely to have AS grades on their UCAS form, although it is not obligatory to take the AS assessment at the end of the AS course; some students may not have their grades at that stage.

Vocational Advanced Subsidiary and Vocational A level

The Vocational A level will come in two sizes. The Vocational A level will have 6 units and the Vocational A level Double Award will have 12 units. It is expected that the 6-unit qualification will be the most commonly offered of the new Vocational A levels and that it will form part of a mixed programme, e.g. combining qualifications from both the general and vocationally related categories of the framework.

The Vocational Advanced Subsidiary will be a 3-unit qualification that will be available in a limited number of subject areas.

Key skills

A new Key Skills Qualification is also available and is based on the first three skills listed below:
- Application of number
- Communication
- Information technology
- Improving own learning and performance
- Problem solving
- Working with others

Further information about post-16 qualifications can be found in the publication Changes to Post 16 Qualifications - A briefing for higher education on changes to the post 16 curriculum in England, Wales and Northern Ireland available from UCAS (www.ucas.com).

Dariel Burdass runs education projects in the External Relations Office at SGM HQ. email education@sgm.ac.uk

Table 1. New and revised post-16 qualifications

<table>
<thead>
<tr>
<th>Level of attainment</th>
<th>General qualifications</th>
<th>Vocation-related qualifications</th>
<th>Occupational qualifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher level/5</td>
<td>e.g. NVQ level 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higher level/4</td>
<td>e.g. NVQ level 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advanced level/3</td>
<td>e.g. Advanced Subsidiary (AS) and Advanced GCE (A2)</td>
<td>e.g. Vocational Advanced Subsidiary Occupational A level</td>
<td>e.g. NVQ level 3</td>
</tr>
<tr>
<td>(entry into higher education)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intermediate level/2</td>
<td>e.g. GCSE grades A*-C</td>
<td>e.g. Intermediate GNVQ</td>
<td>e.g. NVQ level 2</td>
</tr>
<tr>
<td>Foundation level/1</td>
<td>e.g. GCSE grades D*-G</td>
<td>e.g. Foundation GNVQ</td>
<td>e.g. NVQ level 1</td>
</tr>
</tbody>
</table>

Entry level qualifications can provide a basis for progression to qualifications across the framework at foundation level.
A meeting took place on 10 April at the Biochemical Society Bristol Meeting that brought together representatives from QCA, exam boards, universities and schools to look at the impact the new AS/A levels will have on post-16 education in schools and universities.

Roger Barnes from St Edmunds School, Canterbury summed up the views of many teachers when he reported that schools and students were being overloaded both in terms of class sizes and curriculum content. Class sizes have risen by between 33 and 67% due to pupils taking extra AS level courses. This is a particular problem with popular subjects such as biology. Larger class sizes have had a direct effect on teaching methods, with hands on practicals being replaced by CD-ROMs and lessons becoming more teacher-focused, leaving little time for debate.

Concerns have also been expressed over the content of the new specifications. The depth of knowledge required by each pupil has not been reduced. So whilst teachers and students welcome the opportunity to study more than three subjects at AS level and increase their breadth of knowledge, the increase in workload has left them little time to develop their independent study skills. There has also been a reduction in the amount of time that students are able to spend on extracurricular activities such as music. This will obviously have a knock-on effect on the skills and experiences that students will take with them to higher education.

Teachers are reporting that retention is not good and many students are dropping back to three AS levels from the four or even five they originally started to study.

Roger Barnes concluded his talk by calling on universities to give clear and unambiguous advice about entry requirements for 2002.

Will the universities still be asking for three A levels?

This question was answered in part by an article in the Times Educational Supplement on 13 April 2001, 'Admissions tutors blamed as AS levels falter', which reported the finding of a study conducted by London University's Institute of Education which indicated that many universities are barely interested in the new AS level qualifications and even less so in the key skills.

If universities continue to ask for three A levels and students continue to feel under pressure from increased workloads then fewer will choose to opt for the fourth AS level. It appears that the new system is faltering already because the potential consequences were not considered before it was brought in.

The impact of Curriculum 2000

Daniel Burdass, SGM HQ

Developments in Education Fund

A roundup of recent projects funded by the SGM

A teacher's guide to studying the virulence factors of the yeast Candida albicans

Kevin Kavanagh

Candida albicans is a dimorphic yeast capable of inducing a range of superficial and systemic diseases in those immunocompromised as a result of disease (e.g. cancer, AIDS) or therapy (e.g. immunosuppression during organ transplantation, broad spectrum antibiotic therapy). While C. albicans is a normal component of the body flora it can induce oral or vaginal 'thrush' in susceptible individuals. The incidence of infection caused by C. albicans has risen significantly in recent years due in part to the advent of AIDS and also to new developments in medical therapy. C. albicans employs a range of virulence factors to enable it to colonize the host and avoid the attentions of the host's immune system.

This book was produced with the aid of financial support from the SGM and describes experiments to allow class-based examination of the range of C. albicans virulence factors. The book is designed for use in the senior cycle of Irish second level schools and provides the means of performing over 60 experiments to evaluate the virulence of this important pathogen. C. albicans is a good model for studying microbial pathogenicity since it is an opportunistic pathogen and so should not pose a risk to the health of the worker if a number of basic safety precautions (detailed in the book) are followed. The book is divided into sections which deal with safety, antifungal drug susceptibility testing, the dimorphic transition in C. albicans, adherence to host tissue, cell surface hydrophobicity measurement, extracellular enzyme production and phenotypic switching. Techniques to examine each factor are detailed and suggestions for variations are provided. Using the suggested variations a teacher will be able to select a particular angle in studying a number of the virulence factors. Suggestions for obtaining yeast are also provided and these include purchasing from international culture collections but also obtaining samples from volunteers by using sterile cotton buds to take rubbings of the inner surface of the cheeks. Over 60% of the population carry this yeast in the mouth so this can represent a good source of the fungus for school use.

The techniques described in this book are in routine use in medical mycology but many have been altered by workers over the years. The collection of techniques was 'road tested' and fine tuned by an undergraduate student and the illustrations were prepared by an art graduate with experience in illustrating scientific textbooks. It is hoped that this book will encourage teachers to examine this intriguing pathogen and will foster an interest in the area of microbial pathogenicity in school leavers. For further details contact the author.

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Safe practice

These protocols were devised for use in schools in the Republic of Ireland. Different safety rules may apply in other countries. Please obtain advice and carry out a risk assessment before using the book.

Safety information for England, Wales and Scotland is available on the SGM website (www.sgm.ac.uk) or email education@sgm.ac.uk

For any ideas to promote microbiology teaching, why not apply for an SGM grant? The rules are published on p.89. Application forms can be downloaded from the sgm website: www.sgm.ac.uk

www.sgm.ac.uk
Prokaryotic Diversity: a multimedia courseware unit produced in collaboration with the Virtual School of Biodiversity

Linda Thomas

The Virtual School of Biodiversity (formerly the Biodiversity Consortium) began as a network of UK university biology departments dedicated to revitalizing the teaching of biodiversity in undergraduate courses by using multimedia learning technologies. It is now an international group led by Dr Peter Davies based in the University of Nottingham, in collaboration with the University of Hong Kong and the Natural History Museum, London. Together with members of the consortium, as well as Professor Julian Wimpenny at Cardiff University, I had already co-authored some courseware for this group and it was apparent that prokaryotic diversity needed to be covered.

Multimedia courseware will only attract students if it is well designed, easy to use and enriched with appropriate media. Thus, my first objective was to obtain decent images of micro-organisms and so I contacted microbiologists worldwide requesting their help. The generous response from so many of them (who are credited on the unit), together with pictures I had taken, was critical to the success of the unit.

There are many constraints when scripting this kind of courseware. Few words can be used - so these must be chosen with care. Images, diagrams and words are used to create imaginative links from one screen to another, encouraging the student to explore a subject in greater depth and at their own pace (see figures). When I had put the unit together, Dr Will Trewhella of the Virtual School of Biodiversity edited it to match the format of other units and finally the unit was independently refereed.

The courseware unit 'Prokaryotic Diversity' has six tutorial sections:

- An Overview of Prokaryotes
- The Prokaryotic Cell
- Metabolic Diversity of Prokaryotes
- Bacterial Phylogenetic Diversity
- Archaeal Phylogenetic Diversity
- Prokaryotes and Man

Courseware notes accompany the computer-based tutorial, explaining what the unit provides and what is expected of the user. For example, the learning objectives state that after completing the unit one should be able to:

- Distinguish between prokaryotes and eukaryotes, Bacteria and Archaea
- Describe the diversity of visible characteristics, metabolism and habitats of prokaryotes
- Name and recognize the major taxonomic divisions of the Bacteria and Archaea, and describe phylogenetic relatedness within them
- Discuss current views on numbers of estimated species, and species concepts
- Describe the importance of prokaryotes to humans

The units are designed to be teaching aids, not textbooks. They encourage students to think and investigate the topic independently, not just on the computer, but also in the library. Discussion topics are suggested, as well as tasks and multiple-choice questions, offering a means of assessment to tutors.

Additional information on the Virtual School of Biodiversity and the unit 'Prokaryotic Diversity' can be obtained from the www home page at http://vsb.nott.ac.uk/vsb/

Alternatively, contact Dr Peter Davies at the Virtual School of Biodiversity, School of Life and Environmental Sciences, University of Nottingham, Nottingham NG7 2RD (Tel. 0115 951 3238; email Peter.Davies@nottingham.ac.uk).

Dr Linda Thomas is Senior Research Officer, Technical Services Department, Aplin & Barrett Ltd (Danisco Cultor), 15 North Street, Beaminster, Dorset DT8 3EZ. Tel. 01308 862018; Fax 01308 863320 email linda.thomas@danisco.com

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Simfection is a PC-based CAL (computer-aided learning) package based around three scenarios with a microbiological theme. The aim of the package is to introduce nursing students to aspects of the care of patients with different infections and to develop their skills in problem solving, patient assessment and the development of care plans.

On starting the program, the student has a choice of three scenarios. Each of these starts at day 1 with a video clip of a ward manager who explains the background to the case. To complete the day's work, the student then has to examine and assess the patient, read medical notes, write nursing notes, answer some questions and design a care plan.

Before allowing the student to progress to the next day's work, the program assesses the chosen care plan and allows the user to make changes. Some of the scenarios have a branched structure. This allows the user to make inappropriate decisions and to see the consequences of this before going back in time and changing the care plan.

The Simfection project was funded for 3 months by a grant from the Society for General Microbiology's Education Development Fund. This allowed us to employ a vacation student who acted as multimedia author for the project. To ensure the clinical authenticity of the scenarios, an advisory team comprising nursing lecturers from the School of Health Science and clinical nursing specialists from two local hospitals was formed.

By the end of the 3-month period of the project, one scenario was fully completed. This case featured an elderly woman (Mrs Rush) admitted to hospital with a chest infection who subsequently developed a *Clostridium difficile* infection. The feedback from the students who used this scenario has been very positive and they were keen to try further scenarios. SGM members who would like a free copy of the Rush scenario should contact Mike Tait (m.tait@swansea.ac.uk).

Two further scenarios have been designed, but not yet developed. These are a wound infection scenario and an HIV scenario. Although lack of time prevented us from completing these scenarios, we plan to do this as soon as time permits. The techniques used to develop Simfection are currently being used to develop a new larger package called eWARD (the electronic ward). Details of this and our other projects are on the SHS CAL Website at http://www.shscal-swan.ac.uk/

Mike Tait is Senior Lecturer/Head of CAL Unit and Yamni Nigam is a Lecturer, School of Health Science, University of Wales Swansea, SA6 8NL. Tel. 01792 703749/703771; Fax 01792 799230 email m.tait@swansea.ac.uk
the presentation became very large, making distribution
of the work difficult. Nowadays the writeable CD-ROM
is available and would have nearly solved this problem.
As an alternative, we converted it to simple HTML files
(not via PowerPoint). The project can thus be viewed
from any school at http://www.sst.tees.ac.uk/external/
U0000510/sqm/home.html

The HTML coding used was very basic, so don't expect
any flashing microbes!
The students had great fun doing it, widening their microbiological knowledge in the process. I have since used it at a number of school presentations at my university.

It has occurred to me since converting it to HTML that the project could easily be turned into a worldwide one, with individual universities (or companies) hosting a page from the story with further links to the subject area on their own servers. Thus prospective microbiological students could be made aware of university activities and courses in microbiology.

I thank the SGM for providing the funds for the activity.

R. O. Jenkins

Computer simulation of the dynamics of microbial populations

The dynamics of microbial populations can usually be expressed in mathematical form and such relationships invariably form part of undergraduate programmes incorporating microbiology. For many students of biology, meaningful interpretation of seemingly complex mathematical equations represents a considerable hurdle and their value to understanding the dynamics of microbial populations is often not fully appreciated. This problem can be particularly pronounced if the subject matter is taught using an entirely traditional classroom approach.

Computer-aided learning (CAL) software was developed and designed to enhance student understanding of the dynamics of microbial populations through the use of interactive computer simulations. The software combines the linear authoring capability of Authorware Professional with the dynamic simulation capability of PowerSim. A structured front-end, developed using Authorware Professional, provides background and activities for each simulation. A computer-based library is accessible at any stage via the Menu bar and includes concise definitions of terms, as well as descriptions of relevant mathematical expressions describing growth in batch and continuous culture systems. Students address the activities in the simulation part of the software (developed using PowerSim) by exploring, in a relatively unstructured manner, the influence of change of parameter values on model variables. Simulations of the Monod relationship, inhibitory growth substrate, exponential growth, batch culture and chemostat culture are incorporated. Activities relating to the chemostat culture simulation, for example, involve exploring the influence of saturation constant, maintenance coefficient, growth yield coefficient, limiting substrate concentration and biomass feedback factor on biomass output and of steady-state biomass and substrate concentrations. The 'simulator' provides graphical representations of the changes over a range of dilution rates and students are expected to provide explanations for the effects they observe. The software is essentially modular in design and new simulations can be added with relative ease.

Positive student feedback and evidence of enhanced understanding following use of the software in an undergraduate programme (BSc/BSc (Hons) biological sciences; second year module on microbial technology) has been gained, which suggests that the use of simulation to explore mathematical relationships can represent a powerful approach to learning for students of microbiology.

Copies of the software may be obtained free of charge from the author.

R. O. Jenkins

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IoB Affiliated Societies

Science Policy Priorities

Science policy issues affecting the whole biological community were given the spotlight recently at a meeting held at the Royal Society. The launch of the institute of Biology's (IoB) Affiliated Societies Science Policy Priorities for 2001 paper heralded the culmination of year-long discussions with affiliated societies such as SGM. Over half of all comments received by the IoB related to either the state of UK research or careers and short-term contracts.

The main themes of the document were: science funding; careers in science - short-term contracts; the post-genome challenge; public understanding of science; and science to underpin sustainability. Key contributors to the paper gave presentations at the meeting. Dr Peter Cotgreave of Save British Science made the point that most new money in the science budget goes to the Office of Science and Technology, and that ministries, government departments and universities are losing out. MAFF, for example, would need an 80% increase to restore its science to underpin sustainability. Key contributors to the genome challenge; public understanding of science; and careers in science - short-term contracts.

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Several parliamentary bodies, including the Parliamentary and Scientific Committee, and the Conservative and Liberal Democrat parties, welcomed the Policy Priorities document. Lord Stainsbury (Minister for Science) said that he was pleased that the Affiliated Societies were seeking constructive dialogue with policy-makers.

Recent polls have shown that people are resistant to change, especially if they perceive no real benefit. Issues such as BSE have led to an erosion of public trust. He said that to benefit from scientific advances we need to discuss new developments in order to command public confidence.

The Code of Practice for Government scientific advisory committees is currently undergoing its second round of consultation. Send any comments for inclusion in an SGM response to Tracey Duncombe by 20 June 2001.

What future for agriculture?

Can we do without agriculture in the UK? Not according to Sir Colin Spedding of Reading University, for two reasons. First, the ever-present threats to food security. 'We can't assume food will be there to import that is safe,' said Sir Colin. Nuclear disasters, bio-warfare and global warming are real dangers. Second, agriculture also contributes significantly to countryside management. Over two-thirds of rural Britain is grassland. This is good for recreational use but with it comes a requirement for grazing and farming.

Dr David Shannon from MAFF discussed opportunities for science in agriculture. 'Genomics and proteomics will play an important role in our understanding of natural defence mechanisms,' he said. 'Already we have sequenced Mycobacterium bovis, which could soon lead to diagnostic tests for cattle and vaccines for cows and other animals.'

Information on the subjects of future SPA Fora can be obtained from events@britassoc.org.uk

Royal Society

Sites of Special Scientific Interest

A recent report by the Royal Society called on conservation agencies to seek the scientific and taxonomic expertise of universities, research institutions and learned societies such as the SGM so that SSSIs can be studied more fully.

Most biological SSSIs are designated on the basis of relatively large and well-known organisms, such as birds, plants and larger invertebrates, such as large molluscs or insects. There are far fewer cases of designations for less well-known groups such as fungi, soil micro-organisms and smaller invertebrates, despite the profound role these groups may play within the ecosystem, for example in recycling nutrients.

The report also highlights the need for measures to prevent the decline of SSSIs. About 30% of 'habitat types' in England are in poor condition and are not improving. Professor John Pickett FRS, chairman of the working group that prepared the report, said: 'The European Commission is already taking action against the UK Government for breaching the Habitats Directive that protects SSSIs and it will be nothing less than a national tragedy if we allow the condition of these sites to deteriorate further through neglect. We will have difficulty defending our reputation as an international leader in science if we are unable to look after some of the world's most important natural biological and geographical features.'

To obtain copies of the report contact Bob King, Press and Public Relations, The Royal Society, London (Tel: 020 7451 2516).
Foot-and-mouth disease – a case study in microbiology education

Tracey Duncombe & Janet Hurst

Table 1. Chronology of the foot-and-mouth disease epidemic in the UK, 2001

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>20/2</td>
<td>First case discovered at an abattoir in Essex and a five-mile exclusion zone is set up.</td>
</tr>
<tr>
<td>21/2</td>
<td>European Commission (EC) halts all UK foot tests and imposes a worldwide ban on shipments of all cattle and meat.</td>
</tr>
<tr>
<td>23/2</td>
<td>A case on a pig farm in Northumberland is suspected of being the source of the outbreak. UK Government bans livestock movements throughout the country.</td>
</tr>
<tr>
<td>1/3</td>
<td>First suspected case in Northern Ireland. EC announces that vaccination will only be reintroduced in Europe as a last resort.</td>
</tr>
<tr>
<td>2/3</td>
<td>First confirmed case in Scotland. Farmers' leaders say that the outbreak is on the verge of an epidemic. Licensed movement of livestock to selected abattoirs.</td>
</tr>
<tr>
<td>4/3</td>
<td>France discovers infected sheep imported from Britain.</td>
</tr>
<tr>
<td>6/3</td>
<td>EC suspends all livestock markets in the European Union (EU).</td>
</tr>
<tr>
<td>12/3</td>
<td>Germany announces the slaughter of livestock imported from UK.</td>
</tr>
<tr>
<td>13/3</td>
<td>Confirmed case in Northern France.</td>
</tr>
<tr>
<td>15/3</td>
<td>Agriculture Minister Nick Brown announces cull of up to 1 million healthy livestock to prevent further spread of the disease.</td>
</tr>
<tr>
<td>22/3</td>
<td>Dutch authorities vaccinate animals within 5km of infected areas. First case in the Republic of Ireland. UK Government announces £150 million scheme to compensate for culled healthy livestock.</td>
</tr>
<tr>
<td>25/3</td>
<td>UK army prepares to bury up to 500,000 animals at a disused airfield near Carlisle. EC grants permission to vaccinate up to 180,000 dairy cattle in disease hotspot Devon and Cornwall.</td>
</tr>
<tr>
<td>29/3</td>
<td>Government delays vaccination after signs that the cull is working.</td>
</tr>
<tr>
<td>2/4</td>
<td>The general election, which was forecast to take place on 3 May, is postponed.</td>
</tr>
<tr>
<td>3/4</td>
<td>Total number of animals slaughtered exceeds 1 million as number of reported cases rises above 10,000.</td>
</tr>
<tr>
<td>4/4</td>
<td>900 sheep and cattle buried in Co Durham face being exhumed because they threaten to contaminate a freshwater spring.</td>
</tr>
<tr>
<td>12/4</td>
<td>Chief Scientific Advisor David King announces that the epidemic has 'plateaued' as the number of reported daily cases remains between 20 and 30.</td>
</tr>
<tr>
<td>14/4</td>
<td>Nick Brown is under pressure to reconsider vaccinating livestock after admitting that deadlines to slaughter infected livestock are not being met.</td>
</tr>
<tr>
<td>15/4</td>
<td>Government takes emergency powers to bury slaughtered healthy livestock in landfill sites. Government orders a change in policy on vaccination as the number of animals waiting slaughter or disposal approaches one million.</td>
</tr>
<tr>
<td>16/4</td>
<td>Mass burial of thousands of slaughtered animals in mid-Wales is suspended due to pollution fears.</td>
</tr>
<tr>
<td>17/4</td>
<td>Supermarkets give support to the vaccination lobby.</td>
</tr>
<tr>
<td>18/4</td>
<td>Government fails to get farmers’ backing for vaccination.</td>
</tr>
<tr>
<td>19/4</td>
<td>Confidential report from Chief Scientist's own laboratory says that vaccination could do more harm than good.</td>
</tr>
<tr>
<td>20/4</td>
<td>Institute of Directors says that the outbreak has cost the UK £30 billion in lost business so far. Restrictions lifted in parts of Northamptonshire and Leicestershire.</td>
</tr>
<tr>
<td>21/4</td>
<td>Ireland lifts restrictions.</td>
</tr>
<tr>
<td>22/4</td>
<td>Vote for the disease has spread to.</td>
</tr>
<tr>
<td>23/4</td>
<td>Department of Health launches inquiry as concern grows over release of poisonous smoke from massive pyres.</td>
</tr>
<tr>
<td>24/4</td>
<td>Human case of FMD suspected. Government abandons vaccination as outbreak is 'under control'.</td>
</tr>
<tr>
<td>25/4</td>
<td>Government drops its policy to cull healthy animals living near infected farms.</td>
</tr>
<tr>
<td>28/4</td>
<td>First suspected human case given a clear.</td>
</tr>
<tr>
<td>30/4</td>
<td>Total number of cases to date 1,515; total number of animals slaughtered 2,336,000.</td>
</tr>
</tbody>
</table>


Readers worldwide cannot fail to be aware that the UK has been thrown into turmoil due to an outbreak of foot-and-mouth disease in cattle, sheep and pigs. A summary of the events associated with the outbreak is given in Table 1. A policy of wholesale slaughter around farms with a confirmed infection was introduced by the Government, which itself postponed the general election in response to the situation. Footpaths were closed throughout the country in an attempt to halt the spread of the disease, with the knock-on effect that hotels and tourist attractions lost all their business. People were amazed by the revelations of the complexity and extent of animal movements around the UK, and indeed in Europe, which had contributed to the spread of the virus. The scale of past governments' earlier culls – of the national veterinary service and Ministry of Agriculture (MAFF) staff – was exposed, which meant vets had to be brought in from overseas and veterinary students learnt techniques that they would not use in the small animal practices most aspired to. The public were sickened by the sheer scale of carnage which appeared on television screens daily.

Many heated debates took place. Should we vaccinate? Should we have a general election in the midst of the crisis? Is the countryside 'open for business' or not? The arguments, like the epidemic itself, are ongoing, but will hopefully be resolved soon so that Britain can regain its all-important 'disease-free' status. But what lessons have been learnt? There have been public demands to change farming and food production methods in the hope that this may reduce the risk of future epidemics. Some have called for MAFF to be scrapped. Agriculture Minister Nick Brown is keen for reform and has said that a far-reaching government review of UK agriculture would radically change the lives and incomes of farming communities.

Whatever the rights and wrongs and politics of the affair, as we go to press (early May) the measures imposed by scientists and the Government appear to be working – the incidence of confirmed cases is on the wane, Official sources are now predicting that the worst will be over by June. It was decided not to vaccinate. Culling has been scaled down. Media attention has switched to the disposal of carcasses and the possible dangers to health posed by carcinogens from burning pyres and the contamination of water supplies from burial pits. The effects of this disease...
Letters received from members

New vaccines for FMDV?

To what extent is the current disastrous outbreak of foot-and-mouth disease a result of complacency? Europe now has a huge susceptible population of farm livestock since the cessation of vaccination in the early 1990s and can only hope to maintain a disease-free status by controlled animal management and continuous high-level surveillance. We in Britain have traditionally managed to ward off the virus by control of animal movement and slaughter when it has appeared. This policy has worked effectively in the past, although we only just made it in 1968.

What have we learned from the current situation?

First, swift feeding adds a level of risk that must now be considered unacceptable. Second, the extent of animal movement, registered or otherwise, that has become a feature of modern farming practice seems to have taken even the authorities by surprise. As we have seen, this provides the ideal scenario for the wide dissemination of infection. The situation was made worse, of course, because of the difficulty in diagnosing the infection in sheep compared with other species. During the 30 years since we last had a meaningful outbreak of the disease it is perhaps inevitable that our ‘guard will drop a little’ — it is hard to justify the maintenance of a large infrastructure to deal with a rare occurrence. On the other hand, the pandemic spread of the particular strain of virus from which we are now suffering has been monitored by the epidemiologists in Pirbright. Should we have been expecting it?

A lot has been said in the media about vaccines. They were, after all, responsible for the elimination of endemic disease in Europe, so why are they not used now? There are a number of problems associated with the current killed vaccines, such as the antigenic diversity of the virus, the security risks associated with growing huge volumes of virulent virus, the difficulty of distinguishing vaccinated from infected animals, the short duration of effective immunity and the absence of secretory immunity. For these reasons the policy in Europe has been to stop vaccination as soon as possible. One result of this decision is that research into the development of superior new vaccines has been of low priority. However, given the current enormous burden to the country, do we need to re-evaluate the question of new vaccines? I feel sure that with the investment of a tiny fraction of the overall cost of this outbreak it would have been possible to develop new and better products.

A disaster waiting to happen

The two books I recall most vividly from my student days are Macfarlane Burnet’s Biological Aspects of Infectious Disease and René Dubos’ Mirage of Health. Both taught me the importance of seeing communicable disease not from a narrow medical or veterinary viewpoint, but from a broad ecological perspective. Four decades later, I wonder what Burnet and Dubos would have made of the 2001 outbreak of foot-and-mouth disease in Britain.

They might have reasoned as follows. If we were to design a perfect scenario for a highly infectious (and possibly highly virulent) virus to wreak havoc in a population of animals in Britain, we would need to take two steps.

First, we would resolve not to protect our national herd(s) by immunization and would indeed ban farmers from doing so. This would leave the animals totally vulnerable to the infection.

Second, we would arrange our farming and food practices so that, in contrast to the past, animals are moved frequently and widely between farms, holding farms, markets and abattoirs. This would ensure that, if the virus were to enter the country, it would be disseminated widely and efficiently to other unprotected animals.

These two conditions would create the ideal setting for a disaster waiting to happen. However effective our other precautions to exclude the virus, its eventual accidental (or deliberate) introduction from outside would be inevitable.

The danger would be all the greater in the case of a virus that circulates freely in other parts of the world.

This is precisely the scenario we have allowed to develop in the case of foot-and-mouth disease. Of course, existing FMD vaccines, though effective, are imperfect in several ways. Yet we have controlled many other communicable diseases with imperfect vaccines. And eight European countries did precisely that in the case of FMD until about a decade ago (since when vaccine technology has advanced considerably).

I believe that Macfarlane Burnet and René Dubos would have agreed with this analysis.

Bernard Dixon OBE
DSc

FMDV update

Delegates at the Heriot-Watt meeting in March were updated on the foot-and-mouth disease outbreak. In a jam-packed auditorium Dr Nick Knowles from the Institute of Animal Health, Pirbright presented data on the virus and highlighted the transmission route to the UK. He reported that the sequencing of UK samples carried out at Pirbright had revealed that a type-O virus was involved, the so-called ‘Pan-Asia’ strain. This particular strain was identified in India in the early 1990s and subsequently spread through Turkey, Nepal and Malaysia. During the late 1990s there were contained outbreaks of type O in Eastern Europe. But this was followed by a resurgence of India and a more dramatic spread through South East Asia, Eastern Russia and South Africa. Sequence comparisons of UK samples with samples from South Africa were almost identical: only two nucleotides different in the most variable gene. Dr Knowles said, ‘This implies that the virus could have spread from South Africa or that they had a common ancestor.’ A more detailed presentation of this data can be found in Journal of General Virology (2001), 82, pp. 609-621. See also Hot off the Press on p.96.

Tracey Duncombe, SGM HQ

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What have we learned from the current situation?

First, swift feeding adds a level of risk that must now be considered unacceptable. Second, the extent of animal movement, registered or otherwise, that has become a feature of modern farming practice seems to have taken even the authorities by surprise. As we have seen, this provides the ideal scenario for the wide dissemination of infection. The situation was made worse, of course, because of the difficulty in diagnosing the infection in sheep compared with other species. During the 30 years since we last had a meaningful outbreak of the disease it is perhaps inevitable that our ‘guard will drop a little’ — it is hard to justify the maintenance of a large infrastructure to deal with a rare occurrence. On the other hand, the pandemic spread of the particular strain of virus from which we are now suffering has been monitored by the epidemiologists in Pirbright. Should we have been expecting it?

A lot has been said in the media about vaccines. They were, after all, responsible for the elimination of endemic disease in Europe, so why are they not used now? There are a number of problems associated with the current killed vaccines, such as the antigenic diversity of the virus, the security risks associated with growing huge volumes of virulent virus, the difficulty of distinguishing vaccinated from infected animals, the short duration of effective immunity and the absence of secretory immunity. For these reasons the policy in Europe has been to stop vaccination as soon as possible. One result of this decision is that research into the development of superior new vaccines has been of low priority. However, given the current enormous burden to the country, do we need to re-evaluate the question of new vaccines? I feel sure that with the investment of a tiny fraction of the overall cost of this outbreak it would have been possible to develop new and better products.

A disaster waiting to happen

The two books I recall most vividly from my student days are Macfarlane Burnet’s Biological Aspects of Infectious Disease and René Dubos’ Mirage of Health. Both taught me the importance of seeing communicable disease not from a narrow medical or veterinary viewpoint, but from a broad ecological perspective. Four decades later, I wonder what Burnet and Dubos would have made of the 2001 outbreak of foot-and-mouth disease in Britain.

They might have reasoned as follows. If we were to design a perfect scenario for a highly infectious (and possibly highly virulent) virus to wreak havoc in a population of animals in Britain, we would need to take two steps.

First, we would resolve not to protect our national herd(s) by immunization and would indeed ban farmers from doing so. This would leave the animals totally vulnerable to the infection.

Second, we would arrange our farming and food practices so that, in contrast to the past, animals are moved frequently and widely between farms, holding farms, markets and abattoirs. This would ensure that, if the virus were to enter the country, it would be disseminated widely and efficiently to other unprotected animals.

These two conditions would create the ideal setting for a disaster waiting to happen. However effective our other precautions to exclude the virus, its eventual accidental (or deliberate) introduction from outside would be inevitable.

The danger would be all the greater in the case of a virus that circulates freely in other parts of the world.

This is precisely the scenario we have allowed to develop in the case of foot-and-mouth disease. Of course, existing FMD vaccines, though effective, are imperfect in several ways. Yet we have controlled many other communicable diseases with imperfect vaccines. And eight European countries did precisely that in the case of FMD until about a decade ago (since when vaccine technology has advanced considerably).

I believe that Macfarlane Burnet and René Dubos would have agreed with this analysis.

Bernard Dixon OBE
DSc
Women in science
Tracey Duncombe

The Athena Project

How does gender affect progress in science education and research? Here we examine some of the issues and look at one woman microbiologist's career path.

Further reading

Beating Barriers and Constraints in HE Careers. The Open University, Athena Project No 2.

Who applies for research funding? Key factors shaping funding application behaviour among women and men in British higher education institutions (2000). The full report can be obtained (price £15) from the National Centre for Social Research (email info@natcen.ac.uk).

A landmark year for the Athena Project was completed in February when top academics met with Professor David King, Chief Scientific Advisor, at a reception in London to discuss the realization of the past year's projects and the way forward for Athena. The Athena Project was established in 1998 with the aim of advancing women in science, engineering and technology (SET) in higher education. Athena works with higher education institutions (HEIs) to develop, share and disseminate good practice. The Athena Project developed out of the agenda of the Committee of Vice Chancellors and Principals' (now Universities UK) Commission on University Career Opportunity, which aimed to remove barriers to discrimination of women in HE at all levels and to increase significantly the number of women in top posts by 2007.

David King highlighted the threat to the UK science base as the number of science undergraduates continues to fall. He believes that women are a key part of British science. But at present, although women account for only roughly half of all biology graduates, they account for only 9% of biological science professors. A study carried out by the Wellcome Trust and the Research Councils has shown that women are less likely to apply for research grants. A survey held in February 2000 of 3,090 academic staff found that only 50% of women had applied for research grants in the past 5 years compared to 59% of men. Women also made a smaller number of applications, were less likely to be the principal applicant, sought lower levels of funding than their male counterparts and generally applied for grants for shorter periods of time. The under-representation of women in SET in higher education, the differences between the academic careers of men and women and the choices and constraints women face in balancing their career and caring commitments.

In 1999 Athena funded six HEIs to set up local projects to try to identify and tackle some of the issues that prevent women from progressing in their scientific careers. Professor Julia Higgins, Chair of Athena, said, 'All the projects contributed to an improved understanding of the underrepresentation of women in SET in higher education, the differences between the academic careers of men and women and the choices and constraints women face in balancing their career and caring commitments.'

A major feature of the 1999 projects was mentoring. Mentoring projects lasted between 6 and 9 months and most pairs met between two and seven times. Mentors highly rated having someone impartial to talk to, who helped them to improve their self-image and who encouraged them to do things that they would not have done otherwise. These schemes also had an impact on the senior academics who had become mentors - they saw their institution through different eyes and understood the obstacles that young women face in progressing their careers.

Career progression in SET in HE is very different for those who are single and childless. The Open University (OU) however, has proved more successful than wider HE in recruiting women academics. A total of 55% of OU lecturers are women, compared with 21% elsewhere. Associate Lecturer (AL) positions offer women the chance to work part-time which also allows women researchers to gain experience in HE teaching. ALs are a valuable resource of qualified and experienced women who, mainly as a direct or indirect consequence of family and child-care responsibilities, have been excluded from other HE work. Flexibility is the key to the success of OU's AL scheme. Most work can be done at home with timetables planned well in advance to arrange for child care.

All of the 1999 Athena projects involved networking, which was recognized by participants as a positive benefit. Networks are not unions - there is a tightrope to tread between campaigning, development and influence. The University of East Anglia (UEA) project was a self-sustaining support network for contract research staff in the science schools and local research institutes. Participants valued the opportunity to ask questions in a single sex environment. They discovered where to go for information on their rights and also recognized that their eyes had been opened to the realities of research careers. The UEA concluded that 'women are too willing to believe that the answer lies in training, when what they need is to have the confidence to actively pursue their own development needs.'

In September 2000 Athena launched five Local Academic Women's Networks (LAWNs). LAWNs are regionally based networks of women working in SET in HE, research establishments or in related industry and the professions. They will address:

- Institutional culture, values, attitudes and behaviour
- Organizational policies, practices, systems and arrangements
- Personal factors which shape or constrain career choices and outcomes

To contact Athena email athena@ic.ac.uk

Tracey Duncombe is the SGM Public Affairs Administrator

Right: Left to right: Nancy Lane, Julia Higgins, David King and Margaret Evans.
Photo Geoff Wilson
A job in... Research & Development

Tracey Duncombe interviews Alison Flanagan from Pfizer about her career.

I met Alison at Pfizer's UK research HQ in Kent. Over 1,500 research staff are employed on this site, making it the largest research facility outside the USA. The site has come a long way since its foundation in 1957 with only six staff.

Q. Why did you choose to work in veterinary medicine?

"I've always had an interest in veterinary medicine. As a student I spent my holidays working on a farm or in kennels and catteries. During my last year as an undergraduate I spent the summer in a research lab at ILRAD (International Laboratory for Research on Animal Disease) in Kenya. I chose to continue my research in veterinary science for my PhD by studying E. coli infection in piglets. As it turned out, this was also of great interest to Pfizer."

Q. So, do you miss not being in the lab?

"Occasionally I do. I had a really keen microbiologist working for me recently and he would often get me to go into the lab to see what he was doing. I found it exciting just looking at samples under the microscope again. I have moved away from the lab partly by choice and I enjoy the variety. I enjoy the unexpected; I know it sounds a bit strange, but I quite like it when things don't go according to plan and you have to find a solution."

Q. What's a typical day for you at work?

"I don't really have a typical day. I may spend time literature searching and developing ideas for new assays or models or I may have to present for a meeting; setting the agenda and making sure that other people know what they have to present, circulating information and generally making sure that everything hangs together, as well as often producing overheads and making a presentation myself. I am co-leader of a project, which means that I have to co-ordinate the activities of the project as well as supervising some of the members of the team. I am often in contact with external people. For example, I may seek advice from vets who are experts in their field on a particular aspect of a disease. We have a group of 30 vets visiting our site soon. I have to plan what information we will provide and the discussions we will have about different opportunities within veterinary medicine."

Q. Do you think enough is being done to keep women in science?

"Pfizer recently produced a report that highlighted the fact that there are very few senior women. The figures are very bad and they are particularly bad in veterinary medicine. Now central management are making a conscious effort."
February Council Meeting

New Categories of Membership

As reported in the February issue of Microbiology Today, Council has agreed in principle to the establishment of two new categories of SGM membership. Corporate membership at £500 per annum will aim to increase contacts between the Society and its members and industry. Schools membership at £10 per annum should foster closer links with teachers and emphasize the Society's deep commitment to microbiological education, which is vital for future recruitment of scientists in this field and in the wider area of scientific endeavour. Resolutions to alter the Bye-laws to give formal effect to these new classes of membership have been made by Council.

New International Secretary

Professor Jeffrey Almond

Professor Sir John Beringer should be approached to serve as his successor, and was subsequently pleased to learn that Sir John had accepted the invitation. A profile will appear in the August issue of Microbiology Today.

New Food and Beverages Group

As reported in the last issue of Microbiology Today, Council has approved the establishment of a new Food and Beverages Group (previously referred to provisionally as the Food and Water Group). This should ensure the continuation of the highest standards of food microbiology science at SGM meetings. It will focus on fundamental studies and aims to be complementary to the SIAM Food Safety and Technology Group. A steering committee has been formed to set the new Group in motion and the first Group symposium will be at the Warwick meeting in April 2002. See this page for further details.

SGM Journals at HighWire

Council spent some time discussing the recent developments in electronic publishing and the rather aggressive stance of the promoters of the Public Library of Science, which is currently urging academics to boycott journals such as those of the Society. It does not feel that this is a simple issue and members may wish to seek further information before signing up to the aims of this group. An extended statement of Council policy is published on p. 50.

Alan Vivian, General Secretary

New Food and Beverages Group

The Food and Beverages group will promote scientific interaction and facilitate education in the area of food microbiology from farm to fork to table. The remit will cover all aspects of food and beverage microbiology throughout the human and animal food chain.

The six main scientific themes covered will be:

1. Detection, isolation, separation and concentration of food-associated micro-organisms.
2. Physiology of food-associated micro-organisms.
4. Quantitative microbial risk assessment and predictive microbiology.
5. Applied food and beverage microbiology.
6. Epidemiology of food-borne disease.

Within these themes the group will identify specific areas of interest. These will change with time, but currently include the following:

<table>
<thead>
<tr>
<th>Interest area</th>
<th>Scientific theme</th>
</tr>
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<tbody>
<tr>
<td>Emerging food-borne pathogens</td>
<td>1 2 3 4 5 6</td>
</tr>
<tr>
<td>Detection technology</td>
<td>✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>Detection and isolation of mRMA, path. genotypes, bacteriophages</td>
<td>✓ ✓</td>
</tr>
<tr>
<td>Physiology and virulence of food-associated pathogens</td>
<td>✓ ✓ ✓</td>
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<tr>
<td>Gut flora response to food and diet</td>
<td>✓ ✓ ✓</td>
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<tr>
<td>Modulation of gut flora by dietary intervention</td>
<td>✓</td>
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<tr>
<td>Novel food ingredients through microbial biotechnology</td>
<td>✓</td>
</tr>
<tr>
<td>Microbial functional foods and drinks</td>
<td>✓</td>
</tr>
<tr>
<td>Study and development of fermented foods and drinks</td>
<td>✓</td>
</tr>
<tr>
<td>Lactic acid bacteria technology and drinks</td>
<td>✓ ✓</td>
</tr>
<tr>
<td>New processing technologies, e.g. high pressure</td>
<td>✓</td>
</tr>
<tr>
<td>Yeast and non-culturable organisms</td>
<td>✓ ✓</td>
</tr>
<tr>
<td>Food microbiology by bacteria, fungi, yeasts</td>
<td>✓ ✓</td>
</tr>
<tr>
<td>Toxin formation</td>
<td>✓</td>
</tr>
<tr>
<td>Biopreservatives</td>
<td>✓</td>
</tr>
</tbody>
</table>

The members of the steering committee are: Glenn Gibson, School of Food Biosciences, Reading; Bob Partington, School of Food Biosciences, Reading; Marie Louise Bouillon, Waltham Pet Centre; Mike Peck, Institute of Food Research, Norwich; Alan Varham, Food Microbiology Group, University of North London; Tom Humphrey, Department of Veterinary Science, Bristol; Martin Collins, Queen's University, Belfast.

The new Group will make its debut at the 2002 Spring meeting at the University of Warwick, The Convener is Professor Tom Humphrey, Professor of Food Safety, University of Bristol, The Churchill Building, Langford, Bristol BS40 5DT (Tel. 0117 928 2911; Fax 0117 928 5005; email tom.humphrey@bristol.ac.uk) to whom all enquiries about the group should be addressed.

Annual General Meeting 2001

The Annual General Meeting of the Society will be held on Tuesday, 11 September 2001 at the University of East Anglia. Agenda papers, including reports from Officers and Group Convenors, and the Accounts of the Society for 2000 will be circulated with the August issue of Microbiology Today.

Staff News

Congratulations to Jo Couchman, Senior Editor on Microbiology, and husband Martin, on the birth of a 7lb 3oz baby girl, Emma Louise, on 13 March.

Congratulations to Tracey Duncombe and Jane Westwell on successfully completing the British Red Cross First Aid at Work course.

News of Members

Education Secretary, David Blunkett, has appointed Dr Helen O'Sullivan, Head of Quality Assurance at Liverpool Hope University College, to the E-University's Committee for Academic Quality.

Professor Brian Spratt has been appointed to a Chair in Molecular Microbiology at Imperial College, London.

The Institute of Biology in London has elected the following honorary fellows:

Derek Burke, former Vice-Chancellor of the University of East Anglia, and Sir David Hopwood, John Innes Centre, Norwich.

The Society notes with regret the death of Dr G. Fraser (member since 1959).
Prize Lectures

Marjory Stephenson Prize Lecture

This is the Society's principal prize, awarded biennially for an outstanding contribution of current importance in microbiology. The winner receives £1,000 and gives a lecture on his/her work at a Society meeting. The lecture is usually published in a Society journal.

1. The Marjory Stephenson Prize Lecture shall be awarded biennially for an outstanding contribution of current importance in microbiology, without restriction on the area of microbiology in which the award is made.

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

3. There shall be no restriction by means of age or nationality of those eligible for the Prize.

4. The recipient of the Prize shall be asked to publish the lecture in either Microbiology or Journal of General Virology, whichever is the more suitable. The choice will be at the discretion of the Editors of the journals.

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

Peter Wildy Prize for Microbiology Education

This is awarded annually for an outstanding contribution to microbiology education.

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

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

3. There shall be no restriction by means of age or nationality of those eligible for the Prize.

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

Fleming Award

The Fleming Lecture is awarded annually for outstanding research in any branch of microbiology by a young microbiologist in the early stages of his/her career. The award is £1,000.

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

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

3. Candidates, who need not be members of the Society, should submit an outline CV including details of qualifications, scholarships, research grants obtained, etc., a list of publications, an outline of their career progression (posts held in postdoctoral research) and the names of two members who are familiar with their work, who will be asked to provide a statement detailing the candidate's contribution to microbiology and merit for the award.

4. Alternatively, members who wish to make a nomination should provide such a statement and should arrange for a second member willing to support the nomination to provide a statement and should ask the candidate to provide the CV and publications list.

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

Kathleen Barton-Wright Memorial Lecture

Awarded every other year by the Society on behalf of the Institute of Biology, it is awarded for an outstanding contribution to research in a more applied area of microbiology, or an area where microbiology impinges on other areas of biology, and where the topic would be relevant to a wider audience. The prize is £500.

Procedure for nominations

In recent years Council has been disappointed by the lack of nominations for the range of prestigious awards made by the Society in recognition of distinguished contributions to microbiology. To facilitate nominations, a form is included in this issue of Microbiology Today, together with the rules for each prize lecture due to be awarded in 2002. It is now also possible for self-nominations to be made for all awards. The award panel will consider the submissions in the autumn and their recommendations will be taken to November Council for approval. The outcome will be announced in the February 2002 issue of Microbiology Today.

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

The closing date for all nominations is 30 September 2001.
Grants

New grant scheme!

Retired Member Conference Grants

Council is pleased to announce a new scheme to enable Retired Members to attend one SGM meeting per year. They will be able to apply for a grant to cover accommodation and the Society Dinner. The maximum award will be £250. It is hoped that the scheme will enable retired microbiologists both to keep up with their science and to share their knowledge with other members.

Rules

1. The scheme is open to paid up Retired Members of SGM whose membership has not lapsed since the date of their change of status from Ordinary Membership.
2. Applicants may claim for:
   (a) the cost of bed and breakfast accommodation in an en-suite room which must be booked through the SGM Meetings Office
   (b) the cost of the Society Dinner.
3. The maximum award is £250.
4. Grants are limited to attendance at only one SGM meeting in each calendar year.
5. Applications will be considered on a first come, first served basis. A maximum of 50 awards will be made each year.
6. Applications received after the meeting cannot be considered.

Applications are now invited for grants to attend the Society's meeting at the University of East Anglia, 10–13 September 2001.

Forms may be downloaded from the website or obtained from the Grants Office at SGM HOG.

The Watanabe Book Fund

Members who are permanently resident in a developing country are reminded that they may apply for funding to acquire 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.26 of the February issue of Microbiology Today. The closing date for the receipt of applications, which should be made to the Grants Office at SGM Headquarters, is 5 October 2001.

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

Any enquiries should be made to the Grants Office, SGM, Marlborough House, Basingstoke Road, Spencers Wood, Reading RG7 1AG (fax: 0118 988 1392; Tel: 0118 988 1391; Email: grants@sgm.ac.uk).

Education Development Fund Awards

The following Public Understanding of Science grants have been made in recent months.

Dr Susan Assinder, University of Wales, Bangor

has been awarded up to £1,000 towards the creation of an Alphabet of Science in Bangor High Street during National Science Week 2001.

Professor Roy Postlethwaite has been awarded up to £350 towards the expenses of running an exhibition and lecture on Aspects of Modern Medical Science in Cirencester in June 2001.

Dr Joy Perkins, University of Huddersfield, has been awarded up to £350 towards the expenses of running a microbiology taster day for Year 11 pupils in National Science Week 2001: 'Food Microbes - the Good, the Bad and the Ugly'.

Education Development Fund 2001

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

Applications are now invited for either category of award.

Rules

1. Applicants must be members of the Society, currently residing in the UK or Republic of Ireland.
2. Practical teaching aids
   (a) Applicants may seek support, normally within the range £200–£3,500, for:
      (i) purchase of consumable materials, but not capital equipment,
      (ii) short-term assistance, e.g. vacation employment of an undergraduate, or exceptionally a postgraduate after expiry of a studentship.
   (b) Applicants must provide a detailed description of the proposed initiative, which it is anticipated will take place in 2001/2002, full costsing and evidence of any collaborations or other sponsorship.

(c) Successful applicants will normally be required to make the results of their work available to Society members within 12 months of the award being made. This will include a presentation at a Society meeting and publication of an article in Microbiology Today.
(d) The Society would encourage commercial or other dissemination of the results of the project to a wider public. All Intellectual Property Rights, including copyright and design rights, in any materials produced as a result of the grant will be vested in the Society.
3. PUS awards
   (a) Applicants may seek funding of up to £1,000 for small projects to promote the public understanding of microbiology. These might include talks, workshops, demonstrations, posters, leaflets, broadcasts, activities at science festivals and audio-visual or computer-based packages. These activities can take place as part of a SET event at the applicant's place of work, but PUS activities that are part of the programme of an open day to promote the institution are ineligible for funding.
   (b) Applicants must provide a detailed description of the proposed initiative, which it is anticipated will take place in 2001/2002, full costing and evidence of any collaborations or other sponsorship.

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

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

Application forms

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

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

There is no closing date for applications, which will be considered on a first come, first served basis during the period 1 January to 31 December 2001.
International Research Fellowships

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

Rules

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

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

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

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

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

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

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

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

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

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

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

There are normally three rounds of applications during each calendar year. The closing dates for 2001 are 30 March, 31 July and 30 November.

Seminar Speakers Fund 2001/2002

The purpose of the Seminar Speakers Fund is to promote talks on microbiological topics in departmental seminar programmes. Applications are invited from higher education institutions where microbiology is taught for grants of up to £200 towards the travel, and if necessary, accommodation, expenses of an invited speaker. 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 HO 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 2001 to June 2002. It is expected that departments will collaborate in selecting a seminar speaker.

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

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

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

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

6. Applications should contain the following information:

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

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

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

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

   There is no application form for this scheme.

International Development Fund

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

Purpose

1. Support visits (travel and accommodation) by members of the SGM to laboratories in countries where microbiology is inadequately developed but where its further development may assist development in the countries.

2. Support visits to laboratories in the developing countries.

3. Support any other travel expenses incurred.

Guidelines

1. Applications for sums between £1,000 and £2,000 will be considered first. No applications above £5,000 will be accepted.

2. Applicants must be members of the Society.

3. In making applications support for visiting laboratories is expected.

4. Applications should be for travel expenses incurred.

5. Applications should include a supporting letter from the head of the laboratory to be visited and the topic of the seminar.

6. Applications should contain the following information:

   (a) A clear statement of the purpose of the visit.

   (b) A clear statement of the need for a visit.

   (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.

   (e) Details of any previous visits to the laboratory.

   (f) Details of any evidence of the actual expenses incurred.

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 the 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 microbiology 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.

The closing date for applications is 26 October 2001.
ASM/SGM Joint Meeting
San Juan, Puerto Rico, 2-6 October 2001
Biodegradation, Biotransformation and Biocatalysis (BS3)

Travel grants
This grant scheme is intended to assist SGM members to attend the meeting. Up to $500 is available as a contribution towards the costs of registration, travel and accommodation.

Guidelines
Members who are eligible should apply for an ASM student travel grant as well as applying to the SGM (see below for details).

1. Applicants must be paid up members of the SGM of at least 12 months standing before 31 December 2001.

2. The following members are eligible for support:
   (a) Full-time postgraduate students, including research assistants and similar who hold salaried posts in higher education institutions or publicly funded research institutes and are resident and registered for a PhD at a higher education institution in a country in the European Union.
   (b) Postdoctoral researchers in their first position who have been employed on a short-term temporary contract at a university or publicly funded research institute in a country in the European Union.
   (c) Established scientists in the UK and Ireland who are employees of universities, Research Councils, the National Health Service, state-aided research establishments, other governmental bodies and profit-making companies set up by universities.

3. Postgraduate students, research assistants and postdoctoral researchers must provide a statement from their host department in support of their application.

4. Successful applicants will be awarded up to $500 as a contribution towards the costs of registration (at the rate applicable for registrations before 1 September 2001), travel and accommodation.

5. The total funds available are limited and awards cannot be given to all eligible applicants. Preference will be given to applicants who are making a contribution to the meeting by presenting their work. Evidence of submission of an abstract must be provided.

6. Funding from other sources (with the exception of an ASM Student Travel Grant) will be taken into account when the award is made.

7. ASM Student Travel Grants: Postgraduate students and postdocs in their first year of obtaining a PhD may apply for an ASM Student Travel Grant of up to $500 provided the have presented work and the abstract has been accepted.

8. Applications must be made on the appropriate form. Completed applications should be sent to: Grants Office, ASM, Marlborough House, Basingstoke Road, Spencers Wood, Reading, RG7 1AG.

Closing date for applications: 31 July 2001. Applications will be dealt with on a first come, first served basis.

Fellowship announcement
UNESCO-IUMS-MIRCENS- SGM Fellowships

The International Union of Microbiological Societies (IUMS) is a worldwide Federation of National and International Societies and other organizations having a common interest in microbiological sciences. The Microbial Resources Centres (Mircens) of the UNESCO-IUMS (c) is an international network of Academic and Research Institutes spreading over both developed and developing countries.

Fellowships are available every year to provide an opportunity for young microbiologists from less developed countries to pursue, or to complete, a part of an ongoing research programme in a laboratory in a newly industrialized or developed country.

The UNESCO-IUMS-MIRCENS-SGM Short-term fellowships are designed to ease these problems for deserving microbiologists from developing countries and to strengthen the bonds of inter-regional scientific cooperation.

Applications (four copies) must be submitted in English and should consist of a nominating letter from the Head of the organization in which the applicant is working, the applicant's curriculum vitae, a letter of invitation or acceptance from the host organization describing the fellowship, a supporting letter from an organization and a completed application form.

The deadline is 1 July 2001.

Undergraduate Microbiology Prizes

The prizes are intended to encourage excellence in the study of microbiology by undergraduate students and to promote scholarship in, and awareness of, microbiology in universities. The prizes are awarded annually to the undergraduate student in each qualifying institution who performs best in microbiology in the penultimate year of study for a Bachelor's degree. Each winning student will be awarded $50, a certificate and a free year's undergraduate membership of the SGM.

One prize is available to each university in the UK and Ireland offering an appropriate microbiology course. The university will be asked to choose the assessed microbiological work for which the prize is awarded. The submission should be supported by formal marks, not an informal assessment. Winning students should have attained at least 2 1/2 overall in their degree examinations at the stage at which the award is made.

Eligible students may be registered for any degree with a significant microbiology content (e.g. Biotechnology, Applied Biology, etc.) not just a BSc Microbiology. The university must decide which student group studying which microbiological activity is eligible for consideration.

Universities are now invited to nominate a student for a 2001 SGM Undergraduate Microbiology Prize. Submissions may only be accepted on the form which has been sent to all institutions. The full rules and further copies of the form may be downloaded from the SGM website or obtained from the Grants Office at Marlborough House. The closing date for nominations is 31 August 2001.

MCRB-5GMBLH-O}WW
Soapbox!

Here is the £25 winner in this issue.

Dear Soapbox!

As someone coming to the end of their time as a
PhD student it was with a great sense of nostalgia that
I read of the experiences of the previous contributor to
Soapbox!

As a person who now clones genes as a matter
of routine and could probably prepare and run an
agarose gel in my sleep, I still haven’t quite forgotten
those first days in the lab as a project student when
racking a box of pipette tips and successfully
autoclaving them was a big achievement! And
although those few months gave me a tiny insight into
research, nothing could have fully prepared me for the
varied highs and lows of life as a PhD student. The first
few days were certainly daunting. Removed from the
supportive environment of the third year project lab
and a distinct lack of familiar faces I felt way out of my
depth. There were of course the practical problems
of finding my way around a new department and the
realization that fresh boxes of gloves didn’t just
mysteriously appear but actually had to be ordered.
But that was as nothing compared to the recognition
that from now on and for the next three years I
would be responsible for my own work and for choosing the
direction in which it would progress.

Unlike the previous Soapbox correspondent who
writes that a PhD can involve ‘days, months and years’
of ‘following protocol after protocol without thinking’,
in my experience at least, the opposite is true. You may
start your PhD with a detailed plan of the experiments
you want to perform and the results you want to
achieve, but in reality things often do not work out that
way. Techniques may be available that should work in
time, and may indeed have worked for virtually
everyone you have ever met including someone sitting
feel away from you in the lab – but they just don’t work
for you. Speaking from personal experience you may
find yourself spending more time in the library than in
a lab coat. But what a sense of achievement when a
technique that you yourself have dug out of a dusty
paper or from the net actually provides you with the
desired result.

PhD students also spend a great deal of their time
outside the lab as the Research Councils increasingly
emphasize the importance of transferable skills such as
written or oral communication. Moreover, it is not
all work, work, work. As anyone who has attended an
SGM meeting will verify it’s almost as much about
socializing as science and presents everyone with a
chance to catch up with people from other institutions.
PhD research also presents great opportunities for
international travel. A trip to the ASM’s infectious
diseases conference in Canada allowed me to present
my work in front of a prestigious audience as well as
see what scientists who publish in Nature actually
look like in the flesh!

As to whether research can ever be creative – I
suppose that depends on how you define creativity.
Research is never just following protocols and I believe
that a creative streak is a big asset in terms of
problem-solving and when preparing presentations,
especially if you don’t want to hear the sound of gentle
snoring from the back of the auditorium! Of course a
PhD is not as life changing as deciding what to do
after you graduate, there are definite downsides to it
and I believe that the scientific community needs to
address the issue of why many postgraduates are
choosing to leave research after their PhDs. And as to
my future in research – well I’m still not sure what that
may be, but overall I can honestly say that my time as a
PhD student has provided me with a wealth of unique
and positive experiences which I’m sure will prove to
be invaluable in whatever career I choose to pursue.

Irene Dutta, Department of Biochemistry,
University of Cambridge

Dear Soapbox!

As an undergraduate, concepts and the
understanding of whole areas of modules only
became real or important around exam time. I found,
and still find, lectures to be a very passive experience.
Understanding the material was always important, but
lectures now appear much simpler in this respect.
Perhaps it is the smaller scale of numbers of students
and the support network and help available as a postgrad,
or that they seem so much more relevant to my work and myself.

Practical work was also considered important as an
undergraduate and was a vital component of many
modules taken at Nottingham. However, the vast
majority of practical courses aimed only to provide an
idea of the principles or techniques within the lab. This
is not a criticism. Providing large numbers of students
with the facilities to do practical work cannot be easy;
but it still resulted in a very contrived approach. My final
year project was such a change. I went from mixing
solution A with solution B and being told I had
extracted plasmid DNA, to being responsible (within
limits) for making up my solutions and carrying out
work with a palpable end point. I have recently started
demonstrating in first year practicals and find it
amusing to see how my attitude towards practical
work has changed and also how much my technique
has improved.

Another notable difference between undergraduate
and postgraduate study is time. As an undergrad I
often worked week-by-week and never more than a
semester at a time. Time was conveniently divided by
modules starting and finishing, and the repetitive
pattern of weekly lectures/practicals. Exam periods
were potent dividers, with a real feeling of completion,
followed by a period of relaxation (and excess!), then it
all began again. As a PhD student, there isn’t that rigid
form to the course and it is quite a disturbing prospect
to start three years of research with only a rough plan
of where it will go.

Mike Sellars, First year PhD student,
University of Nottingham
SGM education and science promotion programme 2001/2002

The Society takes the promotion of microbiology education and careers very seriously. It employs professionals in this field to carry out the work, in conjunction with interested and enthusiastic members and Education Officer Liz Sockett. The staff organize events, produce appropriate resources and deal with all the enquiries that roll in daily by phone, fax, email and letter from teachers, pupils and the general public. Quite often they have to get out on the road and work long hours and at weekends but the team's commitment and enthusiasm rarely wanes! Here are some of the activities that are planned (or have taken place) in 2001/2002.

Events
- 3–5 January 2001: Association for Science Education Annual Meeting, Guildford
- 4–8 March 2001: Careers Enterprise & Jobs Live, Scottish Exhibition Centre
- 26–27 April 2001: UCAS Careers Convention, Bath University
- 17–18 May 2001: UCAS Careers Convention, Newcastle

For many years SGM has been attending careers fairs for schools with other learned societies and the Institute of Biology under the banner of Biotechnology at Work. This year we joined up with the Institute of Physics and Royal Society of Chemistry to promote all areas of science on a much larger stand. This collaboration has been very successful.

- 6 June 2001: Glasgow University
- 7 June 2001: Association for Science Education Annual Meeting, Guildford

Teachers' workshops on microbiology and biochemistry, joint with Biochemical Society, John Granger, former director of NCBE, Chairman of MISAC and a long-standing contributor to SGM educational activities, is running the practical workshop, whilst Tim Mitchell gives a talk on the latest aspects of antimicrobial resistance.

- 4–5 June 2001: Royal Institution Primary School Workshops

Dariel Burdass has been invited by the Royal Institution to run our popular workshops for primary school children in Staffordshire. These involve creative activities with model microbes, as well as demonstrating the power of yeast to blow up balloons.

- 30 June 2001: Aspects of Modern Medical Science

Participation in event organized by Chichester Science Society. We will be involving a display on food safety.

- October 2001: BAYSAY, Royal Albert Hall

By request from the BA we will be repeating our microbiology workshops for primary school children.

- November/December 2001: Life Science Careers Conferences Bristol, London and Newcastle

Saturday events for undergrad and postgrad life science students – lectures, workshops and exhibition + CV analysis service. Joint venture between SGM, BS, BPS, BSI, PS and SEB. SGM does the administration for these events.

Projects

Current resources

- Classifying Microbes - a poster and set of teachers’ notes for post-16, produced in association with PSET (c.£3)
- Fermentation Investigation pack (with NCEB) - pack of student and technical guides for post-16 (£16)
- Poster: World of Microbes (over 20,000 printed and distributed free to date)

- Set of three posters: Microbes & Food (free)
- Set of two posters: Microbes & the Environment (free)
- Biotech - teaching resources pack for 16+, with ABPI, BBSRC, BS and Welcome Trust (now available on the web www.wellcome.ac.uk)
- World of Microbes - Microbiology teaching pack for primary schools: booklets, teacher’s guide and poster on beneficial and harmful micro-organisms linked to Unit 6B Micro-organisms of the Science Curriculum (now available – see inside back cover)
- SGM website - greatly expanded education pages, including range of fact sheets. Further work and a revamp in progress www.sgm.ac.uk
- Microbiologists Make a Difference - careers poster and leaflet (free)
- Set of careers fact sheets for 16+ (also on website)
- SGM website - extensive web pages on careers; a separate site www.biosci.org.uk is under development.

In progress or planned

- Microbiology in Schools Advisory Committee (MISAC)

SGM acts as secretariat and deals with all enquiries from teachers, distributing the wide range of fact sheets available (also on website: www.biosci.org.uk/MISS). SGM administers the annual competition:

  - 2001 – Microbes & Food – newspaper article (for pupil aged 11–16, in two age groups) judged at Marborough House in April. Nearly 2,000 entries were received. Food and Drink Federation collaborated.

  - 2002 – I’ve got you under my skin magazine feature on fungal infections (11–16, in two age groups) sponsored by British Mycological Society

- Poster set: Microbes & the Human Body (autumn 2001)

- Revision of Practical Microbiology for Schools teaching pack (Key Stage 4, GCSE) (summer 2001)

- TB: A model organism - factsheet for Key Stage 3

- Development of a set of practical activities for post-16

Teacher & Technician Training

- A programme of training courses in practical microbiology for secondary school science teachers and technicians will be running from September, led by John Schollar of NCBE and John Granger, Chairman of MISAC.

- Primary school/teacher workshops will also be available on demand to support the practical activities in the new World of Microbes pack.

Year of Science

See p. 71.

Contacts

- Education Officer: Liz Sockett
  Tel: 0115 919 4436
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- External Relations Manager: Janet Hurst
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- Public Affairs: Tracey Duncombe
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  email t.duncombe@sgm.ac.uk

- Website: www.biosci.org.uk/MISAC SGM administers the annual competition.
Meetings on the web
Up-to-date information on future Society meetings is available on the website: http://www.sgm.ac.uk

Meetings organization
The SGM meetings programmes are organized by the committees of the special interest groups, co-ordinated by the Scientific Meetings Officer, Professor Howard Jenkinson. Suggestions for topics for future symposia are always welcome. See p. 105 for contact details of Group Conveners. Administration of meetings is carried out by Mrs Josiane Dunn at SGM Headquarters, Marlow House, Basings REVIEW, Spencers Wood, Reading RG7 1AG (Tel. 0118 988 1805; Fax 0118 988 5656; email meetings@sgm.ac.uk).

Heriot-Watt meeting
148th Ordinary Meeting Heriot-Watt University 26-30 March 2001
New Challenges to Health: the Threat of Virus Infection
Symposium volume
This is now available from CUP at a special discount price for members. A review of the book appears on p. 104 and an order form is included in this issue of Microbiology Today.

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

Future Meetings
AUTUMN 2001 – 149th Ordinary Meeting
University of East Anglia, 10–13 September

- Main Symposium
  Mycobacteria – New Developments
  Organizers: M. Godfellow, P.M. Goodwin, H.M. Lappin-Scott, G. Sadler and E.M. Wellington
  10–11 September
  N. STOKER (LSHTM) Mycobacteria in the 21st century
  M. GODFELLOW (Newcastle) Systematics of mycobacteria
  T. COLE (Institut Pasteur) Comparative mycobacterial genomics
  P.J. BRENNAN (Colorado, USA) Mycobacterial cell wall
  P. FINE (LSHTM) Tuberculosis and environmental influences
  R.S. CLIFTON-HARLEY (VLA, Aldiestore) Bovine tuberculosis: current epidemiological scenario
  D. VAN SOULDENEN (Ghent, The Netherlands) Contribution of DNA fingerprinting to the transmission of tuberculosis
  B. GIOQUE (Institut Pasteur) Mycobacterial genetics
  P.D. BUTCHER (St George's, London) Tuberculosis gene expression during infection: proteomics and microarrays
  M.J. ELDSTON (NIH) Interactions between host cells and mycobacteria
  J.M. SHARP (Morndun, Edinburgh) Pathogenesis and immunopathogenesis of M. paratuberculosis (B.c.)
  I.M. ORMES (Colorado, USA) Early events in the long and consequences for vaccine strategies
  D.B. YOUNG (Imperial College London) Lipoproteins, glycolipids and new vaccines
  K. DUNCAN (GlaxoWellcome UK) New approaches to drug design

- Other sessions
  - Microbial lifestyles
    Cells & Cell Surfaces Group
    13 September. Organizers: J. Armitage (armitage@bich.ac.uk) & P. Rainey (paul.rainey@plant-sciences.ox.ac.uk)

  - Lower respiratory tract infections
    Clinical Microbiology Group
    13 September. The symposium will cover topics of Streptococcus pneumoniae, conjugate vaccines, fungal infections, cystic fibrosis infections, Chlamydia pneumoniae, Pneumoniae and Legionella pneumophila. Organizers: T. Coates (coates@sgm.ac.uk) & K. Bamford.

  - Research supervision – how to get it right
    Education Group
    12 September. Followed by a Supervisor Training workshop on 13 September (seem. 58 for further details). Organizer: A. Eley (a.eley@shafiield.ac.uk)

  - Microbial interactions in aquatic environments
    Environmental Microbiology Group with British Phycological Society
    11 & 12 September. Organizers: G. Underwood (gjou@essex.ac.uk) & A. Eley (a.eley@shafiefield.ac.uk)

  - Bioprocess monitoring & control
    Fermentation & Bioprocessing Group
    10 September. Organizer: G. Hobbs (g.hobbs@liv.ac.uk)

  - Mobile genetic elements in bacterial virulence
    Microbial Infection Group
    12 September. Organizers: M. Barber & P.I. Langford (p.langford@ic.ac.uk)

  - Metabolic engineering
    Physiology, Biochemistry & Molecular Genetics Group
    12 September. Organizers: N. Bruce & C. Stephens (christopher.stephens@unit.ac.uk)

  - Classification and identification of clinically significant actinomycetes
    Systematics & Evolution Group
    12 September. Invited contributors include M. McNeil (CDC), A. Hassan Fahal (Khartoum), B. Beaman (California Davis), T. Satchell (Sunderland), G. Alderson (Bradford), S.H. Bowden (Memorial-Palisades, CA) and A. Stonesifer (Colorado). A limited number of oral presentations can be slotted in, posters are welcome. Titles and abstracts go onto Gerry Sadler by 31 May 2001.

  - Wellcome Trust Genome Meeting
    12 September. Complete genome sequence data are available now. Members who are postgrads or early career are welcome. Invited speakers are J. Parkhill, T. Keiser, J. Sedgley & M. Dunn (m.dunn@wellcome.ac.uk).

  - Promega Prize Final
    11 September. Promega sponsors this competition to encourage excellence in scientific communication by young scientists. Group Committees have now judged recent oral or poster presentations by members who are postgrads or early career. The winners will go on to compete for the title of Young Life Scientist of the Year against finalists from other learned societies.

- Social events
  Following the popularity of the events at Heriot-Watt, further evening activities have been arranged for UEA:
  10 September. Trade & Welcome Reception
  11 September. Society Dinner at Blackfriars Hall, Norwich
  12 September. Pub Quiz – entrance fee for charity

- Offered posters
  The deadline for the receipt of titles/abstracts was 11 May 2001. The session organizer will, if you wish, submit a paper or poster.

- Meeting flyer – please display
  A small poster to advertise the UEA meeting is enclosed with this issue of Microbiology Today. Please display it in your departmental noticeboard or pass it to colleagues. Further copies are available from the Meetings Office.
Other Events

- **Joint ASM/SGM Meeting**
  2–6 October 2001
 Carlisle Hilton, San Juan, Puerto Rico
  Biodegradation, Biotransformation and Biocatalysis (B3)

- **REGISTRATION**
  SGM members are entitled to register for the meeting at the same
cost. Details of ISAVM members and Student Members may apply for
ASV travel grants. See www.asvms.org for registration details.

- **BURSARIES**
  Grants are available for SGM members wishing to attend the meeting.
  See p. 91 for details.

- **Viral Zoonoses**
  9–11 January 2002
  Royal College of Physicians, London
  SGM Clinical Virology Group, European Society for Clinical Virology
  and the European Society for Veterinary Virology.
  The meeting will cover the latest medical and veterinary aspects of viral
zoonoses. Offered papers and posters on any subject relevant to clinical
virology or veterinary virology are welcome. Titles and abstracts should be
sent to the SGM Meetings Office by email (meetings@sgm.ac.uk) by
  Organizers: T. Wreghitt (Fax 01223 242775) &
  J. Best (john.best@kcl.ac.uk)

- **IUMS Congresses**
  28 July–1 August 2002, Paris, France
  The World of Microbes
  Xth International Congress of Bacteriology and Applied Microbiology
  Xth International Congress of Mycology
  Xth International Congress of Virology
  A flier about the congresses is enclosed with this issue of Microbiology
  SGM members will be able to apply for grants to attend the congresses.
  Details will be published in a future issue of the magazine.
A global view of FMD

The importance of foot-and-mouth disease (FMD) in the UK has coincided with publication in JGV of research by Alan Samuel and Nick Knowles of the Institute for Animal Health at Pirbright in Surrey. They analysed 105 isolates of FMDV virus (FMDV) to give the most comprehensive picture so far of its spread and diversity around the planet. They used information held by the OIE/FAO World Reference Laboratory for FMD at the Institute, which has been built up since 1924, and now includes the latest genetic sequence information as well as samples of the virus and reports on outbreaks.

All the isolates were of serotype O, the type involved in the current UK outbreak. This is one of the seven immunologically distinct types of FMDV, although there is considerable variation within each group. To detect this, the researchers now use the sequence of the FMDV genome, which allows the identity of isolates to be checked with great precision. The Reference Laboratory has over 1,000 sequences of part or all of the genome of FMDV serotype O isolates, and the researchers picked ones that would give them a good picture across the whole planet. When they put all the sequence data into a computer program that could cluster the sequences together based on their similarities, it sorted the isolates into eight distinct genetic lineages, called topotypes, each predominantly in particular geographical regions.

When the researchers looked closely at exactly which isolates were in each group, this revealed part of the history of FMD. FMDV belongs to a group of viruses which are very prone to acquire small changes in their genomes quite rapidly. However, some isolates showed surprisingly little variation despite having been isolated years apart. The best explanation for this came from the fact that they were all similar to one that had been used to make vaccines, with the implication that some of the disease isolates originated from improperly prepared vaccine, giving a new angle on the use of vaccination against FMD.

Other clusters echoed the movements of people around the world. For example, European and South American viruses formed one group. This matches with the first appearance of the disease in Argentina in 1970, in the livestock of European immigrants. They evidently took their disease, as well as their animals, with them. This topotype has probably continued to travel in cattle, because the researchers spotted that an FMDV isolate from Angola was also in this group, and may have come from animals imported from South America in the 1970s.

Some isolates were in unexpected clusters, probably explained by world trade. This might have been the origin of an isolate from Moscow which was most similar to others found half a world away in China, since it came from an outbreak thought to originate from imported pig meat. The disease may also be lasting evidence of clandestine activities, as in an isolate of a topotype usually confined to Ghana, Ivory Coast and Guinea that appeared in Algeria and might have come from illegal movements of Zebu cattle in 1999.

The importance of FMDV in pigs:

A further report from the Institute for Animal Health concerns FMD in pigs. Infected pigs are powerful emitters of airborne FMDV and cattle are highly susceptible to infection by inhalation. The pattern of wind-borne spread of FMDV over more than 10 km is thus invariably from pigs at source to cattle downwind. This investigation into the early stages of the disease was carried out before the recent outbreak in the UK, in biosecure isolation buildings, with careful precautions to minimize suffering to the animals, as well as to ensure that the virus could not escape.

To start the infection, the researchers injected four pigs with the virus: within 3 days the animals were so unwell that they would not stand up. At this point, eight healthy pigs were brought into their room, left for 2 hours and then returned to their own individual cubicles. The researchers then killed the sick pigs and dissected the room, their clothing and anything else that had been in contact with the pigs. Over the next 4 days, they observed the condition of the other pigs and selected each two day to be clinically examined and then killed, keeping blood and other tissues to test later.

One of the difficulties with FMDV is to detect its presence, or confirm its absence, in apparently healthy animals. There are several ways to do this, and the basis of the project was to compare the sensitivity of a method based on detecting the viral genome with one that actually measured how infective the virus was by growing it in cultured animal cells. The amount of virus increased very rapidly in some parts of the pigs, reaching as much as 100 million virus particles per gram of tissue. The measurement by both methods matched, with the advantage that figures based on the amount of virus genome were not influenced by the immune responses of the pigs to the disease. This tended to decrease the infectiousness.
Minimalist microbes

*Mycoplasma pneumoniae* causes bronchitis in young people that occasionally develops into pneumonia, but usually clears up on its own accord. Although it is not impressive as a pathogen, it has the distinction of pushing the boundaries of a living cell to their lowest limits. Its cells attach themselves as closely as possible to the human cells covering the surface of the respiratory tract and have evolved to exploit this close association to the extent of relying on their involuntary host for many essential compounds. As well as discarding biosynthetic abilities, *M. pneumoniae* has shed its cell wall and replaced it with some sort of internal skeleton. One consequence is that *M. pneumoniae* has one of the smallest genomes of all known bacteria with only 688 genes, all of which were sequenced about 5 years ago.

The stripped-down nature of its cells may make the job of finding out what does much easier than in more self-sufficient organisms. One of its unusual components is the presumed internal protein skeleton, which appears as shadowy images in electron microscopic pictures after the rest of the cell's proteins have been gently washed away with salt and detergent. The tip seems to be essential for *M. pneumoniae* to stick to human cells. A group of German microbiologists have been trying to discover what the presumed cytoskeleton is really like, and in particular, what proteins are in it.

After isolating the best protein skeletons that they could, they separated out every individual component as tiny spots within a slab of jelly. Then to identify each one, the researchers delicately picked out the spots and analysed each in a machine that could record at least part of the order of the amino acids in each one. The trick to using this to identify the proteins relied on the fact that they already knew the sequence of all the genes in the bacterium. The sequence of a gene includes the instructions for the order of the amino acids in the protein that is made from it, so from knowing the arrangement of a short length of amino acids, the researchers had a good chance of being able to name the protein.

They found over 100 proteins associated with the fibres from the cells and managed to identify 41 of them. Several of the proteins were ones that had already been fingered as part of the tip of the skeletal structure, along with several others whose role was previously unknown. However, for many of the proteins, it was not clear whether they were really a normal part of the skeleton, or had simply attached to it as the cells broke open. The next step for the German researchers will be to test how some of these proteins are arranged within the cell.


FreeTree' taxonomy program

Biologists are very interested in characteristics that make individuals unique and that allow them to be grouped together. Ideas about what defines a species, its relationships to other species, and their evolution, are important to ecologists, epidemiologists and sociobiologists, as well as to taxonomists. The application of molecular methods to taxonomy has solved some problems that were out of reach by traditional methods, but has caused further debate. For example, is there more to base taxonomy on the molecular details of a single gene or on a number of them?

As well as philosophical arguments, there are some technical differences between these two approaches. Many readily available computer programs apply mathematical methods to molecular data from a single gene and include statistical procedures to assess the reliability of the results. In contrast, few programs can do the same when the data come from a large number of genetic loci. Scientists at Charles University in Prague and the Academy of Sciences of the Czech Republic have been remedying this omission, and a recent paper in the program describes the application of their new program, FreeTree, to 731 species. FreeTree and demonstrated the importance of assessing the reliability of any taxonomy. The results clearly indicated that *Trichomonas vaginalis* had an ancient origin, compared with the trichomonad-like species *Trichomonas suis*. However, the program's statistical analysis indicated that no firm conclusions could be drawn from details within the *Trichomonas* grouping. In contrast, the statistics indicated that it was safe to infer that the intermixing of harmless isolates of *Trichomonas* suis from the intestine of pigs, with pathogenic ones of *Trichomonas* foetus from the urogenital system of cattle supported previous suggestions that they are in fact the same species.

Submission to the ESPERE online submission and peer-review system. This involves authors submitting a single PDF file of their paper to a secure website. An encrypted URL is forwarded to the Editor who then forwards it to the chosen reviewers. Reports are submitted to the Editor using our online report form.

It is early days yet, but ESPERE should result in a reduction in the time taken to make a decision, thus helping in a more rapid publication, and also result in savings in postage and courier charges. The fact that it is web-based means that it will be easier to get reports rapidly from all over the globe.

We hope that authors, reviewers and Editors will appreciate the benefits of online submission and will embrace this exciting development.

Supplementary data

As mentioned in the February issue of Microbiology Today, the supplementary data facility is now in operation. A variety of data types have been attached to papers, including video, figures, tables, large sequence alignments and even a free computer program (FreeTree, see p. 97 of this issue). The system should help contain the size of the printed journals and also provide added value to our online services.

Order! Order!

One of the most obvious things about bacteria is that they all look much the same. This rapidly drove researchers on a quest for other characteristics. Microbiologists have now carefully catalogued around 4,500 species in 958 genera, many of which are defined on features including their patterns of nutrition, the nature of their cell walls, particular types of chemicals in their cells, their typical habitats and, increasingly, information about their genes. John Young, from Landcare Research in New Zealand, has described, in a recent issue of USEM, the ways that taxonomists use this information to classify bacteria and the challenges that may come from increased knowledge about bacterial genetics.

Classification is the ordering of organisms on the basis of their relationships, e.g. grouping similar strains into species, and species into genera. Phenetic classification is based on overall similarity by equal weighting of all known characters and it can make use of all sorts of information about bacteria, from the shape of cells, or nutritional requirements, to characteristics of the DNA and RNA. Polyphasic classification is based on a consensus of all available methods, phenotypic and genomic.

These two systems can conflict with another goal in systematics, which is to group organisms together based on ancestral relationships (phylogenetic classification), because the possession of a common feature does not necessarily mean that organisms evolved from a recent common ancestor. An obvious example of this among animals is that although both birds and bats have the power of flight, it is almost 250 million years since they shared ancestors. Bacteria have left very little in the fossil record, so all inferences about their ancestry have to come from measurements of differences between the sequences of their genes and assumes that all the changes relate to historical relationships. A problem with phylogenetic classifications is that they sometimes give views on relationships between bacterial isolates that rely on subjective decisions about which gene to investigate.

Some recent proposals for new bacterial genera depend on differences in sequence within only one gene, leaving open the question of whether the same degree of difference applies to all the other genes in the two isolates.

One ability of bacteria that would certainly affect the assumptions of phylogenetic classifications is the way they can pick up and retain genes that are beneficial to their survival from unrelated bacteria. The extent of this genetic exchange is still being evaluated, but is certainly much greater than anyone once imagined. For example, it seems as if about 18% of the genome of *Escherichia coli* comes from the stable integration of transferred genes. John Young says there is already speculation that the conserved regions that make one gene particularly valuable for creating phylogenetic classifications, simultaneously make it a prime candidate for transfer between bacterial. As a final thought, he suggests that we might come to view bacterial species and genera as groups of organisms which share a collection of genes, but have access to many others from outside the group. This would certainly be a challenge to some current concepts in bacterial taxonomy.


Surviving acid attack

Although *Escherichia coli*, the well-known inhabitant of the human gut, does not like acidic surroundings, it can tolerate even pH 2 for a few hours. Indeed, pathogenic strains have to be able to survive the extremely acidic stomach if they are to reach the intestines and set up an infection. Researchers at the University of South Alabama College of Medicine in the USA have discovered that the cells have at least three distinct ways to protect themselves through this dangerous time in their lives. The researchers have now focused on trying to understand how one system is influenced by the cell's environment. It involves the enzyme glutamate decarboxylase and requires a source of the amino acid glutamate to mop up any acid that enters the cell.

They created strains of *E. coli* that as well as containing the genes encoding the enzyme also had the DNA instructions that switch these genes on or off attached to a so-called reporter gene. Reporter genes encode proteins that are particularly easy to detect. The idea was that the cells would respond to their surroundings as normal, but the reporter gene would make it much simpler to see exactly when glutamate decarboxylase was present. In particular, the researchers wanted to know whether other proteins, called sigma factors, that help recognize the DNA sequence at the start of genes, were involved in switching on production of glutamate decarboxylase. They also looked at what happened when they changed the growth medium to mimic the nutrient-poor stomach, or the nutrient-rich intestine.

They discovered that the enzyme was present when rapidly growing cells experienced mildly acid conditions, but only if they were in a nutrient-poor environment. In contrast, if the cells were about to stop growing, acidity triggered increased enzyme production above a modest level, regardless of the nutrients in the environment, provided the cells also contained a particular sigma factor, called σ^A^.

As a further feature, the researchers worked out that another protein, which detected how much of the sugar glucose was in the environment, was also involved in regulating enzyme production. The complexity of the system for detecting and counteracting acidic surroundings makes the researchers certain that it is very important to the survival of *E. coli*.


The SGM publishes two monthly journals, *Microbiology* and *Journal of General Virology*.

The *International Journal of Systematic and Evolutionary Microbiology (USEM)* is published bimonthly on behalf of the IUMS in conjunction with the ICSP.

The three journals are now available online. For further information visit the journal website: [http://www.sgmjournals.org](http://www.sgmjournals.org)

Members may purchase SGM Journals at concessionary rates. See p. 49 or contact the Membership Office for details. Information on commercial subscriptions is available from the Journals Sales Office.
Watching evolution

How can you study evolution and see living creatures really changing over time? Do all changes improve their abilities to live, and reproduce, or are some of them purely accidental? Bacteria offer an almost unique opportunity to study this. Not only are they very small, with short lifespans, but they can be grown in very tightly controlled environments. Even better, their cells can be deep-frozen and then revived to capture the characteristics of any generation.

A group of microbiologists at Michigan State University has tried this out with a strain of soil bacterium from the genus Ralstonia. They inoculated twelve flasks of liquid, so the conditions around each cell would be uniform, and also six sets of agar plates where the bacteria would experience gradients of nutrients and their own excreted products. As a way to keep track of the bacteria, they all had resistance to one of two antibiotics. After a thousand generations the researchers compared the appearance and several other properties of each population, as well as the starting, ancestral cells, and were surprised at the extent and variety of the changes.

Almost all the new cells stuck to surfaces more tenaciously than their ancestor and their appearance had also changed, with the cells in one population now 4.7 times longer, while those in three others had shrunk. When the researchers checked whether the cells could use any of 95 different nutrients, no two of the new populations were the same and all differed from their ancestor. The only pattern to the changes was that the cells that had evolved in liquid environments split into two groups, depending upon the antibiotic resistance of the founding population. For other features, like the fats within the cells, ones grown on solid agar retained a spectrum very similar to their parent, while those from the liquid environments had changed.

After the researchers put all the information on the cells together, they could make some guesses as to what it meant. One of the themes that showed through was that all the new Ralstonia cell populations were better suited to their environments, despite their very different characteristics. Almost all the cells had lost the surface coating, called a capsule, of their ancestor and its absence could account for changes in their nutritional requirements, as well as increased adhesion. Of continuing interest to these workers is the great variability of the changes and the speed at which the changes accumulated. The organism continues to be studied because of this apparent plasticity.

Books for children

Horrible Science Series
Published by Scholastic Children's Books

1. Bulging Brains
By Nick Arnold (1999)
£3.99, pp. 158
ISBN: 0-590-11319-4

2. Nasty Nature
By Nick Arnold (1997)
£3.99, pp. 159
ISBN: 0-590-19126-8

3. Ugly Bugs
By Nick Arnold (1996)
£3.99, pp. 157

4. Chemical Chaos
By Nick Arnold (1997)
£3.99, pp. 158
ISBN: 0-590-19124-1

5. Blood, Bones and Body Bits
By Nick Arnold (1996)
£3.99, pp. 158
ISBN: 0-590-55608-0

6. Suffering Scientists
By Nick Arnold (2000)
£1.99, pp. 224

7. The Awfully Big Quiz Book
By Nick Arnold (2000)
£5.99, pp. 100
ISBN: 0-439-89759-0

8. Evolve or Die
By Phil Gates (1999)
£3.99, pp. 128
ISBN: 0-590-54282-6

9. Microscopic Monsters
By Nick Arnold (2001)
£3.99, pp. 142
ISBN: 0-439-98950-1

Many readers with younger children will have encountered the Horrible Histories books, in which the emphasis is on the more gruesome aspects of life as, say, a Roman or a Victorian. The books are extremely popular with the 9-12 age group, and having hit on a winning formula the publishers, Scholastic Books, have extended their reach into other areas of the curriculum including geography (Dorothy Oceans and Violent Volcanoes) and science.

I use the word 'curriculum' intentionally, because although outwardly these books would like you to believe that they offer a comic book approach to the subject, I'm afraid I have to blow the gaff and reveal that the genteel look is deceptive. Large illustrated volumes contain an enormous amount of serious stuff cunningly designed to look light-hearted fun.

It is interesting that female scientists are given a reasonably high profile wherever possible, including some whom few readers will have come across. In Suffering Scientists Rosalind Franklin (dubbed Forgotten Franklin in typical alliterative style) is given a whole chapter, although Watson and Crick do get a mention. Caroline Herschel is credited with ensuring her husband William's success as an astronomer. Anonymous cartoon scientists appearing as commentators are just as likely to be female as male and the message is clearly that science is for girls as much as for boys.

The premise of the books is that science is something children are forced to endure at school, that it is a subject that is so boring that either you go to sleep or, if you manage to stay awake, you only take in half the facts and can make no sense of any of them. (Science teachers will no doubt groan at this point.) These books are an antidote to that and intend to lure the unsuspecting and reluctant student into learning something without realizing it. The 'blurb' promises that there will be lots of gore and goo, something without realizing it. The 'blurb' promises that there will be lots of gore and goo, supposedly fascinating to children. True, there is a liberal scattering of 'rude words' such as rape, blow and bum, which owe their presence to the well-documented British obsession with lexicological humour, and a number of grisly anecdotes, like the story of Antoine 'Luckless' Levasseur's unfortunate end on the guillotine. But the books are far more relevant and useful than the title suggests. They are panoramic in their scope, covering the key points of their topic in an economical style that nevertheless includes all the important points.

The level of humour is nicely judged and shows a thorough acquaintance with the Beano and the Dandy, since the illustrations use all the common conventions found in comics - speech and thought bubbles, exaggerated physical characteristics and vocalized noises like 'snigger' and 'chortle.' Readers are expected to be sufficiently familiar with these conventions to be able to cope with a fairly complicated page layout. Although the books are loosely arranged in chapters, inserted panels containing mini questionnaires, potted biographies of famous scientists and so on constantly interrupt the narrative, and for some readers keeping hold of the thread of the story may be difficult.

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

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

Reviews

Bulging Brains
Bulging Brains is a book from the Horrible Science series exploring all corners of science. Many of the jokes are about science teachers and there are funny captions and speech bubbles with the brilliant and often rude cartoons of Tony De Saulles. Every now and then a quick quiz pops up and a tear-jerking tear is a more serious matter for a teacher. I liked the memory chapter because it has loads of facts and was very funny. I would give this book 9 out of 10.

Blood, Bones and Body Bits
This book tells you everything from how many times you change your body position every night and which man eats metal without getting indigestion. There are more quick quizzes and teacher tea-break teasers and there were more brilliant cartoons. My favourite part was about sleep in the brain chapter because it was interesting and full of facts. I would give this book 9 out of 10.

Suffering Scientists
I liked Suffering Scientists because it had lots of little biographies of famous scientists and their earlier lives. It told you what they discovered and what theories they got wrong. I liked the part about Newton because it was clever and I could understand it. It has a PhD on Darwinism and Children's Literature at Reading University.

Hilary Fraser is doing a PhD on Darwinism and Children's Literature at Reading University.

Book reports

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Books for grown-ups!

Emerging Diseases of Animals
Edited by C. Brown & C. Elin
Published by American Society for Microbiology (2000)

Do not be misled by the title as the animal diseases in question have been selected on the basis that they also pose a health hazard to man. Current human population pressures on this planet force us to live in closer association with animals, whether domesticated or free living, and the outcome of this is the emergence of new diseases or, more frequently, the re-emergence of old ones. This collection of reviews is hang up-to-date and is essential reading for any scientist interested in 'One Medicine', as espoused by Rudolf Virchow. The outlook is almost totally from a North American perspective which may limit its attraction elsewhere in the world, but institutions with interests in zoonotic infections should buy this book. Chillingly topical is a chapter on agroterrorism which discusses in fine detail how terrorists could lay waste to a country's livestock industry by the introduction of a highly infectious disease. Foot-and-mouth virus is top of the list.

Liz Sackett
University of Nottingham

Molecular Motors. Essays in Biochemistry, Vol. 35
Edited by G. Bunting & S.J. Higgins
Published by Portland Press (2000)
ISBN: 1-85573-103-4

Do cell biologists know that prokaryotes exist? This book claims to feature 'all of the main motor systems', which it defines as mechanisms converting the chemical energy of ATP into movement. The broader-minded editors include proton-driven F1-ATPase, but then disconcertingly omit bacterial flagellum motors. Moreover, despite excellent chapters on microtubule-associated processes and kinesin-driven organelle movement in animal cells, we find nothing on chromosome segregation or FtsZ-driven septation in bacteria. Microbes are not omitted entirely - Wooley writes excellently on eukaryotic cilia and flagella. Moreover, although it counted the word 'bacteria' only once, there is an admirable chapter by
Teaching Science for Understanding: A Human Constructivist View
Edited by J.J. Mintzes, J.H. Wandsorser & J.D. Novak
Published by Academic Press (1989)
$39.95, pp. 360
ISBN: 0-12-49360-X

This is a companion volume to Assessing Science Understanding by the same authors. (reviewed for Microbiology Today, Vol. 21, May 2000). I hoped it might include analysis of case studies showing why certain teaching methods work better in science. This is included to an extent in chapters 7–10 but the remaining ten chapters are heavily devoted to the history of ideas on teaching and the psychology and sociology of the classroom setting. This balance makes the book poorly suited to science academics (who are probably not its primary target). A chapter that I did like was one on using analogies in teaching, something that I employ in my lectures. In conclusion, the Assessing Science Understanding companion volume to this one seems a better purchase for institutional libraries. It contains more practical suggestions for the science academic, based on similar teaching and learning methods (V diagrams, concept maps) to those described here.

Liz Sackett
University of Nottingham

Microbiology: Diversity, Disease, and the Environment
By A.A. Salzers & D.D. Whitt
Published by Fitzgerald Science Press (2000); d/o Blackwell Science
$27.50/US$53.95, pp. 608
ISBN: 1-891-786-11-8

This entertaining American book is aimed at university students, despite the cover picture of a chimpanzee playing with a GATC building block. I find it ideal in first-year genetics tutorials for a variety of reasons: it avoids the style of textbooks and is also an enjoyable read. It introduces concisely the principles behind a variety of molecular genetic processes and techniques, including RT-PCR, RAPD, automated DNA sequencing, protein folding, transposition, transcription, molecular evolution and taxonomy. It includes cartoons, sketches and some corny jokes, very like the shorthand that students use in their own lecture notes. DNA sequencing explanations in this book are the most undergraduate-friendly of all texts I have tried. Purists may be irritated by its lack of molecular detail, but this book is an ideal primer that allows students to pick up the basic concepts and then look up the details in 'proper textbooks': A must for your office!

Liz Sackett
University of Nottingham

Edited by S. Specter, R.L. Hodinka & S.A. Neung
Published by ASM Press (2000)
US$124.95, pp. 644

The third edition is an expanded and expanded version of the previous one. The first section gives detailed descriptions of the laboratory procedures for detecting clinically important viruses. The length of each chapter doesn’t reflect how much each procedure is used. For example, complement fixation tests, described in 15 pages, have been largely superseded in the majority of laboratories by enzyme immunoassays, to which only 12 pages are devoted. It is unfortunate that neuroaminidase inhibitors have been omitted from the chapter on drug susceptibility testing. The second section describes groups of viruses under headings of biology, pathogenesis, epidemiology, diagnosis and treatment. Appendices in the final section give details of US virus laboratories and the services provided by them. There are a number of other clinical virology manuals on the market and, although they may not cover the subject in quite as much detail, are much more affordable, particularly for students.

Chris Ring
GlaxoWellcome R&D, Stevenage

By D. Burke, D. Dawson & Tim Stearns
US$75.00, pp. 205

This recently published Yeast Genetics Course Handbook has long been an essential reference work for all laboratories working in the field and is an ideal resource for newcomers. At one level, it provides a concise source for the recipes and protocols of everyday laboratory work. It provides an authoritative answer to those irritating questions that sound easy, but can be hard to nail, e.g. what’s the correct concentration of tease in minimal medium? This year’s edition goes much further; it contains full details of the recent modifications and new resources that have made the awesome power of yeast genetics easier to exploit. The list of techniques covered includes the basic and rewarding, synthetic lethal screens, synthetic lethals, tagging, UAS, e.g. how you don’t even have to clone the gene and the generation of conditional mutations using these powerful techniques. As well as complete and easy-to-follow protocols, there are excellent commentaries introducing the rationale of the procedures and problems that can arise. For teachers it provides a short-cut to what would be a very sophisticated and rewarding practical course. In short, a brilliant resource for yeast biologists and teachers at all levels.

Peter Sudbery
University of Sheffield
too many contributions on analysis of metabolic pathways, while there is a single, well-written chapter describing protein structure determination. It was pleasing to see some niche areas such as biofilms receive mention, while the final two chapters on such as biofilms receive mention, the final two chapters on analysis of metabolic pathways, spectroscopists interested in unique features, for instance, would have to get together to work out what can be done, provided they then get together to work out how to do it.

Rob Cooke, GlaxoSmithKline, Stevenage

Handbook of Enology: Vol. 1 The Microbiology of Wine and Vinifications; Vol. 2 The Chemistry of Wine Stabilization and Treatment

By P. Ribereau-Gayon, D. Dubourdieu, B. Doniche & A. Lonvaud (Vol. 1); P. Ribereau-Gayon, Y. Blondes, A. Maatjean & D. Dubourdieu (Vol. 2)

Published by John Wiley and Sons (2000)


Both volumes are extremely readable translations of the original French texts. The authors provide a comprehensive treatise of the microbiology, biochemistry, grape production, process methodology, chemistry and stabilization techniques underpinning European wine production. Although not exhaustive in every aspect, and clearly not intended to be, there are sufficient citations to enable the reader to delve deeper if required. Aimed at winemakers and students of enology, the texts explain the scientific principles and practices involved in wine production in such a way that little prior knowledge is required. This is a book that deserves space on library bookshelves in colleges where food-related courses feature. Buy it as a reference book and you won’t be disappointed. Read it as an informed amateur and you’ll gain much from its content. I walked away from the books feeling informed and greatly saddened at the British climate!

Glyn Hobbs
Liverpool John Moores University

The Ecology of Cyanobacteria. Their Diversity in Time and Space

Edited by B.A. Whitton & M. Potts

Published by Kluwer Academic (1999)

N.L.G.E.60.00/US$345.00/225.00 ISBN: 0-7923-4735-8

This is an extensive and well-structured book that combines the collective expertise of many of the top researchers working in the cyanobacterial field. By writing a general introductory chapter, the Editors have opened up what is an essentially specialist book to the general microbiologist. Cyanobacteria are examined from every conceivable angle from their fossil record through their phyley to their interactions in a number of complex and extrane environments. Descriptions of molecular responses to environmental stress, significance of genomic repetitive DNA and production of toxins expand the ecology further. Whereas most chapters describe the cyanobacterial diversity in a given environment, two cyanobacteria, Nostoc and Synechocystis, are given individual chapters based on their ubiquity and commercial importance respectively. As the book is clearly written, well presented with excellent colour plates and extensively referenced, it is an ideal reference book for those working in or entering this area of microbiology.

Roger Pickup
CEH-Windermere

New Challenges to Health: The Threat of Virus Infection. SGM Symposium Vol. 60

Edited by G.L. Smith, W.L. Irving, J. McCaughey & D.J. Rowlands

Published by Cambridge University Press (2001)

Non-members: £70.00/US$125.00
Members: £28.00/US$50.00


Although the last few decades have seen advances in our understanding of the biology of virus infections that would probably amaze the pioneers of virology—such as influenza (then merely as a ‘contagious agent’ capable of causing disease)—the threat of virus infection still hangs over our heads like the sword of Damocles. At the start of a new millennium the human race and its attendant species (pets and livestock) face a bewildering variety of virus species, all able to cause significant morbidity or mortality. This volume is thus timely. The 15 chapters give a comprehensive, detailed and informative insight into the molecular biology, pathogenesis and epidemiology of some of the most important viruses affecting the globe today. A notable exception, which with the benefit of hindsight would have made the volume even more opportune, is foot-and-mouth disease virus. However, I am sure that this omission will be more than adequately compensated for in other publications in the near future.

The book starts from a moralistic standpoint with a chapter by C.J. Peters, in describing the emergence of so-called ‘exotic’ viruses such as Sin Nombre. He lays the blame on the hands of western governments to support the developing world. The chapter moves from geographical history to modern epidemiological detective work and ends with some dire predictions for the future—in an era of great change—the threats posed by viruses (and indeed other microbes) are ignored at our peril. This is an accessible chapter, easily read by the informed layman or scientist alike.

The second chapter, by Bryan Grenfell, stands alone in that it describes the mathematical modelling of epidemics, with emphasis on the author’s own study of measles virus. There follow chapters on pathogens such as burro viruses, influenza, hepatitis viruses and dengue virus amongst others. These chapters vary in their emphasis but in general focus on the molecular biological aspects, interspersed with some epidemiology. All of the contributions provide a broad review of their allocated subjects, with the exception of the chapter on prion diseases which sets out to mainly review work in the author’s (Charles Weissmann) own laboratory. Personally speaking the most enjoyable chapter was that written by Liv Bode and Hanns Ludwig, dealing with Borna disease virus. This chapter provides an in-depth account of our knowledge of the biology of this fascinating virus that is implicated in the aetiology of neurological diseases such as schizophrenia. Both molecular and clinical aspects of Borna disease virus are comprehensively and eloquently covered.

The volume finishes with a consideration of antiviral drugs by Graham Darby, highlighting the development of anti-HIV drugs and the problems of resistance.

Mark Harris
University of Leeds

An order form for the book is included in this issue of Microbiology Today.

I believe that this book will be of use to virologists at all stages in their careers, from the motivated undergraduate wishing to get those extra marks in final year exams, to those involved in virology teaching and research. Unlike many review volumes this one will not be out-of-date before it is published and I recommend that you add it to your library now!
Microbiology education in 2001

Microbiology education in our schools, colleges and universities is in a state of rapid flux. We have moved on from regarding micro-organisms just as pathogens (plant or animal) and have regard to them as co-inhabitants of our environment with uses and benefits as well as threats.

We have recognized through biotechnology that many micro-organisms and their products are commercially useful and can replace chemicals in some industrial processes to provide biological and pharmaceutical products more efficiently and cheaply. We have now entered the era of genetically modified micro-organisms which can be applied to a wider range of processes. The potential for the exploitation of fungi and bacteria for mankind's benefit has never been greater.

So how do we impart this excitement to students and the young people who will follow us?

School syllabuses recognize the part micro-organisms play in our lives, and teachers are increasingly aware of the interaction between microbiology and subjects such as immunology and molecular biology. This trend is to be encouraged and interdisciplinary co-operation promotes microbiology and shows biology can be studied in a modern integrated way. Part-time and continuing education need also make a significant contribution to education later in careers.

In universities we have a problem in retaining and communicating our enthusiasm in the face of increasing numbers of students moving away from biological science, and indeed from science generally. The attractions of degrees in media, business, sports studies and computing are powerful and the perception by students that some courses may offer a better prospect of good employment and be less intellectually demanding is enough to swing the pendulum away from science, no matter that we may be turning out a generation of leisure centre managers.

Many departments of microbiology have lost their identities, being swallowed up in schools or divisions of (for example) biological sciences and the special nature of the subject has been eroded. To keep numbers up and achieve a more 'efficient' (what does that mean?) staff/student ratio, students are taught in larger numbers with those on other courses and this can exacerbate the loss of identity which they feel. Coupled with reductions in unit funding, this 'new' has led to an inability to provide for our students the experience to which they are entitled. Modern microbiology is a wide-ranging, vibrant and exciting subject that offers splendid careers; our task is to get the message over to students and the public, to ensure that it continues to lead and underpin so many other areas of science.

To reverse the swing away from our subject we must get the message across that the successes of the new 'sexy' subjects of molecular genetics, genomics and biotechnology are largely dependent on knowledge of the whole biology of micro-organisms. Multimedia and other innovations have contributed new ways of learning microbiology. Today's textbooks all have colour illustrations and many include CD-ROM packages. The internet provides a wealth of information and also teaches students how to use it. What they read, since not all is accurate. Professional microbiologists outside academia are often willing to participate in training schemes and this can result in future employment prospects for the right candidates.

The very real research/teaching divide within the profession needs to be recognized and removed. Too many researchers still regard teaching as something which should be done by others. No one would argue that well-funded researchers should be forced to undertake 300 hours student contact a year, but there is a strong case for students learning directly from them if they are to produce graduates with up-to-date skills and approaches to science. Similary teachers should seek to be involved in research and promotion of others' work. The excellent ideas we see in some of the Education Development Fund applications are testament to the ingenuity and originality of teachers which should be encouraged.

We should see ourselves as microbiologists, not divided into researchers and teachers; most of us came into the trade because we liked the idea of working with micro-organisms – we should now view those who learn from us as our apprentices and we must help them develop the same interest and fascination that we had.

None of this will help unless the HE science sector as a whole is recognized for what it tries to do, which is to stimulate students to question, to investigate, to innovate and thus contribute to knowledge and prosperity. As teachers we have to be at the beginning of that process.

We may have no difficulty in communicating enthusiasm, but we need adequate support from good university management working in concert with its stuff, and proper resourcing by Government. We will then see the recovery in morale in HE and as microbiologists we will be able to provide for our students the experience to which they are entitled. Modern microbiology is a wide-ranging, vibrant and exciting subject which offers splendid careers; our task is to get the message over to students and the public, to ensure that it continues to lead and underpin so many other areas of science.

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I am grateful to members of the Education Group Committee for helpful comments.