Quarterly

SGM

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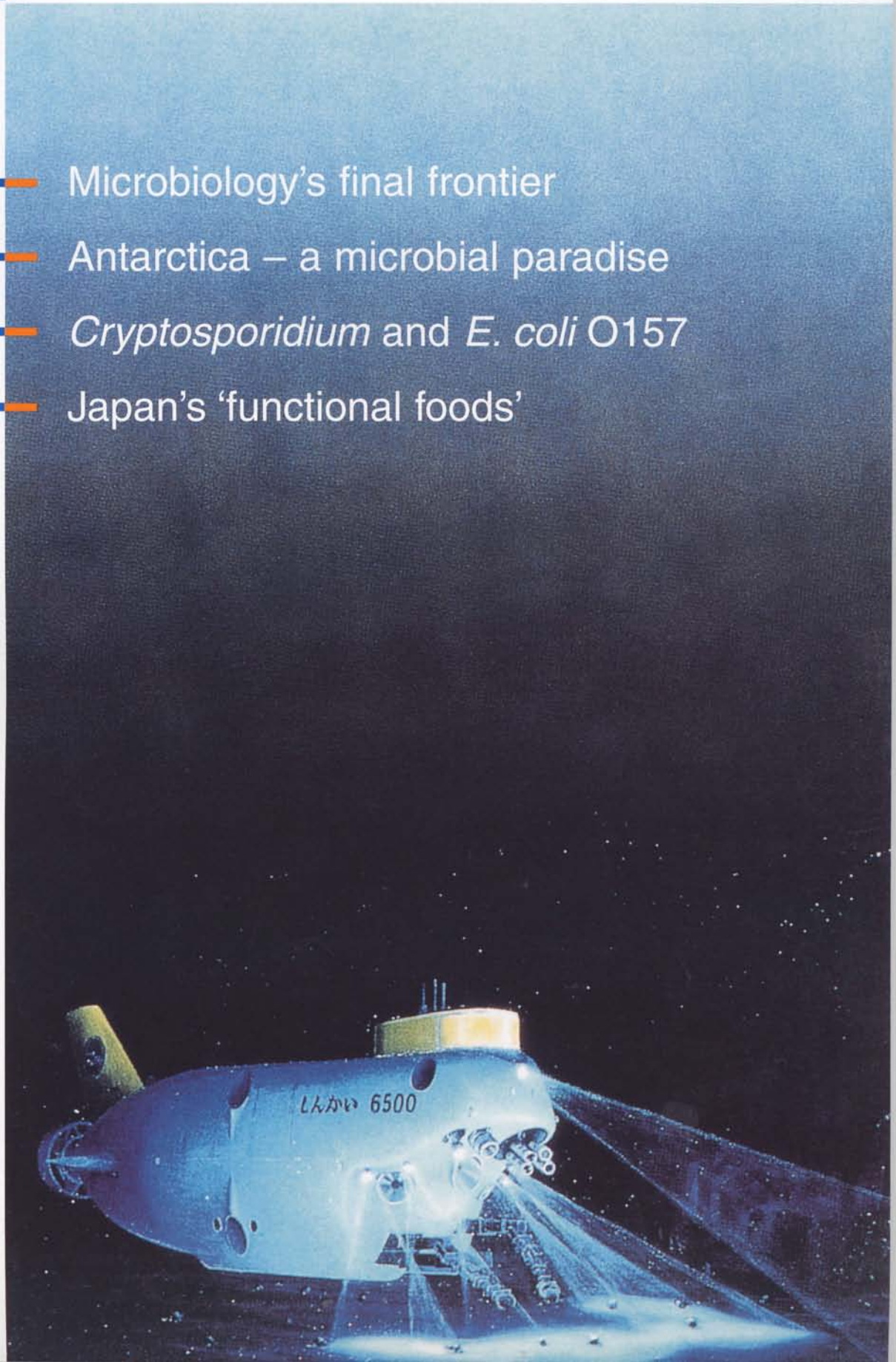
MAY 1997

- Microbiology's final frontier
- Antarctica – a microbial paradise
- *Cryptosporidium* and *E. coli* O157
- Japan's 'functional foods'



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Front cover: The world's deepest-diving manned submersible, JAMSTEC's 'Shinkai 6500'. A crew of three, a pilot, navigator and researcher, are encased in a 2 m titanium sphere. A wide array of lights, cameras and sampling equipment can be attached to the front end and controlled by the crew. See article on p. 47. Photo courtesy of the Promotional Office, JAMSTEC.

Editor: SGM Publications Officer, Dr Dave McL. Roberts, Department of Zoology, The Natural History Museum, Cromwell Road, London SW7 5BD (Tel. 0171 938 8790; Fax 0171 938 8754; Email d.roberts@nhm.ac.uk).

SGM Headquarters: Marlborough House, Basingstoke Road, Spencers Wood, Reading RG7 1AE (Tel. 0118 988 5577; Fax 0118 988 5656; Email admin@socgenmicrobiol.org.uk).

SGM Web site: http://www.socgenmicrobiol.org.uk

Assistant Editor: Janet Hurst

Production Editor: Ian Atherton

Production Assistant and Book Reviews Manager: Janice Meekings

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

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EDITORIAL

Risk

As scientists we instinctively qualify almost everything we say, which puts a very effective barrier between us and 'the public'. We tend to treat incoming information in the same cautious way. This attitude might be described as cynical, but for us it is a way of life. Nothing is believed to be quite as simple as it appears. We enjoy teasing apart the tangled set of influences which modifies the behaviour of the system we are studying. If it were not so, we would not do it. This is a characteristic of academics encapsulated by Aristotle's observation that 'the test and the use of man's education is that he finds pleasure in the exercise of his mind'.

In this issue there are background articles on two topics which have given rise to substantial public interest and media coverage: the water-borne pathogen *Cryptosporidium* and *E. coli* O157. These follow Jeff Almond's article in the May 1996 *Quarterly* on prion diseases. These issues have come to prominence because they all pose some form of risk, real or perceived. Even the speculation around the possibility of life on Mars and Europa has been reported in the media from the perspective of the risk of contamination that might be posed by returned samples.

Last March the Royal Society organized a conference on Science, policy and risk (http://thesis.newsint.co.uk/RS/rs.html). This was a follow-up to the 1992 conference which failed to resolve the distinction between real risk, in the sense that it is based on statistical treatment of incident records, and perceived risk. As a child I used to play cricket in the street with a wicket chalked on a lamp-post. I would not dream of letting my son play in the roads now because I perceive them as a dangerous place to be. Statistically, however, there are fewer children injured on the roads now than when I was a boy despite the exponential increase in the amount of traffic.

The myriad ways in which life-style changes affects how we react to perceived risk and these changes in turn, modify the risk. The new-variant CJD, for instance, affected the sales of beef profoundly. This was in spite of the observation that a change of eating-habit now would not lessen the risk of development of the disease because beef is less likely to be contaminated now than a few years back at the height of the BSE epidemic. I have not seen any reports that the sales of cooked-meat products have been comparably affected by the O157 outbreak which has already killed more than twice the number of people with new-variant CJD. This may be a media influence, but it might also be that O157 is food poisoning, a phenomenon with which we are familiar and thus accept the risk more readily.

The recent report on abattoir practice and the continuing problems of *Salmonella* in the poultry industry reflect changes in our attitude to food. The objective of the food industry is, of course, profit. Profit is enhanced by having longer shelf-life and by reducing production costs. The former means finding ways to control spoilage, especially microbial growth, while the latter means finding ways to prepare the food more economically while staying within the prescribed safety standards. I can only guess at how the tasteless mushrooms on the supermarket shelf are made to last as long as they do compared with the ephemeral thing picked from the field. The consumer also demands cheap food; look at the real cost (inflation adjusted) of chicken these days and speculate how these savings were achieved.

Personally I like my cheese, my yoghurt and my beer to have life. Do not even talk to me about bread! I see no particular problem in cheese having a living skin composed of organisms that should be there. However, it does mean that each one tastes different. Here is another challenge for marketing. National marketing means that the cottage-industry levels of production are hard pressed to deliver in quantities to the demands of national buyers. But what are the risks associated with this change of practice? Bland food, to be sure, but is it really so much safer?

The Advisory Committee on Dangerous Pathogens has published an interim report (HMSO, June 1996) because they were asked to consider the general principles of micro-biological risk assessment and its application to public health issues. They recommend continued development of microbiological risk assessment (MRA) particularly to encompass scientific, economic, political and sociological grounds. It will be interesting to see just how these various factors are balanced off against each other. There is a pressing need for suitable methods to judge issues over consumer labelling and advertising. Just how clear should labels be and how much should they tell you? Mr Justice Hawkins, delivering judgement in the 1890s over advertised claims for a patent medicine said, 'It must be remembered that such advertisements do not appeal so much to the wise and thoughtful as to the credulous and weak portion of the community'. People certainly factor price into their own risk assessments. Make your meat-pies cheap enough and people will buy them, *E. coli* notwithstanding.

Surely what is needed is a sense of proportion in these risks. There is no doubt that familiarity with a risk generates a degree of tolerance and acceptance of it. The great killer diseases of our grandparents' generation are now a distant memory so that we have fewer benchmarks against which to judge emergent disease (AIDS, ebola, O157, etc.) and thus seem to react with alarm to what has become an unknown, unquantified threat. Over dinner recently, a fellow guest was recounting with obvious horror a scene from a TV show about animals where someone pressed their hand onto an agar plate and time-lapse photography revealed the development of the subsequent hand-print. The message was clear; always wash your hands after handling animals. To most people microbes only represent a threat and one that is not understood.

I cannot finish without mentioning the brouhaha that has attended the announcement of Dolly, the cloned sheep. The general arguments that have followed have tended to focus on the ethical issues and much has been said about the affront to human dignity being posed by these genetic techniques and by extension, science in general. The affronts made to human dignity by poverty, hunger, disease, violent crime and war seem to pale into insignificance beside Dolly...

Dave Roberts

In this issue ...

MICROBIOLOGY always seems to be in the headlines. *Cryptosporidium* and *E. coli* O157 have been hot topics of public concern recently and articles on these organisms appear on pp. 52–57.

Meanwhile, in Japan, claims are being made that immunity to disease can be enhanced by eating certain foods (p. 58).

Some of our members have been exploring microbiology in more exotic locations than the supermarket or kitchen. Alan Bull (pp. 47–49) tells readers of life in the ocean deeps, whilst Nick Russell escapes to the icy wastes of Antarctica (pp. 50–52).

Back in the lecture theatre, Jo Verran has some ideas for enlivening the ways of teaching microbiology (pp. 64–65).

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

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

The Deep Seas – Microbiology's Final Frontier

Alan T. Bull

An exciting range of microbes is being found in the ocean depths. Their biological diversity and metabolic activities show great promise for exploitation by scientists.

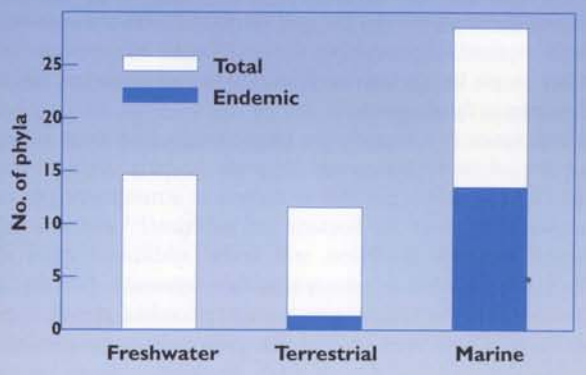
To those who regard the existence of life on Mars as beyond reasonable doubt, the notion of the deep seas as microbiology's final frontier may seem to be an exaggerated claim. Yet despite the fact that almost 60 % of the Earth's surface is covered by seas greater than 2,000 m deep, wherein all life must be able to tolerate a minimum pressure of 200 atmospheres, our knowledge of deep-sea microbes is very meagre. This is not to undervalue the pioneering work of ZoBell, Morita, Kriss and their like; simply it reflects the daunting scale and immense logistical difficulties of exploring the microbiology of the abyssal depths. Such exploration carries with it the burdens of 'big science' – high technology and huge costs. Not surprising, therefore, that only a handful of countries have invested in very deep-sea research and that international collaboration is vital for pushing back this particular frontier. Nevertheless, knowledge of bacteria occurring in the sediments of some of the deepest oceans has been known for over a century. Reports of the Talisman and Humbolt Expeditions, which appeared in 1884 and 1894, include descriptions of bacteria cultivated from depths greater than 5,000 m, while half a century or so later, research from the Galathea Expedition revealed large bacterial populations at the bottom of the Philippine Trench where the pressure exceeds 1,000 atmospheres! But perhaps the two recent events that really have sparked excitement in deep-sea biology – microbiology included – have been the discovery of communities of organisms associated with hydrothermal vents, first observed in the Galapagos Rift in the 1970s, and the development of submersibles that can descend to the ultimate ocean depths. The most advanced fleet of submersibles is that of the Japan Marine Science and Technology Center (JAMSTEC) whose Shinkai 6500 is the world's deepest-diving manned submersible, and whose recently commissioned unmanned submersible Kaiko can explore the very deepest trenches.

As I sketch this article my sense of trepidation rises – a mere land-lubber and newcomer to deep-sea microbiology trying to sound convincing about a new-found research interest! I can offer only the combination of profound curiosity and fortuitous circumstance for this state of affairs. A long-standing fascination by microbial diversity and the opportunities it provides for biotechnology has caused several of us at Kent to search unusual or neglected environments for novel micro-organisms and properties. Then, 5 years ago, as JAMSTEC was launching its deep-sea microbiology initiative (DeepStar), its newly appointed director, Professor Koki Horikoshi, invited us to extend this interest to the deep sea and to embark on what has become an absorbing and happy collaboration.

The environment of the deep sea often is depicted in terms of extreme pressure, low temperature, lack of light and paucity of nutrients, conditions which, at first sight, may seem inimical to life itself. But this is far from being the case. The bottom sediments, even at depths of 10,000 m, and in contrast to the overlying water, can maintain very high populations of micro-organisms representing all three of the Domains. Indeed, the biological diversity and density of the deep sea may rival even that of tropical rain forests and attempts to estimate the total species diversity of the deep sea currently is the subject of fierce debate. For example, extrapolations from detailed samplings of sediments suggest that the diversity of deep-sea invertebrates could be at least 10 million and possibly even 100 million. This debate will not be settled quickly given the difficulties of studying deep-sea ecology and the rarity of taxonomists working on the deep-sea macro- and microfauna. However, one other startling fact surely must excite microbiologists about the prospects for finding novel organisms in the deep seas; this is the astonishing degree of animal endemism found in the marine environment (Fig. 1). From data already available we can predict with reasonable confidence that specific microbial–invertebrate symbioses may be the normal life style of these organisms in the deep sea, and hence these could be priority niches within which to search for new microbial taxa.

The deep sea is far from being a uniform environment and, in addition to hydrothermal vents, cold seeps (nutrient-rich water released from underlying rock as a result of geological pressure), hydrocarbon seeps, and localized brine incursions, the occurrence of underwater storms and the periodic deposition and redistribution of the organic 'fluff' provide a patchy mosaic of microhabitats for microbial exploitation. It is not surprising that the hydrothermal vents have captured both scientific and public interest – just imagine an ecosystem on whose visiting card we read high temperature, abnormally high radioactivity, high concentrations of heavy metals, ammonia, hydrogen sulphide and methane, and an instability of the most chaotic type! Yet these 'dark Satanic mills' of the abyssal depths are home to an unexpected diversity of organisms: the latest inventory of vent eukaryotes, for example, lists 110 families, 278 genera and 525 species. And associated with the vent fauna, or existing freely in the vent environs, is an inestimable diversity of bacteria and archaea upon whose chemosynthetic activity the whole ecosystem depends. Some interesting facts are emerging on the biogeographic distribution

DIVERSITY OF ANIMAL PHYLA *(after Ray & Grassle, 1991)*



ENDEMISM IN HADAL INVERTEBRATES (> 6000 METRES)
(after Wolff, 1970)

Group		Endemic species (%)
Crustaceans	Cumacea	100
	Ostracoda	100
	Amphipoda	82
	Isopoda	76
Echinoderms	Crinoidea (sea lilies)	89
	Holothurioidea (sea cucumbers)	64
	Echiuruda (sea urchins)	63
	Omphiuroidea (brittle stars)	60
Molluscs	Gastropoda	88
	Bivalvia (clams)	65
Porifera	(sponges)	75

Fig. 1. Biodiversity in the sea.

Fig. 2. Launching 'Shinkai 2000'. The submersible can be lowered into waves up to 2 m and the whole process takes about 10 minutes. *Photo courtesy of Joy Colquhoun.*

of these prokaryotic primary producers. In the Pacific vents the endosymbiotic bacteria cluster within the γ-Proteobacteria and are associated largely with tube worms and bivalves. At the mid-Atlantic Ridge vents, however, the dominant animal is a shrimp which forms an ectosymbiotic association with a single species of previously unknown bacterium of the ε-Proteobacteria. Evidence for biogeographic distribution of marine micro-organisms also is coming from a variety of sources, including a recent study of the fish pathogen *Vibrio anguillarum*. Strains of this bacterium having distinct phenotypic characteristics were associated with geographically separated sediment samples and with non-fish hosts.

The conditions of the deep seas are arguably the most extreme that sustain life on Earth. Extremophiles have been defined very neatly in terms of pressure and temperature (PT) by Aristides Yayanos as organisms in direct proportion to the distance in PT-space between their habitats and that of us humans (1 atmosphere, 37 °C). Thus microbial – and other – life exists along the 250 atmospheres isobar typical of the hydrothermal vents to at least 110 °C, and along the 2–3 °C isotherm to the maximum pressure of the deepest trenches of approximately 1,100 atmospheres. Recently the limits of the biosphere have been extended to even greater extremes through the analyses of deep marine sediments by John Parkes and his colleagues in Bristol and Cardiff. These sediments, which may be up to 1 km or more thick, are colonized by bacteria to a depth of at least 750 m. The question of how deep-sea micro-organisms adapt to and sense extremes of pressure and temperature is easy to pose but as yet we have no comprehensive answer. Hyperbaric pressure elicits a variety of effects on gene expression and protein synthesis and, for example, may induce both heat- and cold-shock proteins. But these pressure-inducible effects are not restricted to those marine microbes that may be subject to pressure changes as they pass through the water column; they have also been observed in such terrestrial microbes as *Escherichia coli* and yeasts. Sensitivity to high pressure appears to be due to the disorganization of multimeric proteins involved, among other things, in replication, ribosome assembly, transcription and translation. Thus, the ability to induce the synthesis of shock proteins may be one of the key features of pressure tolerance. Genetic studies of deep-sea bacteria are gradually beginning to reveal the secrets of pressure tolerance. Groups at the Scripps Institute of Oceanography and at Koki Horikoshi's DeepStar laboratory have cloned and sequenced pressure-regulated promoter sequences from several deep-sea bacteria, and recently the Japanese group have analysed the open reading frames downstream from the promoter of a barotolerant strain. A finding of considerable interest is that one open reading frame (*orf3*) complemented the *cydD* gene of *E. coli*, the product of which is required for assembling the cytochrome *bd* complex. Here, therefore, might be one important insight to understanding survival mechanisms in the deep seas.

Barotolerance is a remarkable phenomenon and demonstrably a property of many and varied deep-sea bacteria. Even at hadal depths (>6000 m) it is possible to recover at atmospheric pressure populations of at least 107 bacteria (ml sediment)$^{-1}$ and molecular biological methods doubtless will reveal additional types and numbers of viable but as yet unculturable organisms. Not that the relationship between extreme pressure and microbial growth is one-sided. Bacteria have been isolated that grow only under conditions of high pressure – those obligate barophilic organisms that are unable to grow at atmospheric pressure.

Fig. 3. The research vessel 'Yokosuka' is mothership to the 'Shinkai 6500 and, until this year, the robotic 'Kaiko' system (see Fig. 5), which now has a ship of its own. The 'Yokosuka' houses three research laboratories. *Photo courtesy of the Promotional Office, JAMSTEC.*

As research on deep-sea organisms gathers pace, an interesting question, first posed by ZoBell & Morita, reappears: is pressure tolerance a sufficient distinctive feature with which to delineate species or are deep-sea species the pressure-adapted variants of surface microbes as they sink through the water column? Our own research on deep-sea actinomycetes has revealed well-defined clusters of abyssal and hadal rhodococci that are clearly distinguished from all type species of *Rhodococcus*. These studies of deep-sea actinomycetes have strongly reinforced the view that a polyphasic taxonomic approach is essential for uncovering the full diversity of microbial communities and that reliance

on unitary approaches, for example ribotyping, is likely to pass over such diversity. The metabolic activity of deep-sea microbes has major importance for global homeostasis in terms of carbon turnover and deposition in the carbon archive of the vast ocean sediments. Only recently have we begun to appreciate the scale of biogeochemical activity in deep-sea sediments, Parkes estimates that in terms of carbon their discovery is equivalent to increasing the planet's biosphere by 10 %. Moreover, this activity increases with depth under certain circumstances such as sites of deep methane hydrate deposition.

All the evidence of extraordinary biological diversity and metabolic activities in the plethora of ecosystems found in the deep seas encourages my optimism that these are the places to go bioprospecting. Numerous novel metabolites have been discovered in marine organisms that exhibit a wide range of bioactive properties. To date most of these compounds have come from shallow sea invertebrates – sponges, corals, tunicates, etc. – or their bacterial symbionts, but as the means for more regular sampling become available, the screening of deep-sea microbes certainly will follow. Novel biocatalysts also are an obvious target for deep-sea search and discovery programmes and already there is a substantial database on thermostable enzymes of vent hyperthermophiles. Pressure stability and activation are other desirable properties in biocatalysts. Precedence for this type of activity was provided by the DeepStar group who discovered a protease in a *Sporosarcina* species, isolated from 6,500 m, whose activity was specifically enhanced at 600 atmospheres.

So what of the future? The expense and engineering demands of deep-sea exploration are formidable but the recent commissioning of the Kaiko supersubmersible and current developments such as Deep Flight in the United States attest the undiminished interest in what has been called 'inner space'. However, Professor Horikoshi makes the telling point that more people have travelled to outer space than have descended 2,000 m into this inner space. The emphasis, therefore, will continue to be on international programmes and this will be important in establishing research priorities. By the time that this article is published a bilateral meeting will have convened in Tokyo to consider future research collaborations in deep-sea microbiology between Japan and the UK. For microbiologists already immersed in or about to accept the challenge of deep-sea research, the prospect could not be more exciting.

Alan Bull is Professor of Microbial Technology at the Department of Biosciences, University of Kent, Canterbury CT2 7NJ, UK (E-mail A.T.Bull@ukc.ac.uk).

Fig. 4. A hydrothermal vent at Ogasawara Trough at a depth of 1380 m. The temperature is 280–300 °C. The substratum in the West Pacific is normally very rocky around hydrothermal vents which can grow to form tall chimneys. *Photo courtesy of the Promotional Office, JAMSTEC.*

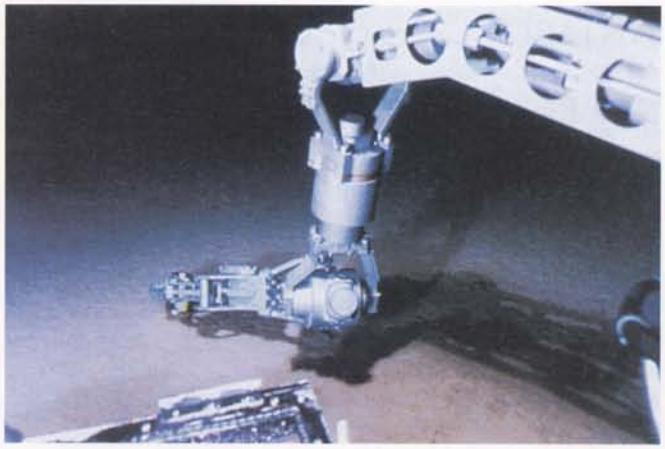


Fig. 5. The latest technology has been used for the arms of 'Kaiko' which are controlled from the ship. The controller sits on the operator's forearm and mimics the hand movement. *Photo courtesy of the Promotional Office, JAMSTEC.*

ACKNOWLEDGEMENTS

Very special thanks to Koki Horikoshi and to JAMSTEC for making it possible for me to engage in the thrill of deep-sea microbiology; to him, his DeepStar group and Dave Roberts for many stimulating conversations; to BBSRC and British Council Tokyo for funding my deep-sea work; and to Joy Colquhoun, Jo Mexson and Steve Heald in the Kent laboratory for their enthusiastic support.

FURTHER READING

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Fig. 6. Sea water is entrained through the substrata where a series of chemical reactions alter its composition and it emerges to react with the oceanic water causing precipitation of (mostly) sulphides, giving these vents their popular name of 'Black Smokers'. *Photo courtesy of the Promotional Office, JAMSTEC.*

Antarctica – A Microbial Paradise

Nick Russell

Despite the difficulties of getting to and staying in Antarctica, it probably provides the best guarantee of an undisturbed and uninhabited ecosystem in which to work.

Have you set up a field experiment, only to return later to find it vandalized beyond recall? Very frustrating and especially difficult to avoid, particularly if you do your ecological fieldwork anywhere close to urban development. Clearly, one solution is to move as far away from such development as possible, and for a Northern hemisphere microbiologist Antarctica is the ultimate. Indeed, for anyone it is a pretty remote spot in which to work! But not only is Antarctica free of inquisitive schoolchildren and bored teenagers, it probably provides the best guarantee of an undisturbed and uninhabited ecosystem in which to work. Moreover, despite the impression given by calendars and magazine articles, its ecology is dominated by micro-organisms, not penguins, seals and whales. So unless you choose to work in the middle of a penguin rookery (which does have certain attractions!) or within the close environs of one of the permanent national bases, you can select from a remarkably broad variety of undisturbed ecotypes. Only about 0.4 % of the continent is free of snow and ice during the short austral summer but the exposed soils vary widely in humidity and nutrient status. There are rocks with endolithic microbial communities hidden a few millimetres below the surface, snow and ice melts to give terrestrial (fresh)water and there are sea-ice microbial communities (SIMCOs) as well as those in free maritime waters. And it is not all cold! There are volcanoes with associated geothermal vents and warm soils. Together, these sites encompass a panoply of microbial types from bacteria to archaea, yeasts to diatoms and microalgae to lichens.

The author endolith hunting above the dry valleys.

So why isn't the SGM Membership rushing off to pursue ecological research in Antarctica?

Perhaps the single greatest reason is a logistical one, in terms of both the expense and the difficulty of getting to Antarctica, isolated by the Southern Ocean and apparently propping up the rest of the world on your drawing-room globe. Recent tales of round-the-world yachtsmen and dramatic stories of rescues have highlighted the remoteness of the region and the harsh conditions which can prevail even at the height of summer. For the scientist working there, this becomes self-evident in the journey to get the continent.

There are two ways of travelling – by boat or plane. Thankfully I have avoided the former, as romantic thoughts of gentle sea-cruising and time to read those books about the early explorers *en route* had been dispelled by tales of the disturbing effects which the Antarctic Convergence (where the circumpolar current meets the other main oceanic currents) has on ship movements and human semi-circular canals, with the well-known attendant physical manifestations! More and more, planes are replacing boats as the main means of access, whether it is flying from Port Stanley to British bases on the Peninsula or from Christchurch in New Zealand to the American base at McMurdo, about 3,000 km, as the skua flies, on the other side of the continent. The 'kiwi route' brings you into somewhat intimate contact with the US Navy and for a day or so you are subject to 'rules and regulations' as you, your special clothing and equipment are organized in military fashion, destined for a 7-hour-plus flight crammed in the belly of a Hercules transporter plane, which is definitely not designed for comfort nor indeed, it seems, for passengers at all! But first the pre-flight briefing, guaranteed to send the clientele of a scheduled BA flight running back to the safety of the terminal lounge:

If there's a fire on board we'd like to know – stay in your seats, unless the flames are directly beneath you when I guess you'd better move.

If we ditch in the sea hang on to something heavy enough to sink!

Mind you, 'seat' is a euphemism for your 15″ of open-webbing, slung from the uninsulated side structure, which is alarmingly full of what looks like too many rivets. Ear-plugs in and survival suit on, you settle down as best you can to read that trash novel bought at the airport, since conversation is impossible with the din of the engines. The less said about the bathroom facility the better.

But your first glimpse through the spy-hole windows of the trans-Antarctic mountains and the pack-ice make it all worthwhile and the adrenaline builds as finally you 'ski-land' on the sea-ice runway on the Ross Ice Shelf – you've arrived at 78° 60′ S on the world's second largest continent. Transfer to tracked vehicle (an iron box on cat tracks), trundle across the ice-shelf, negotiate the tricky ice-land interface (yes, there really is water under that apparently solid and unending vista of ice) and you are at Base Camp, Scott Base for the Kiwis and McMurdo Station (somewhat inevitably nicknamed 'Mactown') for the Yanks.

Then follows a round of sorting out equipment, briefings, check polar hollow-fill sleeping bag (no duck down for the allergic!), attend safety and survival courses (*de rigeur* for even the most experienced visitors), collect rations, check helicopter schedules, wait, recheck the 'helo-skeds', wait, log into E-mail again. Then suddenly we're off in a mad rush, after a final check that everything is in place and you are flying across the ice shelf and up the

Terra Nova Bay – the Italian base camp with the sea frozen over the bay in the mid-ground and the volcanic Mount Melbourne quietly smoking in the background.

Deploying plastic cloches in the Taylor Valley with David Wynn-Williams, to study the effects of climate change on soil microbes.

Dry Valleys with spectacular 360° mountain scenery: glaciers, snow fields, valleys and peaks all looking crystal clear in the dry, clean air, as if you could lean out and touch them. Can't believe I'm here. Then we're landing at field camp in a cloud of dust on the rocky terrain, to a big welcome from members of the advance field party. Over coffee and our Harrods shortbreads, we discuss what work is going on, camp routine, gossip and begin the process of relationship-building. Then down to the business of pitching tents, unpacking scientific gear and personal effects. Next a tour of the experimental sites, whether they be melt-ponds on an ice shelf or land, the sides of a dry valley, hidden inland valleys, a melt stream at the foot of a glacier or maritime silt at the ocean edge. Back to camp to plan experiments and first dinner with new companions – talk late into the evening about work, politics, Antarctica, latest gossip from the helo pilots, all fuelled by Jim Beam or beer or on special occasions by the (in)famous Canada glacier blue gin cocktail, complete with green olives – the latter being quite an accomplishment of logistics and forward planning.

Then clean teeth, one last look at the scenery or maybe even a walk onto the ice or along the valley to soak up the quiet remoteness in a moment of solitude after the criss-cross, often intense conversations, and then remove a few outer layers of clothing (baldies – keep the hat on!) and sink into the cosy warmth of the polar survival sleeping bag for a deep 6 hours sleep in the relative warmth of the tent. A seasoned NZ colleague has decided to take the specifications of his sleeping bag to the letter and, seduced by the panoramic view of The Royal Society mountain range, is cocooned like a grub outside his tent under the midnight sun. It is 24-hour daylight during summer, the sun blazing through the ozone hole with a skin-wrinkling intensity – not that you leave much exposed and those bits which are have been coated in factor 45 (yes, it does exist) sun-block. The continuous summer daylight means that you must, of course, set your own daily rhythms of work and sleep, but after long 'days' in the deep field or at camp, the latter is seldom a problem; time seems to be particularly precious because of the special circumstances, and long working hours are the norm.

You wake refreshed and after a quick splash with precious water collected from the glacier melt-stream a mile away – don't remove too much sunblock – breakfast on coffee and crisp rolls: the dry, cold, clean atmosphere means bread doesn't go mouldy but it does turn impressively hard!

Pack the day bag, something for lunch, don't forget to fill the water bottle and pack the complementary 'pee-bottle' (everything which comes into Antarctica must go out, in whatever form it may be) and we're off to the experimental sites. That might involve collecting soil or sediment samples, or hunting for endoliths hidden beneath the surface of weathering rocks – the debate continues about cause and effect, but it is hard not to believe that microbial colonization isn't the cause when you see the rock structure *in situ*. Or it may be to set up an experimental site, including perhaps a data logger for temperature, humidity, etc., in a moss bank or cyanobacterial mat, or UV-opaque and UV-transparent plastic cloches for studying the effects of ultraviolet exposure and thermal warming on soil microbial community structure, development and metabolism. It all takes time and effort, often a lot of walking over rough terrain, maybe some climbing and scrambling, but always in radio contact with colleagues at the camp and via them with the base camp. Perhaps the radio contact, even more than the quiet solitude, the certainty that you won't meet anyone round the next corner, emphasizes the isolation. Besides one's immediate companions, the only company will be the occasional skua or snow petrel, or perhaps a seal or penguin if you are at a coastal site. Even more remote sites are accessed by helicopter for short-term visits of a few hours to collect samples or download data from continuous-monitoring systems; longer trips may also be undertaken, the helo pilots camping out with the scientists and lending a hand where they

can, their skill and professionalism as 'flyers' often extending to their enthusiasm for working as temporary research assistants in such incredible surroundings.

Samples of soil or water may be taken for transfer back to the field camp for further investigation, to identify or isolate new species, to perform physiological measurements of respiration or photosynthesis, to make physical measurements, or to carry out our radioactive incorporations to determine metabolic pathways. The experimental systems used even in remote field camps may be surprisingly sophisticated, since small generators and fuel can be flown in to power such equipment as fluorescence microscopes, image analysers, infra-red gas analysers and oxygen electrodes. Solar panels can be used to recharge batteries for the radios and computers, which nowadays are commonplace and make available virtually instant data evaluation, manipulation and presentation. When linked to networked systems back at base, suddenly the world seems smaller and Antarctica less remote, as you make daily contact with your research group and the latest football results ... but then the weather closes in, helo ops are suspended and you are on your own preparing agar plates over the camping gas stove, and once more you are deliciously alone with only a few companions and your favourite microbes for company.

Collecting soil samples on the flank of Mount Melbourne.

P.S. Don't expect a Christmas card from me this year!

Nick Russell is Bridge Wardens' Professor of Food Microbiology, Microbiology Laboratories, Department of Biological Sciences, Wye College, Wye, Ashford, Kent TN25 5AH (Tel. 01233 812401; Fax 01233 813140; E-mail n.russell@wye.ac.uk).

Cryptosporidium and Cryptosporidiosis

Colin Fricker and Huw Smith

Water-borne transmission of the protozoan gut parasite *Cryptosporidium parvum* has received much publicity. Detecting the oocysts of this organism presents a great challenge to the water microbiologist.

Cryptosporidium parvum is a protozoan parasite with a complex life cycle, involving both asexual and sexual reproductive cycles which are completed within an individual host (monoxenous). *C. parvum* infects the enterocytes which line the intestinal tract and is responsible for cryptosporidiosis in man and domestic mammals. The intracellular reproductive stages are extracytoplasmic and reside in a parasitophorous vacuole in the brush borders of enterocytes where they interfere with fluid and nutrient absorption. Auto-infection occurs within this monoxenous life cycle ensuring the build up of large numbers of parasites. Infection is transmitted by an environmentally robust oocyst excreted in the faeces of the infected host. Oocysts of *C. parvum* are spherical (4.5×5.0 μm), are fully sporulated and infectious when excreted, with up to 1010 oocysts excreted during the course of infection.

While some infections may be asymptomatic, diarrhoea is the predominant symptom in human cryptosporidiosis and can be accompanied by low grade fever, nausea, vomiting, abdominal pain, anorexia, flatulence and a 'flu-like' illness. Symptoms last 3–20 (mean 6) days typically and there is an equal distribution of cases between the sexes. No documented effective specific drug treatment is available. Rehydration of the patient may be required in severe cases. In patients with reduced or impaired immunity, these symptoms can be protracted and the infection can be life-threatening. A severe cholera-like illness can occur resulting in intractable nausea, weight loss and severe dehydration. Except in those individuals in whom the immunosuppression can be relieved, or in whom the disease resolves, symptoms persist unabated until the patient dies.

Small numbers of infectious oocysts can cause infection in susceptible hosts. In a human volunteer study, the ID_{50} for *C. parvum* was 132 oocysts, although infection occurred in 62 % of volunteers ingesting 30 oocysts or more of an Iowa strain of the parasite. In other studies, 100 oocysts produced infection in 22 % of mice, whereas 10 oocysts produced infection in 2 out of 2 infant non-human primates tested. Five oocysts produced clinical disease in gnotobiotic lambs.

Infection can be transmitted between human beings and other susceptible non-human hosts. Transmission of infection can occur through any route by which material contaminated with viable oocysts excreted by infected individuals can reach the mouth. Whilst initial cases of human infection were believed to have been acquired from non-human hosts, person-to-person transmission of *C. parvum* is the major route. Secondary cases and possibly asymptomatic excretors can be a source of infection for other susceptible persons. Transmission can occur readily in families and among pre-school children. Cryptosporidiosis has been reported in domesticated animals including companion animals, livestock and wildlife and these may be important reservoirs of human infection. The broad host range exemplified by *C. parvum* and the high output of infective oocysts from numerous mammalian hosts

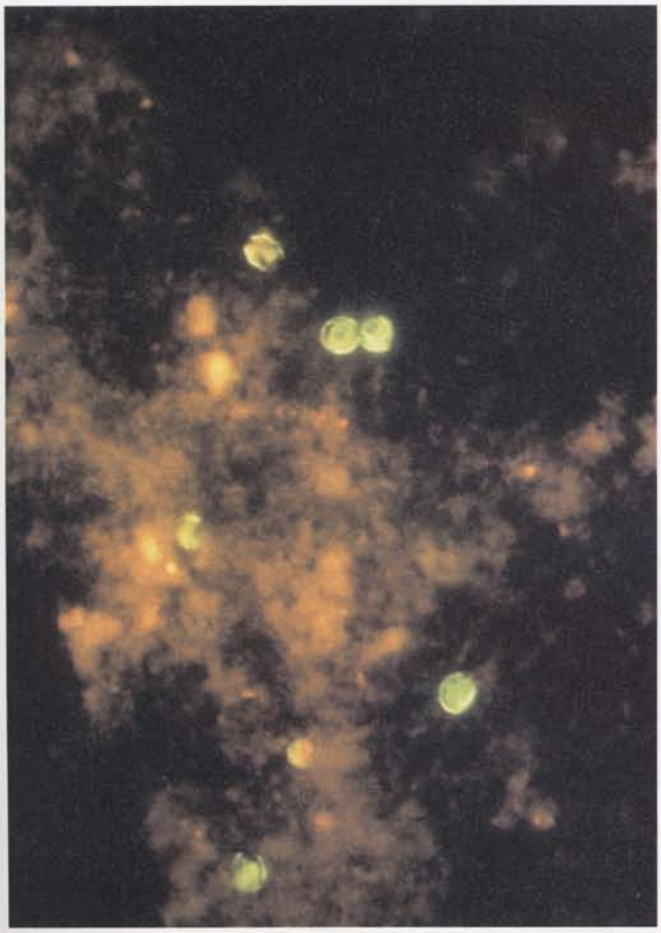
ensures a high level of environmental contamination. Food-borne and air-borne routes have been documented, but further evidence is required to clarify the significance of these routes of transmission. Sexual transmission has also been documented. Outbreaks of cryptosporidiosis have been recorded in nursery schools, day-care centres and playgroups, in institutions and hospitals, following touching/holding/feeding infected lambs and calves during educational farm visits, following consumption of oocyst-contaminated apple cider, following the accidental ingestion of swimming pool water and the consumption of contaminated drinking water.

Water-borne transmission of *C. parvum* has received much publicity and, over the last 10 years, 17 water-borne outbreaks, affecting over an estimated 418,000 individuals, have been documented. Water-borne outbreaks in the USA and the UK have been associated with untreated drinking water, water receiving chlorine disinfection only and water receiving conventional treatment (e.g. coagulation, sedimentation, sand filtration and chlorination).

The detection of *Cryptosporidium* oocysts in water has become the most challenging task facing the water microbiologist, largely because the organism cannot be cultured *in vitro* from environmental samples and because the levels of detection which are required are so low. The process of detecting the organism can be broken down into three basic steps, namely concentration, separation and detection. Each of these steps has its own problems and each of these needs to be addressed to substantially improve the overall method. Whilst there is a draft UK standard method, no single procedure is suitable for all water types or for all purposes. When selecting a method to be used for analysing water samples, the type of water and the reason for sampling should be borne in mind.

Since the infectious dose of *C. parvum* is low, it is important that the sensitivity of the procedure for detecting these organisms is high and that wherever possible, large volumes of water should be examined. Currently, three methods of sample collection are utilized in the UK: cartridge filtration, membrane filtration and calcium carbonate flocculation. Cartridge filtration has the advantage that large volumes of water can be concentrated although the efficiency of the concentration and subsequent elution of the captured material has been questioned. Both membrane filtration and calcium carbonate flocculation suffer from the problem that only a relatively small volume (up to 40 litres) can be concentrated. This may be adequate in some cases, but monitoring of treated drinking water should, wherever possible, utilize larger volumes. However, concentration of large volumes of water may not be beneficial if the amount of resulting material is so large that only a small fraction can be examined. For this reason, a separation or purification step is required to separate oocysts from other particulate materials. Three such techniques are available, a density separation based on flotation of samples on a sucrose solution of known density, flow cytometry with fluorescence-activated cell sorting (FACS) and immuno-magnetic separation (IMS). Of these, the most widely used world-wide is sucrose flotation, despite the fact that the recovery efficiency of this step is extremely low. The use of flow cytometry for the detection of *Cryptosporidium* oocysts was first described in 1991 and subsequently FACS was successfully applied to the separation of oocysts from other particulates. This technique has now become widely used throughout the UK although it is expensive, requires considerable expertise and may not be suitable for some samples. IMS appears to offer a simple and reliable way of separating oocysts from other particulates, but initial work showed that the efficiency of the procedure was severely compromised by the high levels of particulates. However, more recently, the use of an IgG anti-*Cryptosporidium* antibody in place of the previously used IgMs showed that the presence of particulates had far less effect. The detection of the oocysts relies on the use of monoclonal antibodies labelled with FITC and examination of water concentrates with epifluorescence microscopy. Preliminary or presumptive identification can usually be made on the basis of size and shape of the oocyst, but definitive identification requires the examination of suspect particles with differential interference contrast microscopy (DIC) with which the internal structures of the oocyst can be examined. Whilst DIC can aid considerably in identifying oocysts, one problem is that a large proportion of oocysts found in the environment have lost their contents and are therefore impossible to identify absolutely. Although these oocysts are of no health significance *per se*, the detection of any oocysts in treated drinking water is cause for concern since their presence demonstrates that oocysts are passing through treatment and thus that viable and infectious oocysts may also be present. This issue of viability of oocysts has prompted considerable effort aimed at developing assays to determine viability. The most widely used of these for environmental samples is the DAPI/PI technique developed at the Scottish Parasite Diagnostic Laboratory in Glasgow.

There are a considerable number of reports in the literature describing the recovery efficiency of various techniques and whilst some reports quote recoveries of up to 70 %, it is generally accepted that the true recovery varies considerably between samples. This variation is due to a number of factors including water quality, the age and condition of the oocysts, the method employed and the operator, and the likely recovery efficiency for naturally occurring samples is in the range of 0–25 %. Considerable efforts are under way to develop more efficient and reliable procedures for oocyst detection but as yet there has been no substantial improvement in the methods employed in routine laboratories. This can largely be attributed to the difficult nature of the task and the lack of research monies.



Cryptosporidium oocysts stained with an FITC-labelled monoclonal antibody.

Colin Fricker is at Thames Water Utilities in Reading and Huw Smith is at the Scottish Parasite Diagnostic Laboratory in Glasgow.

VERO CYTOTOXIN-PRODUCING *ESCHERICHIA COLI* O157: CAUSE FOR CONCERN

Henry R. Smith

A recent outbreak of fatal illness associated with meat products in Scotland has focused public attention on *E. coli* O157, an enteric pathogen which has emerged in the past 15 years. What is this organism and why is it so important?

Escherichia coli O157 has had considerable media coverage in recent months following the large outbreaks in Japan and Central Scotland in 1996. Problems associated with this organism and food safety have been highlighted particularly in relation to abattoirs and handling of meats in retail outlets. Although the numbers of infections are small compared with those resulting from *Campylobacter* or *Salmonella*, the severity of disease frequently associated with Vero cytotoxin-producing *E. coli* O157 has demonstrated why infections caused by this pathogen should be regarded as an important public health problem.

Vero cytotoxin (VT) was first described in Canada in 1977 when it was observed that there was a cytotoxic effect on Vero cells (African green monkey kidney cells) with culture supernatants of certain strains of *E. coli*. However, it was not until 1982/83 that the importance of Vero cytotoxin-producing *E. coli* (VTEC) in human disease was recognized. VTEC strains of serogroup O157 (O157 VTEC) were isolated in the United States and Canada from patients with severe bloody diarrhoea. In the same year a close association was reported between VTEC, including strains of serogroup O157, and haemolytic uraemic syndrome (HUS), a disease characterized by acute renal failure. The early studies showed that the O157 VTEC strains usually possessed the flagellar antigen H7 and were distinguishable from most other *E. coli* strains because they did not ferment sorbitol. Although strains of serogroup O157 are the most important in human disease at present, *E. coli* of many different serogroups produce VT. There are two main classes of VT belonging to a family of related toxins that includes Shiga toxin produced by *Shigella dysenteriae* type 1 and the plant toxin, ricin. For this reason VTEC is also termed Shiga-like toxin-producing *E. coli*. The biological activity of all these toxins in eukaryotic cells is to inhibit protein synthesis by cleavage of a specific glycosidic bond in the 28S rRNA.

O157 VTEC can cause a wide spectrum of disease from a mild diarrhoea to haemorrhagic colitis and HUS. Symptoms of haemorrhagic colitis often begin with abdominal pain and watery diarrhoea, followed by bloody diarrhoea frequently without fever. In addition to acute renal failure, HUS is characterized by haemolytic anaemia and thrombocytopaenia (reduced number of platelets). HUS occurs in all age groups but is most common in young children and is the major cause of acute renal failure in children in Britain and several other countries. The receptor for VT, the glycolipid Gb3, is present in human renal cells and human renal endothelial cells grown in culture are very sensitive to the action of VT. Approximately 10% of cases with O157 VTEC infection develop HUS but the reasons why only certain individuals are affected are not understood. Fatal cases occur in all age groups but are more common in young children and the elderly. As seen in the recent Central Scotland outbreak, the mortality rates may be up to 5% and have been much higher in some institutional outbreaks.

One of the major routes of transmission of O157 VTEC to humans is through the consumption of contaminated foods, particularly inadequately cooked minced beef, such as beefburgers, and unpasteurized milk or milk contaminated after pasteurization. Other vehicles of infection are cooked meats, meat pies, yogurt, cheese, fermented sausage, raw vegetables, unpasteurized apple juice and water. Poor hygiene practices can result in cross-contamination from raw to cooked or ready-to-eat foods. The infectious dose of O157 VTEC appears to be very low, probably less than 100 organisms, and this is an important factor in the transmission of these organisms. Healthy cattle are the main reservoir for O157 VTEC, although they have also been detected recently in sheep. In the abattoir carcasses become contaminated from faecally soiled hides and contact with intestinal contents at slaughter. There have also been reports of isolations of O157 VTEC from deer, goats, horses, geese, dogs and seagulls. Contamination of the farm environment is likely to lead to the spread of the organisms to different animals and the control of this will be very difficult. O157 VTEC can survive under a wide spectrum of conditions including low pH. Direct contact with farm animals has resulted in sporadic infections and outbreaks have been linked to farm visits. Person-to-person spread is an important route of transmission in family outbreaks and in institutions such as nurseries and homes for the elderly. The duration of excretion of O157 VTEC appears to be longer in young children than in older children and adults; O157 VTEC positive stool cultures detected more than 3 weeks after onset of symptoms have been reported in several outbreaks. This is clearly of importance in the prevention of spread in institutional outbreaks.

There has been a significant increase in the isolations of O157 VTEC and a rise in outbreaks caused by this pathogen in Britain and several other parts of the world. The numbers of confirmed isolates of O157 VTEC in 1996 in England and Wales, and Scotland were 660 and 506, respectively. The rates per 100,000 population are variable throughout Britain with the highest rates in Scotland. The doubling of the rate for Scotland in 1996 compared with 1995 was due to the Central Scotland outbreak from which 272 cases were confirmed by isolation of O157 VTEC (Fig. 1).

The increases probably result from improved isolation techniques and better ascertainment as well as a true increase in infections caused by O157 VTEC. The age range of affected individuals is very wide with a peak in children less than 4 years old. Most cases of O157 VTEC infection appear to be sporadic but outbreaks occur both in family settings as well as in institutions and the community. In Britain there have been over 40 general outbreaks in the last 3 years

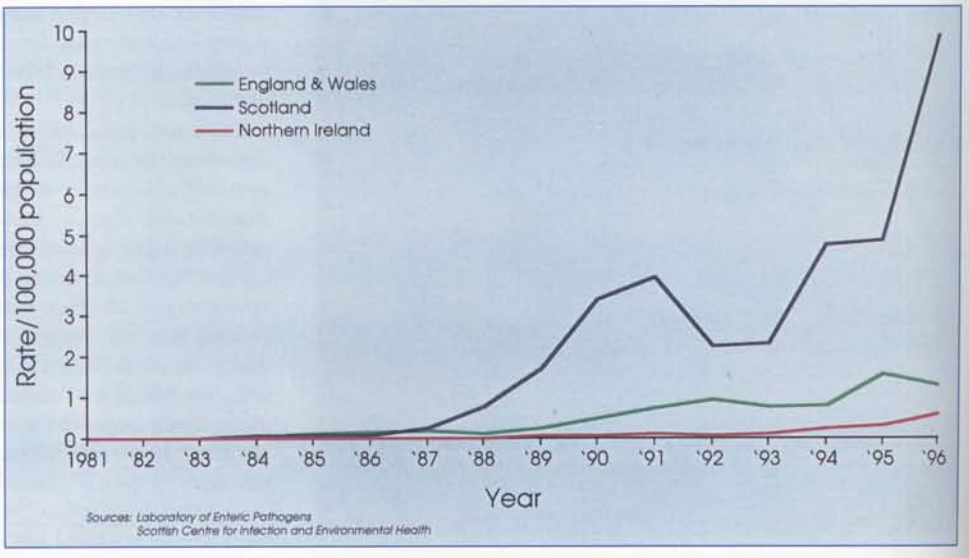


Fig. 1. Isolation rates of VT-producing *E. coli* O157 in the UK, 1981–1996.

TABLE 1. EXAMPLES OF OUTBREAKS CAUSED BY *E. COLI* O157 VTEC

Country	Setting	Cases (fatalities)	Likely mode of transmission
USA (1982)	Restaurants	26	Beefburgers
Canada (1985)	Nursing home	73 (17)	Sandwiches, person to person
USA (1989)	Community	243 (4)	Water
England (1991)	Restaurants	23	Beefburgers
USA (1992/93)	Restaurants	732 (4)	Beefburgers
England (1994)	Farm visit	7	Animal contact
Scotland (1994)	Community	100 (1)	Milk
Japan (1996)	Schools, community	c. 10,000 (13)	Foods
Scotland (1996)	Community	496 (18)	Cooked meats, gravy

with most of them affecting only small numbers of people. Table 1 shows examples representing different countries, settings, food vehicles and modes of transmission.

Most of the largest outbreaks caused by O157 VTEC have occurred in the last few years and often involved the wide distribution of particular foods. In the western United States in 1992/1993 an outbreak was caused by contaminated beefburgers from multiple outlets of a restaurant chain. The identification and withdrawal of the incriminated batches were considered to have limited the scale of the outbreak. In Japan over 10,000 cases were reported in several different prefectures between the end of May and September 1996 with the largest focus in Sakai city where over 6,300 people were ill in July. Most of the victims were school children and it was thought that school meals, from central kitchens serving many schools, were the source of infection, but specific food vehicles were not identified. The largest outbreak in Britain occurred in Central Scotland in late 1996 where there were 496 cases and 18 deaths. The infections were associated with consumption of meat and gravy originating from a butcher. The scale and severity of outbreaks are clearly dependent on the distribution of the vehicle of infection and the population affected, with young children and the elderly being most at risk.

Measures for the control and prevention of O157 VTEC infections have been addressed in Britain. In 1995 the Advisory Committee on the Microbiological Safety of Food produced a report on VTEC and following an investigation of the Central Scotland outbreak a group chaired by Professor Hugh Pennington has just published their final report. The 1995 report made several recommendations for prevention and control measures in relation to VTEC in foods. Relevant sections of the food industry should adopt a Hazard Analysis Critical Control Point (HACCP) approach to prevent contamination by VTEC and to minimize their survival in food. The sale of unpasteurized milk should be banned in England, Wales and Northern Ireland. Other important recommendations included guidance for basic good food hygiene practices such as thorough cooking of foods, particularly minced beef and minced beef products, and improved labelling of foods, including cheese made from raw milk. Many of these recommendations made in 1995 were included and extended in the final report by the Pennington Group. They made 32 recommendations in eight major areas covering all aspects of food production and consumption from 'farm to fork'. The Government accepts all the recommendations and some of the major changes that have been proposed will require new or revised legislation.

Any effective control and prevention measures must break the three major transmission routes, that is, food-borne infections, direct or indirect contact with animals and person-to-person spread. The guidelines for the control of spread of infection, particularly in institutions, must take account of the low infectious dose and the severity of disease, especially in young children and the elderly. To increase safety measures in laboratories, the Health and Safety Executive have proposed that VTEC be reclassified from hazard group 2 to hazard group 3 and this will be implemented in 1997. Effective control of the public health problems caused by O157 VTEC will depend on much improved communication, collaboration, education and training, including the Government, public health organizations, consumers and all relevant sections of the food and agricultural industries.

Henry R. Smith, Laboratory of Enteric Pathogens, Central Public Health Laboratory, 61 Colindale Avenue, London NW9 5HT.

FURTHER READING

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ESCHERICHIA COLI O157: FROM FARM TO FORK AND BEYOND

Bernard M. Mackey and Glenn R. Gibson

As a follow-up to the previous article, microbiologists from the Institute of Food Research consider some strategies which show promise for controlling *E. coli* O157 in the future.

Escherichia coli serotype O157 was first isolated from piglets with enteritis in 1972, and strains of *E. coli* producing a toxin active against cultured Vero cells were first described in 1977. Genetically, the O157:H7 clone, linked with haemorrhagic colitis, is more closely related to O55:H7 strains that are established human pathogens, than to strains of O157 associated with enteric infections in animals. It is now believed that a new pathogen emerged when an O55:H7-like progenitor, already possessing a mechanism for adherence to intestinal cells, acquired determinants for Shiga-like toxins and plasmid-encoded adhesins.

As already described (p. 54), the first outbreaks of human food poisoning caused by Vero cytotoxic *E. coli* O157:H7 occurred in 1982 in the US and Canada and the number of laboratory-confirmed cases in the UK is increasing year on year.

CONTROL IN THE FOOD CHAIN

Foods most commonly implicated are under-cooked minced beef and unpasteurized milk. However, outbreaks have also been associated with cheese, salami, raw vegetables, unpasteurized apple juice and water. The infective dose, estimated from counts of the organism in foods associated with outbreaks, appears to be less than 50 organisms.

The percentage of bovine carcasses infected is typically 1–5%, but the incidence is very variable and higher levels have been reported. One study showed that *E. coli* O157 could be isolated from 2–3% of frozen beefburgers or minced beef, but was not detected in ready-to-eat products.

The factors affecting carriage in live cattle and the particularly high incidence of the organism in Scotland are not understood.

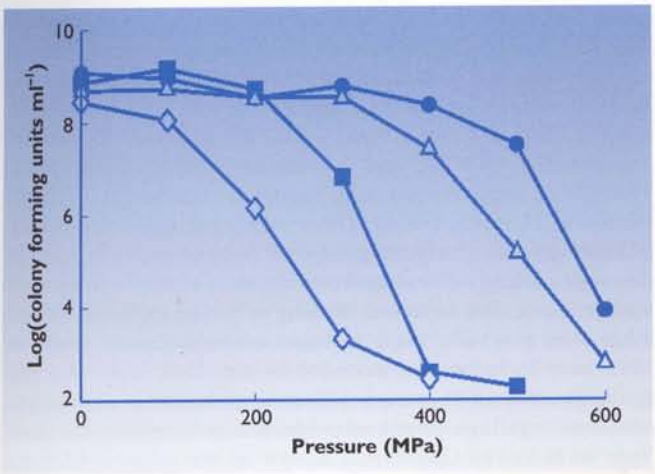

Fig 1. The effect of pressure on viable counts of *Pseudomonas fragi* (◇), *Hafnia alvei* (■), *Salmonella thompson* (△) and *Listeria monocytogenes* (●) after 5 min treatment.

The Pennington Report (1997) has concluded that research should be carried out on prevalence of the organism in Scottish cattle and the biology of its carriage. If an association can be established between *E. coli* and dietary factors, husbandry practice or handling before slaughter, it may become possible to reduce the probability of carriage by appropriate preventive measures.

During slaughter, there is ample opportunity for bacteria present on the hide or in the gut to be transferred to the meat surface. During recent years legislation has been introduced to improve hygienic standards in slaughterhouses. The regulations cover separation of clean and dirty areas, cleaning of equipment and specifications of materials to be used on walls, floors and surfaces. While these measures are desirable, it must also be recognized that the key to hygienic slaughter lies in the skill of the slaughtermen. Dirty carcasses can arise in clean surroundings if evisceration is carelessly done and the gut is punctured, or if dirt is transferred by hand from the hide to the carcass surface. Conversely, a skilled slaughterman can produce clean carcasses, even working in primitive conditions.

Attempts to decontaminate carcasses using hot water, organic acids, chlorine, infra-red, nisin and trisodium phosphate have often been disappointing. Nevertheless, any treatment that reduces numbers and incidence of the organism on carcasses would lower risk to the consumer. The use of a steam vacuum sanitizer system that reduced numbers of *E. coli* O157 on beef tissue by about 5 log units has been approved by the USDA.

The minimum growth temperature of *E. coli* in most media and food is around 6–8 °C, but is lower in media containing lactose. The risk of *E. coli* O157 growing under refrigerated storage may thus vary depending on the type of food. Published data do not indicate unusual heat resistance in *E. coli* O157. The UK advice is that food should be heated to an internal temperature of 70 °C for 2 min. Based on published D and z values for inactivation in beef, this would reduce numbers by around 50 log units. These guidelines are considerably more stringent than the corresponding US regulations. For example, the FDA recommended that burgers be heated until the temperature reaches 155 F (68.3 °C), no holding time being specified. Investigation of an outbreak in Washington State in 1993 revealed that some restaurants were only cooking hamburger patties to 56 °C.

Reports that *E. coli* can survive in acid conditions have caused concern in the food industry. In 1993 and 1996, outbreaks of HUS in the western USA and Canada were associated with consumption of unpasteurized apple juice. It was shown that the organism could survive in the product for up to 31 d at pH 3.6–4.0. Subsequently, several reports of the acid tolerance of the organism under laboratory conditions have emerged, though the results are somewhat variable. The basis of this variation and the mechanisms involved are currently being investigated at IFR and elsewhere.

With continued consumer pressure for fresher more natural foods there has been a trend towards milder processing and the decreased use of preservatives. We are investigating the use of high hydrostatic pressure to inactivate pathogenic micro-organisms, particularly *E. coli* O157 and *Listeria monocytogenes*. Since this can be done without the application of heat, flavour compounds are not destroyed. Pressure is known to affect several components of the microbial cell, including enzymes, ribosomes, nucleic acids and membranes, but critical events leading to cell death have not yet been identified. Resistance to pressure varies between species and depends on the food environment in which cells are pressurized. Strains of *E. coli* O157 show great variation in pressure resistance, some being more resistant than *L. monocytogenes* shown in Fig. 1.

Strain variation in resistance to inimical conditions appears to be a feature of many food-borne pathogens, including *E. coli* O157, *Salmonella typhimurium*, *S. enteritidis* and *L. monocytogenes*. Mutations in *rpoS* in *E. coli* O157 affect resistance to acid, heat, salt and starvation, and it will be interesting to discover whether variation in resistance of natural isolates is related to *rpoS* activity. There is now some concern that the stress responses, needed to survive in lightly preserved food, may enhance virulence.

The ability to predict the behaviour of microbes in food from a knowledge of food composition and structure is of great use to industry and allows the number of empirical inoculated pack trials to be reduced. Data for predicting growth of *E. coli* O157 have been generated at IFR for inclusion in *Food MicroModel* and the predictions have been satisfactorily validated by comparison with published growth rates in different foods (Fig. 2).

BEYOND THE FORK

There is another aspect which may prove useful in prophylactic management of gastrointestinal infections. This involves the gut microflora composition and activities. The human colon contains a vast diversity of bacterial species, with well over 90% of total cells in the body being prokaryotes in the large intestine. The gut microbiota comprises some bacteria that offer improved colonization resistance – mainly the lactic microflora. For this reason, and other purported health benefits, organisms such as bifidobacteria and lactobacilli are added as probiotics to fermented milk products and are also available as 'over the counter' lyophilized forms. Records show that probiotics ('soured milks') have been ingested by humans since pre-biblical times. However, it is unclear how well the bacteria survive after ingestion.

An alternative is to use prebiotics which are non-digestible food ingredients that are selectively metabolized only by certain components of the colonic microflora. They are, therefore, non-viable food components which are specifically fermented by the indigenous 'health-promoting' genera. Oligosaccharides that contain fructose have the ability to stimulate bifidobacteria such that, after a short feeding period, they become numerically predominant in the faeces of human volunteers (Fig. 3).

Is there any mileage in improved microflora management, through prebiotics, directed towards prevention of gastrointestinal infection such as that caused by *E. coli* O157? Our recent research has

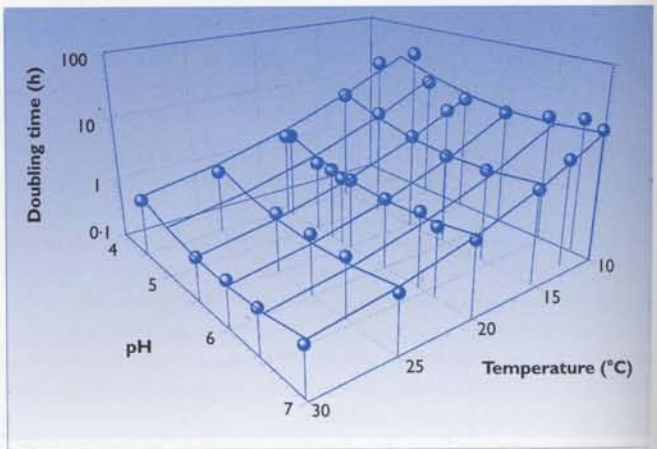

Fig 2. A quadratic response surface fitted to growth rate data for *E. coli* O157. The quadratic function is then used to predict growth as a function of the environmental conditions.

shown that some species of *Bifidobacterium* (mainly *B. infantis* and *B. longum*) are able to exert powerful antagonistic activities towards *E. coli* O157. That is, in laboratory cultures, the bifidobacteria exerted an anti-microbial activity which was not related to pH or growth media constituents.

The story possibly takes on an added relevance with the recognition that faecal bifidobacteria show a marked decrease above the age of about 55 years. It may be less than a coincidence that the recent UK fatalities during the *E. coli* outbreak have involved the elderly. There could be a connection between reduced pathogen resistance, low numbers of bifidobacteria and the natural production of inhibitory factors.

Whilst the analogy will remain conjectural for the recent outbreaks, it may be that improved colonization resistance is achievable through prebiotic usage, with the elderly being an important target group. Prebiotics occur in over 30,000 plant materials; however, the current dietary level is probably not sufficiently high to markedly affect the gut flora composition. Intake of higher quantities is possible though their extraction, purification and possible incorporation into more common foodstuffs such as cereals, cakes, confectionery, etc.

Protective effects in the gut are likely to be multi-factorial; however, it is possible that organisms like bifidobacteria do contribute. Apart from the direct antimicrobial effects mentioned above, other mechanisms that may involve the normal flora include a lowering of the gut pH, competition for binding or receptor sites normally occupied by pathogens, competition for nutrients or other growth factors) and better immune status.

Improved hygiene between the farm and fork is paramount; however, there may be an additional preventative strategy beyond the latter.

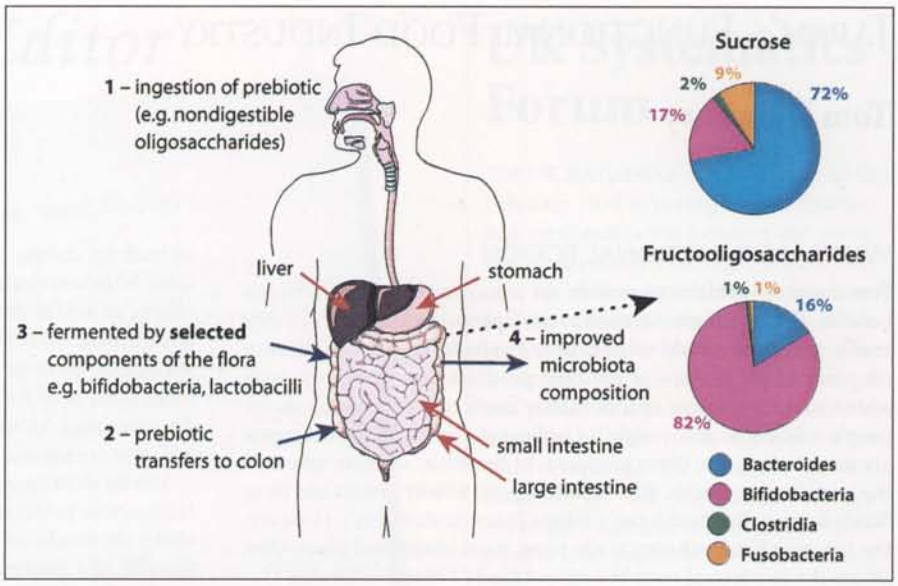

Fig. 3. The prebiotic concept and a diagrammatic representation of how 15 g oligosaccharides d^{-1} for 15 days can influence the faecal microflora composition. The data are from a human volunteer trial that involved a controlled diet, the only variable being addition of sucrose or fructose.

Bernard M. Mackey and Glenn R. Gibson are from the Microbiology Department, Institute of Food Research (IFR), Reading.

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JAPAN'S FUNCTIONAL FOOD INDUSTRY

Tom Salusbury

Japan has a unique functional food industry. This is now a burgeoning sector, with 73 products available. Japan may have a 10 year lead in what may become a huge global industry.

WHAT ARE FUNCTIONAL FOODS?

Functional foods claim to provide the consumer with certain health benefits. They are of great interest to the Japanese food industry as they enable companies to add value to their products. They are an advance on previous generations of enriched products (e.g. margarine with added vitamins) and or special dietary foods (e.g. reduced foods for people wishing to lose weight). Confusingly, several different terms are used to describe these products. In the West, we have invented the term 'nutriceuticals'. The Japanese government prefers the term 'foods for specified health use' ('*tokutei hoken yo shokuhin*'). However, the Japanese food industry, trade press, mass media and consumers all use the less formal term 'functional foods' ('*kinosei shokuhin*').

DEVELOPMENT OF THE FUNCTIONAL FOOD INDUSTRY

The foundations of the Japanese functional food industry were laid in 1984 by Professor Fujimaki at the University of Tokyo. Professor Fujimaki's team took food research into a new area, different from traditional studies of nourishment, wholesomeness, fortification and reducing certain ingredients. Instead, they looked at ways of enhancing factors such as immunity, disease-resistance factors and the control of serum cholesterol through special foods.

The Ministry of Health & Welfare (MHW) is the agency responsible for both food safety and the pharmaceutical sector. In June 1993, the MHW approved Japan's first two functional foods: Shiseido's Fine Rice (with reduced globulin) and Morinaga's Low Phosphorus Specialized Formula LPK (for renal dialysis patients). Other products followed and by October 1996, the number of functional foods available to the Japanese consumer had risen to 73. The trade paper *Nikkei Biotechnology* estimated that the Japanese functional foods market is now worth over ¥30 billion (£150 million) per year. Takara Shuzo's Calcium Parlor (a soft drink with increased bioavailability of calcium) accounts for 70% of total sales. Between 1994 and 1995, sales of this product increased by 250%. Other popular products are Suntory's Yoghurina (with 13% of total sales) and Calpis Food Industry's Oligo CC (14%). Both are drinks which increase the number of bifidobacteria in the gut.

Products which satisfy the MHW's criteria can be marketed widely. They are sold in pharmacies, as well as supermarkets and convenience stores. All of these products carry an official MHW mark to denote their status as 'foods for specified health use'. They must contain only natural food ingredients and must not contain any drugs or artificial additives. The health benefit claimed must be explained clearly on the label, together with an indication of how much needs to be eaten to achieve the desired effect. For example:

> *For people concerned about cholesterol. Regular use can reduce the level of cholesterol in your blood by 10%. Should* **not** *be taken by hypercholesterol patients.*

THE APPROVAL PROCESS

To gain approval, the manufacturer must demonstrate that the product has a beneficial effect. These beneficial effects might include control of serum cholesterol, prevention of tooth decay, reduction in the effects of allergens, improved absorption of minerals, control of serum glucose, encouraging the growth of beneficial gut bacteria and the control of blood pressure. The aim is not to prevent disease but to promote health in healthy people.

The approval process involves seven relatively simple steps. The first step is for the company to approach the local public health centre and local authority. Further steps involve a submission to the MHW Office of Health Policy on Newly Developed Foods, a presentation to an evaluation committee of 42 experts and testing at MHW's National Institute of Health & Nutrition. Experimental data must be submitted to back up claims, though the actual research does not have to be done in Japan. Companies usually show evidence of *in vitro* health effects, as well as demonstrating the effects in experimental animals and humans. Here MHW have prepared extensive guidelines to help applicants. As most products contain traditional food components, there is no need for the detailed efficacy and toxicity tests required for new drugs. However, there is an extra step for a natural product which is not normally eaten in large amounts, such as chitosan.

The list of 73 approved products includes 22 oligosaccharides and 15 lactosucrose preparations. All claim to be suitable for those concerned about the condition of their gut, as they encourage bifidobacteria to flourish. In a country where osteoporosis is common, it not surprising to find three products which claim to increase calcium absorption. Other products contain soy protein ('to reduce high blood cholesterol'), chitosan ('to inhibit cholesterol absorption in the gut'), fibre (both insoluble and soluble types) and a *Eucommia* leaf glycoside ('to relieve mild hypertension'). Some chocolates and chewing gums contain green tea polyphenols, which are claimed to counteract the tooth decaying properties of the main ingredients.

WHAT NEXT?

Food companies have many new products in the pipeline. Some are trying to develop new areas. Japan has several long-standing laws which prevent quacks from claiming that their products can cure cancer. However, the MHW officials we have spoken to conceded that some claim for cancer-fighting properties might be permissible in the future (perhaps using wording like 'encourages the organisms in your stomach which fight cancer'). However, they would have to see "mountains of evidence" before allowing this type of claim. If such products could be developed, this would be a major step for the industry.

A MARKET OVERSEAS?

In 1995, a team of visiting British nutritionists concluded that Japan is at least 10 years ahead of Europe in the development of functional foods. Since the mid 1980s, the UK food industry has devoted most of its research effort into foods for special dietary uses, such as low calorie products. The industry is now trying to improve its product range and to add value in other ways. Several British companies are now thinking of entering the functional foods market but they were divided on whether there would be a real market for these foods in Europe and uncertain about the response of legislators. (Historically, health claims have always been banned in Europe.) However, there are now some new products which could justify health claims. One problem is that enforcement of food labelling is dealt with at the local level. It is up to individual trading standards officers to challenge claims made in food labelling. One solution might be for the food industry to set up voluntary guidelines, based on an established mechanism for substantiating health claims.

Japan is the world's largest importer of food. In 1993, Japan imported $723 billion of foodstuffs, fish, meat, fruit, vegetables and grain. Total exports came to only $27 billion. Although they will never become major exporters of foods , several Japanese companies (including Ajinomoto and Yakult) have established a presence in Europe and the USA. Selling functional foods could be a way of breaking into these markets, either through exports or local manufacture. In technology, most of Japan's major food companies are integrated both vertically (food ingredients, processing etc.) and horizontally (cosmetics, pharmaceuticals etc.). They certainly have the technological capability to do this.

Tom Salusbury has just left the British Embassy in Tokyo after 6 years as First Secretary Science & Technology. He now works for the DTI.

Letter to the Editor

Dear SGM Quarterly Editor

Re: David Harrison's article on how bacteria swim in February's SGM Quarterly

Please contact the British Olympic Association immediately. Britain has in David Harrison a certain swimming gold medal winner for the Sydney Olympics in 2000!

Clearly, David is a pretty handy swimmer. He estimates that he can swim "several body lengths a second". Let's assume he is 1.8 metres tall and that "several" body lengths means three. He could therefore swim at 5.4 metres per second and cover 50 metres in a little over 9 seconds.

As a comparison, the official male world record for swimming 50 metres freestyle is about 22 seconds. Assuming this swimmer is also 1.8 metres tall, he was doing a rather pathetic $1^{1}/_{4}$ body lengths per second.

David - your country needs you for the Sydney Games. We can't keep depending on oarsman Steve Redgrave to get us into the medals!

(I wonder if David wears his underpants over his trousers and avoids kryptonite?).

Yours in awe,

UK Systematics Forum

THE UK SYSTEMATICS FORUM was set up in February 1994 to promote co-ordination and communication between the major UK collections-holding institutions and the wider systematics community. In May 1996 the Forum began work on developing a national strategy for systematic biology research. As part of this initiative, it has recently carried out a survey on user needs for systematics and completed the analysis of the database of UK systematic biology expertise. Summaries of both these reports are available on the Forum's Web Page: http://www.nhm.ac.uk/uksf where details of all the other activities of the Forum are also posted.

Further information may also be obtained from:
The Secretary, UK Systematics Forum
c/o The Natural History Museum
Cromwell Road, London SW7 5BD
Tel. 0171 938 9522
Fax 0171 938 9531
Email: ew@nhm.ac.uk

Scientist–School Liaison

SCIENCE IS A COMPULSORY PART of the National Curriculum in England, Wales and N. Ireland, but it is often taught by teachers who have little direct experience of the subject outside school. Practising scientists who develop links with schools can considerably enhance the education received by pupils in a variety of ways. They can bring science alive – demonstrating the relevance of their work to everyday life and communicating the excitement and challenges of research – as well as promoting the understanding of their subject or helping with laboratory practicals. Interaction can be with primary schools, secondary schools or tertiary colleges (or all three!).

Many scientists prefer to form a link with one school, or even one teacher within a school, participating in a set of activities which have been agreed. Others want to interact with more than one local school or college, perhaps by giving a talk, offering work placements for pupils or teachers, showing school parties around their workplace laboratories or sites, putting on practical demonstrations or donating surplus equipment to school laboratories. There are also some schemes to promote scientific research in schools which will be covered in greater detail in a future issue of the *Quarterly*.

Interested in promoting microbiology in this way? There are now a number of guides to assist scientists who want to make links with schools, some of which have been produced by the Research Councils to assist their own scientists who now have to promote their work to the public as a condition of their grant, but which have a wider application.

BBSRC has two useful booklets: *Making that Link: A practical guide to scientist–school liaison* and *Scientists and Primary Schools: A practical guide*. The former contains lots of information on how to run various activities and events, with detailed examples of initiatives that have already been carried out. Several of these feature SGM members who are active in promoting microbiology and biotechnology to schools. This booklet also has a useful bibliography and list of relevant organizations. The booklet aimed at working with primary schools gives some general background information for scientists and then describes starting points for investigations linked to the National Curriculum. Copies are available from Tracey Reader, BBSRC, Polaris House, North Star Avenue, Swindon, Wilts SN2 1UH.

The Medical Research Council issue two free publications : *Scientists Talking to Secondary Schools*, which includes tips on how to make a schools talk a success (and some danger points to avoid!), and *Scientists Making Links with Primary Schools*, which describes the successful MRC Teacher–Scientist Link Scheme as a model and gives useful tips, strategies and ideas. Contact the Education Officer, MRC, 20 Park Crescent, London W1N 4AL.

COPUS (c/o The Royal Society, 6 Carlton House Terrace, London SW1 5AG) offers *Bringing Science to Schools*, a leaflet for scientists in research institutions and higher education departments. This includes a good overview of the range of potential activities and describes the activities of various bodies engaged in this area of work.

Single copies of all of these publications are free. *Scientific Research in Schools: A Compendium of Practical Experience* is also free but £2 is required to cover postage and packing. It is available from The Clifton Scientific Trust, c/o 49 Northumberland Road, Bristol BS6 7BA. It includes individual case studies of scientific research carried out in schools, details of science education partnerships, an information index and a bibliography.

Whatever you decide to do, particularly in the way of practical microbiological work, safety considerations should be paramount. The Association for Science Education (College Lane, Hatfield, Herts AL10 9AA) has several useful publications which include detailed guidance on microbiology and biotechnology investigations. These include *Be Safe* (for Key Stages 1 & 2), price £4.95, *Topics in Safety* (£7.50) and *Safeguards in the School Laboratory* (£9). The DfEE has recently published *Safety in Science Education* (£14.95 from HMSO Publications Centre, PO Box 276, London SW8 5DT), but the microbiology section is severely flawed and contains a number of errors.

Finally anyone wishing to promote microbiology in schools should contact MISAC (Microbiology in Schools Advisory Committee) c/o Janet Hurst at SGM HQ. A number of factsheets are available on resources, speakers and so on.

Plant Virus Epidemiology and Control Training Course

International Institute of Tropical Agriculture, Ibadan, Nigeria

J. Michael Thresh

Financial support from SGM and other organizations enabled me to assist Jacqueline Hughes, virologist at the International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria, in holding a training course in November 1996 on the epidemiology and control of viruses of tropical crops.

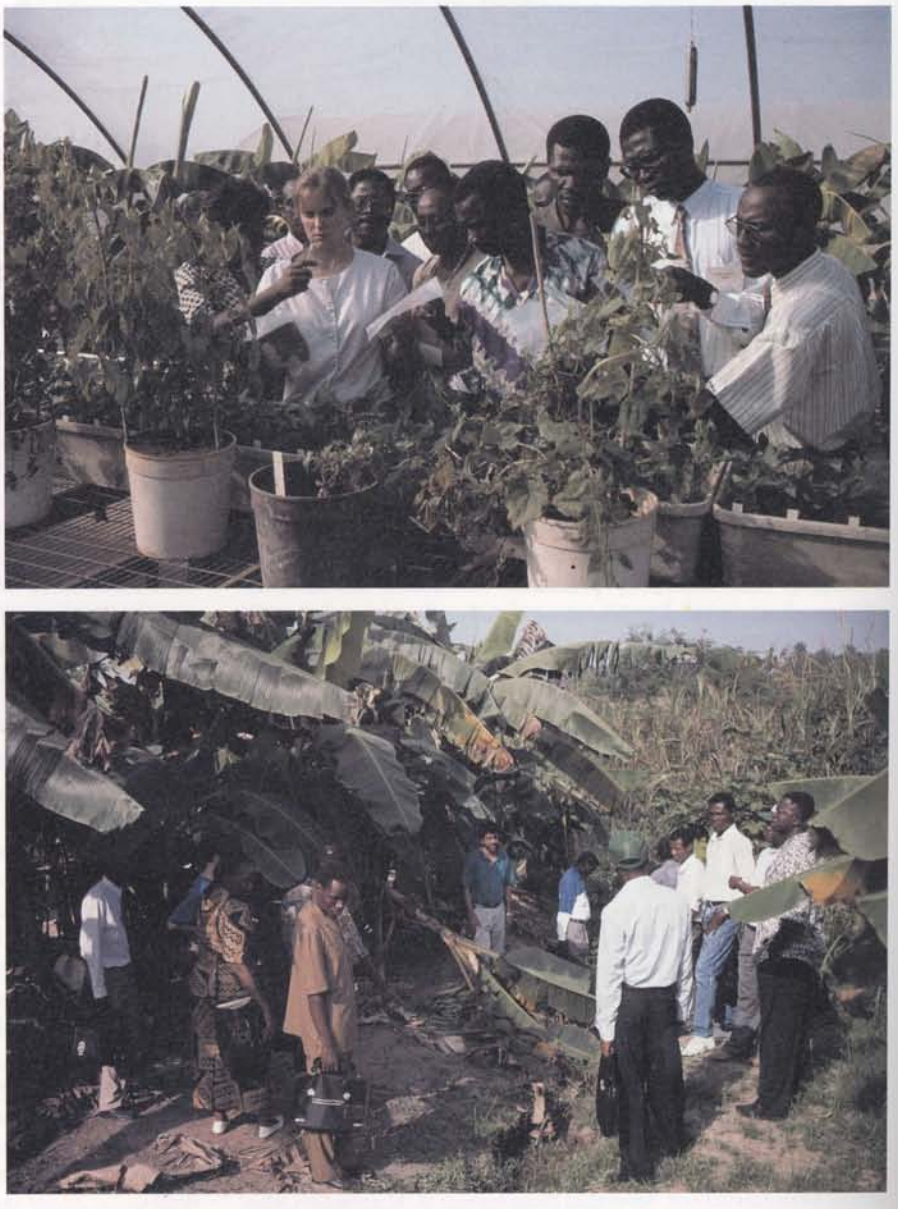
The course is believed to have been the first of its type ever held in sub-Saharan Africa where there is a dearth of trained virologists and limited epidemiological expertise. This is apparent from the ever widening rift between the sophisticated laboratory studies being done in developed countries on such tropical diseases as groundnut rosette, maize streak and cassava mosaic and the inadequate information available on their behaviour and control. A similar unsatisfactory situation is developing with banana streak which is a disease of great topical importance in Nigeria, Uganda and several other parts of Africa. Recent studies have shown this disease to be caused by a novel pararetrovirus that is being investigated in laboratories in the West but there is little information on the distribution of the disease or its mode of spread.

Fourteen trainees from nine different African countries, together with PhD students and staff from IITA, attended the two-week course. It is hoped to produce additional copies of the training material for more general distribution to the many others who were unable to attend because of the lack of travel funds.

The main emphasis of the course was on epidemiological principles and specific case histories of diseases of particular importance in Africa, including maize streak, assava mosaic, banana streak, cocoa swollen root and groundnut rosette. Of necessity, much of the time was spent in the discussion room, but part of each afternoon was spent in the field or laboratories at IITA and a visit was arranged to the National Plant Quarantine Station at Moor Plantation, Ibadan. Specialist contributions to the course were provided by Teifion Jones (Scottish Crop Research Institute), Peter Markham (John Innes Centre, UK), R.A. Naidu (International Centre for Research in the Semi-Arid Tropics, Hyderabad), Forrest Nutter (University of Iowa) and Laud Ollennu (Cocoa Research Institute of Ghana). Further contributions were provided by workers from IITA and nearby research centres in Nigeria.

The course was well received by the participants and rated highly in the detailed evaluations carried out by the IITA Training Unit. However a course of only two weeks duration has obvious limitations given the very diverse, and in some instances, limited background of those involved. This emphasizes the need for additional short courses on a wider range of virology topics and for a longer and more comprehensive course lasting several months and including appropriate practicals. The experience gained with the IITA course will be invaluable in arranging such courses, but the practical difficulties are formidable – not least the cost of bringing together trainees from the different countries and providing suitable tuition. Further details of the course can be obtained from Jacqueline Hughes or Michael Thresh who would also welcome comments on the status of plant virology in Africa and suggestions on how to improve the current unsatisfactory situation.

Dr J. Michael Thresh is a Consultant Plant Virologist at the Natural Resources Institute, University of Greenwich, Central Avenue, Chatham Maritime, Kent ME4 4TB (Tel. 01634 880088).



Course participants examining symptoms caused by viruses of yam (top) and banana (bottom) at the IITA, Ibadan, Nigeria.

Reciprocal Attendance at Meetings Held by Other Societies

THERE EXISTS a reciprocal scheme between the Societies listed below whereby student members are able to attend meetings on the same basis as the host society's members. This normally means that attendance is free of registration charges, but if the host society has to charge a fee then student members of other societies will pay the same fee.

- the Biochemical Society
- the Genetical Society
- the British Pharmacological Society
- the British Society for Immunology
- the Physiological Society

SGM Student Members wishing to attend a meeting of another society in the scheme should contact the meetings office of the body concerned prior to the final date for registration for the meeting and complete the appropriate booking forms. On arrival at the meeting, the student should register at the conference desk and be prepared to provide evidence of his/her membership of SGM. Please note that prior registration for any meeting is essential.

The Second European Meeting of Virology

University of Southampton, 3–5 September 1997

Grants for Younger SGM Members

Funds are available to assist a limited number of PhD students and first postdoctoral workers to attend this meeting. Applications for funding, giving the reasons for wishing to attend and a breakdown of costs, should be made to the Virus Group Convener, Professor Malcolm McCrae, Department of Biological Sciences, University of Warwick, Coventry CV4 7AL, **by 13 June 1997.** Preference will be given to applicants who are presenting work at the meeting (see p. 75).

Student Members of the Society should also note that they are eligible to apply for a grant from the President's Fund to attend this meeting.

KANGAROOS AND CONFERENCES

ROSSLYN BIRCH

THE 9TH INTERNATIONAL SYMPOSIUM ON YEASTS (ISY) was held in Sydney between 25 and 30 August 1996, the first time the ISY had been held in Australia, and I had the pleasure to attend. Run in conjunction with the 10th International Biotechnology Symposium (IBS), this made for a very interesting meeting. A large and prestigious conference, it has been termed the 'Olympics' of yeast research conferences, being held only every four years and ironically, in this Olympic year, it was held in the city which will host the next sporting Olympics in the year 2000 – Sydney seems to be holding a precedent here.

The 1996 meeting was very successful with around 350 delegates from various countries around the world and topics covering all aspects of yeast research and biotechnology. It was held in the Sydney Convention Centre in Darling Harbour, within easy reach of the famous Opera House and Harbour Bridge. The conference itself was divided into a programme of plenaries, symposia, proffered papers and poster sessions covering active research in the areas of ecology, biochemistry (metabolism, transport and stress), growth, food feed and beverage yeasts, wine yeasts, ethanol production, taxonomy, gene expression, genetics and pathogenic yeasts. Being run in conjunction with the 10th IBS, the combined attendance at the two meetings must have been around 1000 delegates. Some plenary sessions brought us together discussing the subjects of biotechnology as a whole, but the majority of sessions and symposia were run concurrently, such was the wealth of speakers.

The most relevant area to my own work was that of the stress response in yeasts. Various aspects of the subject were covered, including heat and osmotic stress. Professor Ken Watson (Australia) gave an overview of the transient nature of induced stress tolerance and Dr Peter Piper (UK) spoke on plasma membrane heat-shock proteins and their role in the stress response. Offered posters covered the involvement of membrane composition, trehalose, genetic involvement, including *tps1*, *OSR1* and heat-shock protein gene expression, and our own work on the inorganic ion aspect. Both Dr Walker's presentation and my poster were well received and for me the poster sessions were very interesting, giving me the opportunity to discuss and defend my work with colleagues from all over the world. I enjoyed the opportunity and was grateful for the stimulating discussions which ensued. I was pleased with the amount of interest we generated in this novel area of work.

The topic of biodiversity was one of the more important topics in the ecology section of the conference and attracted speakers from several laboratories. Professor Herman Phaff (USA) gave an excellent talk on the biodiversity of yeasts and it was a joy to listen to this grandfather of yeast research. Dr Allen Hagler (Brazil) spoke on the biodiversity found in Brazilian mangroves and indicated the wider reality that we really do not know how many strains of micro-organisms we have yet to discover! The genetic aspect of this research was covered by Dr Leda Mendoça-Hagler (Brazil) and she discussed characterizing the communities discovered, an aspect of genetic research leading onto taxonomy. Dr Cletus Kurtzman (USA) gave a plenary lecture on the molecular taxonomy of yeasts and this topic was expanded through two symposia which included talks by Professor Jack Fell (USA), again on biodiversity, and Professor Ann Vaughan-Martini (Italy) on the taxonomic riddle of the genus *Saccharomyces*, which very well illustrated the confusing nature of taxonomy over the years. However, with the molecular techniques now available, hopefully we have a more simplified and truer definition of this genus.

In the area of heterologous proteins, several labs have worked on the use of yeasts in recombinant insulin production, etc., and of course it is important for this research to continue, but one very interesting talk was given by Dr Ian Macreadie (Australia) on the role of yeast in AIDS research. This work, on the expression and characterization of HIV-1 auxiliary genes in yeast, includes the role of yeast in the production of proteins and also as a model for predicting the biological function of HIV-1 proteins in AIDS pathogenesis, an interesting way forward for AIDS research.

Sydney seems to have been neglected as a conference venue in the past, probably due to its distance from Europe. However, in this day and age with such ease of international travel, why should it be ignored? The wealth of research in Australia is not to be scorned either, being wide-ranging and of high calibre, and not only in the fields of yeast research displayed at this conference.

The Sydney Convention Centre, situated in Darling Harbour, is an excellent conference setting. With the harbour-side complex adjacent, with shopping, food courts, bars and restaurants, it satisfies all tastes for those free moments or a rushed lunch between symposia. Within easy reach of the city centre on foot or via the monorail, you can easily wander through the shopping malls and streets of downtown Sydney during time off from the conference. The Sydney Opera House and Harbour Bridge are a mere ferry ride away, either via a shuttle to Circular Quay or on one of the many harbour cruises which sail daily. They are certainly a sight to behold whether viewed from the water or on dry land, as you walk up to them or climb to the lookout points. Around Sydney there is much to see; the Blue Mountains National Park, a mere day trip from the city, is wooded with Blue Gum Eucalyptus and this mountain range with its amazing blue haze is a remarkable sight. Koalas and kangaroos can be seen around Sydney. A visit to a wildlife park is a must for visitors who have never seen these indigenous animals. For those who appreciate a good wine, the Hunter Valley wine region is also within easy reach of the city.

Sydney is also the gateway to a wonderful country... there is much more to Australia than Sydney. Australia is a vast country which dwarfs Europe many times over. It contains a wealth of landscapes from deserts to coral reef, island paradises to the magnificent Uluru (Ayres Rock) there is much to experience, combined with a fascinating history, indigenous or otherwise. Australia may be a young country, but it is an interesting one, scientifically and culturally.

I wish to thank the Society for awarding me a grant from the President's Fund and in doing so giving me the opportunity to present my work at this prestigious conference, to have the chance to see beyond my own field to the extensive research world which exists and hence increase my knowledge and horizons within my own research, and to visit an amazing country.

Rosslyn M. Birch BSc (Hons) MSc, School of Molecular and Life Sciences, University of Abertay Dundee, Kydd Building, Bell Street, Dundee DD1 1HG.

New Settlement of the Spanish Type Culture Collection (CECT)

SINCE OCTOBER 1996 the Spanish Type Culture Collection (CECT) has been located in the Research Building of the University of Valencia in the University Campus of Burjasot. The CECT now has two laboratories for research, one room for washing and sterilizing material and culture media, one room for freeze-drying and sealing ampoules, and one dark room. It also has one large controlled-temperature storage room and two cold chambers. Finally, there is an office room with computers, fax, telephone and several working places for CECT staff. All of this occupies an area of about 350 m^2.

The CECT maintains cultures of micro-organisms (bacteria, filamentous fungi and yeasts) of industrial importance, taxonomic type strains, micro-organisms used for assays, testing, teaching, biochemical and genetic research and strains of general interest. The collection is an International Depository Authority (IDA) under the Budapest Treaty for patent purposes and also provides an identification service for various kinds of bacteria, filamentous fungi and yeasts.

The new address of the CECT is as follows:

Colección Española de Cultivos Tipo (CECT)
Universitat de Valencia
Edificio de Investigación
Campus de Burjasot
46100 Burjasot (Valencia) Spain
Tel. +34 6 3864612; Fax +34 6 3983187; Email cect@uv.es

BRITISH COUNCIL *'Best of British Microbiology'*

ONE OF THE SOCIETY'S OBJECTIVES is the promotion of the science of microbiology. We need, from time to time, material demonstrating high quality 'British Microbiology' for promotional activities run by ourselves and third parties. We intend to assemble a package for use overseas next year which will show the strengths of microbiology in the UK. This is intended to be very much a forward-looking product, not a revel in past glory. The guidelines are simply that the work featured should be of international standing.

Please send to Marlborough House (addressed to External Relations Office and marked "UK Micro 98") areas of microbiology that you think should be included in such a review. There is a clear danger that such a review could offend those whose work is not covered, which is why this invitation is being offered. To avoid being left out, please make sure we know about areas you think are important.

ROYAL SOCIETY GRANTS FOR JOINT PROJECTS WITH CENTRAL EASTERN EUROPE AND THE FORMER SOVIET UNION

As part of the Royal Society's policy of encouraging scientific links between the UK and the countries of Central and Eastern Europe (CEE) and the former Soviet Union (FSU), applications are invited for grants for two year collaborative research projects between institutions in the UK and in eligible countries in the CEE and FSU. Grants are for the cost of visits by researchers of at least postdoctoral level from the countries involved in each project. The natural sciences, non-clinical medicine and agriculture are amongst the subjects which will be considered for research grants. The maximum award per annum is £3k for projects with CEE and £4k for projects with the FSU, to include travel expenses and subsistence, plus £500 for consumables/equipment.

For full details and application forms contact Mr R. Constantinescu, International Exchanges, The Royal Society, 6 Carlton House Terrace, London SW1Y 5AG (Tel. 0171 451 2563, Email ezmb016@mailbox.ulcc.ac.uk).

SGM Autumn Meeting 1997

The 138th Ordinary Meeting of the Society, incorporating the 2nd European Virology Meeting, will take place at the University of Southampton from Monday 1 September 1997 to Friday 5 September 1997.

MAIN SYMPOSIUM (1–2 September)

CHECKPOINTS AND NON-LINEAR DEPENDENCY RELATIONSHIPS

S. OSMANI (Danville, USA)	*What are checkpoints?*
V. NORRIS (Rouen, France)	*Controlling elements in the cell cycle of Escherichia coli and some other bacteria*
R. DEVORET (Orsay, France)	*Timing of repair pathways in bacteria*
C. DORMAN (Dublin)	*Dependency relationships in Escherichia coli fimbriation*
A. GROSSMAN (Massachussets, USA)	*Checkpoints, cell cycle events and sporulation in Bacillus subtilis*
D. SUMMERS (Cambridge)	*Plasmids and checkpoints*
J. WILLIAMS (London)	*SH2 signalling in a lower eukaryote: the master switch regulating Dictyostelium pattern forming functions via a STAT protein*
K. GULL (Manchester)	*Checkpoints linking nuclear and cytoplasmic events in the trypanosome cell cycle*
G. WAHL (San Diego, USA)	*Checkpoints in the mammalian cell cycle*
T. ENOCH(Boston, USA)	*Cell cycle checkpoints in Schizosaccharomyces*
K. HARDWICK (Edinburgh)	*The spindle assembly checkpoint in budding yeast*
V. SIMANIS (Lausanne, Switzerland)	*Checkpoint controls within mitosis that link the timing of septum deposition with spindle integrity in fission yeast*
T. WEINERT (Arizona, USA)	*Lesion processing by checkpoint genes in Saccharomyces cerevisiae*
K. NASMYTH (Vienna, Austria)	*Ordering the duplication and segregation of chromosomes in eukaryotic cells*
FLEMING LECTURE	
TONY CARR (University of Sussex)	*Cell cycle control in Schizosaccharomyces pombe*

Education — 1 September
- *Microbial Informatics: Data Acquisition, Management and Exploitation* (Symposium)

Environmental Microbiology — 1 September
- *Waste Treatment* (Symposium)

Microbial Infection and Physiology, Biochemistry & Molecular Genetics — 3–4 September
- *Polysaccharides* (Symposium)

For further information about Group Symposia, see *News from the Groups* (pp. 72–75).

OTHER MEETINGS

Promega Prize Meeting *(Postgraduates)*

Keynote Speaker: A. P. J. Trinci (University of Manchester & SGM President)
To be followed by a Young Members Reception.

2nd European Virology Meeting: *Virus–Host Interactions*

3–5 September

OFFERED PAPERS

Offered Poster Papers are invited on any aspect of microbiology. Titles and authors (including full addresses) should be sent to the Meetings Administrator, Marlborough House, to arrive no later than **4 June 1997**. Abstracts will not be required at this stage, but authors will later be asked to complete an abstract form, sent out on receipt of the paper title, to be used as camera-ready copy for the Abstracts Booklet that will be available at the meeting.

CBL Resources for Teaching Ecology

THE CTI CENTRE FOR BIOLOGY held a workshop on *Computer-based Resources for Teaching Ecology* last year and have produced a compilation of the relevant products. This is available in their on-line resource directory. See under 'publications' on the Centre's web site (http://www.liv.ac.uk/ctibiol.html). Of particular interest to microbiologists will be the work of the Digital Learning Centre for Microbial Ecology at Michigan State University (http://commtechlab.msu.edu/CTLProjects/dlc-me).

Pig Disease Information Centre

THE PDIC NOW HAS A WEB SITE to provide direct information about its services and on pig diseases and pig breeding. It also includes a database of pig health information resources. The URL is http://www-pdic.vet.cam.ac.uk/ (*please note that there is a hyphen '-' after* 'www' ***not*** *a dot*).

The snailmail address of the PDIC is Dept of Clinical Veterinary Medicine, University of Cambridge, Madingley Road, Cambridge CB3 0ES.

'Plagues, Pestilences and People' – A Student-centred Elective Unit in an Undergraduate Biology Course

Joanna Verran and John Willcox

There are many reasons for the increase in student-centred learning (SCL) in undergraduate courses. The champions of active versus passive/deep versus superficial learning are supported by those who press for reduced staff–student contact, larger classes and more student-centred activity on financial, resource or managerial grounds.

Whatever the reasons, many microbiology courses have introduced activities which satisfy both camps, and which fortunately also engender some enthusiasm for and learning in the subject. Group work, poster design, leaflet production, microbiological whodunits, mini-projects (open-ended lab work) and so on, nurture useful skills in addition to the acquisition and use of knowledge. This article describes one example of distance/student-centred learning.

At Manchester Metropolitan University, electives were introduced into undergraduate provision in 1993/94. They provide students with the opportunity of broadening their studies. Subject to timetable constraints, students may take elective units offered in any department by the university. The range offered is greatest at the lower stages of courses. Electives may be compulsory, e.g. maths and chemistry, to raise standards of students weak in those subjects. Languages are also offered but 'home' units are the most popular.

With an increasing emphasis on full-time equivalent (FTE) students, numbers are credited to a given department, hence influencing funding and future target numbers. It is therefore desirable to offer electives which are of interest to 'away' as well as 'home' students. Thus, the more generally popular an elective, the more students, and the more FTEs and funding to the home department. Interdepartmental/faculty timetable differences may hamper such interdisciplinary study, but an elective which is predominantly student-centred, with minimal contact time, is a convenient alternative.

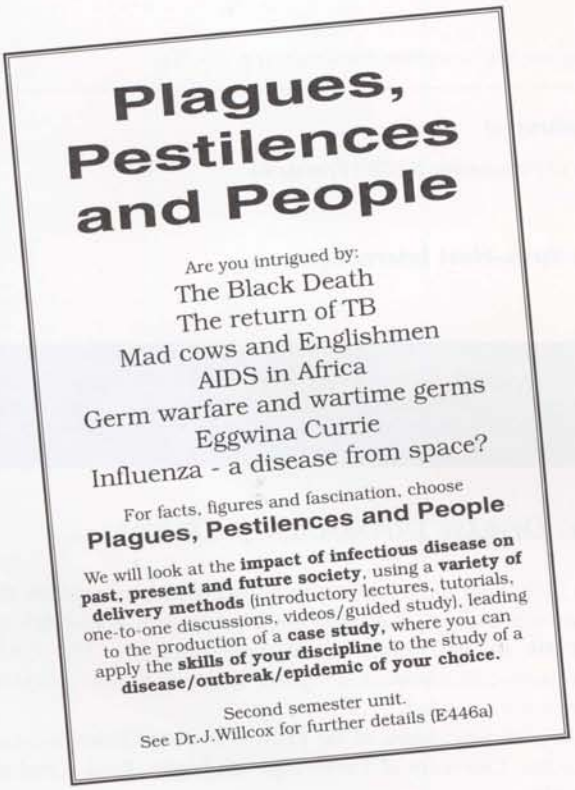


Fig. 1. An example of the way in which electives are advertised.

The BSc (Hons) Applied Biological Sciences degree is run under the University-wide Credit Accumulation Scheme (CATS). The degree has three levels (1–3). To complete a level, students must accumulate 120 credits, by passing a number of units. Units are usually rated at 10 or 20 credits, and each 10-credit unit requires 100 hours of student effort. At level 1 of degree programmes, 20 credits of the 120 credits taken are elective units.

There were two considerations taken into account when designing the 10-credit level 1 elective unit *Plagues, Pestilences and People*. Firstly, it should attract a wide range of students from various departments, not merely those dedicated to their degree subject, in this case biology and biomedical sciences. Secondly, contact time should be minimal, reducing pressure on staff timetables.

Electives are advertised (Fig. 1) and students sign up for their choice of units. There is no upper limit for numbers on distance learning electives. Other units offered in biology are *Drugs from Plants* (very popular!), *Biology in the Media*, *Biology of Food Supplements*, *Health and the Environment* and *Fitness Health and Lifestyle*.

Plagues... attracted 48 students in its first year, 56 in its second and 50 in the third (1996–97). The majority were biologists, but chemists and mathematicians were also present. Arts and humanities students were not evident, but one hopes this will change.

The unit programme (11 weeks) comprises four keynote lectures, one from each of the academic staff involved in the unit: orientation; epidemiology; pathogenesis, and control. The course is centred on 'Invisible Enemies', a series of four 45 minute video programmes on Origins of disease, Epidemics, Invisible armies and Will we ever learn? Permission was obtained to use the videos for teaching purposes. Copies are available for students to borrow.

Students watch the programmes and write critical summaries of each (one side per programme). One member of staff takes responsibility for marking one programmes' critiques.

In addition, groups of students (3–4 per group) are assigned to a member of staff. At a preliminary meeting each group of students and their staff tutor pick a disease, and then individual students work on a particular aspect of the disease (case study). This allows individuals to investigate sociological, psychological, economical, moral, geographical, historical, etc. aspects, rather than merely concentrating on the more mundane microbiology (general properties, diagnostic tests etc). Thus 'away' students are not disadvantaged, since they can develop an angle appropriate to their interests.

At the end of the course each group presents a 5 minute overview on 'their' disease, and their chosen aspects of interest to the class, using one illustration. Each student also writes a 2,000 word case study.

The final assessment is a test. At the beginning of the unit, tutors provide 200 questions/facts (50 per tutor) derived from lectures, videos and general knowledge. These formative facts are used to construct a summational MCQ test at the end of the programme. Sample facts and questions are listed in Fig. 2.

Thus, assessment comprises:

Summary of video programmes	20
MCQ	30
Individual case study	40
Group presentation	10
Total	100

Facts for plagues and pestilence – from JV lecture and programme

1. Definition of following terms:
   Epidemic / Endemic / Pandemic / Incidence / Prevalence / Prevention / Treatment / Subclinical infection / Nosocomial infection.

2. Ability to explain an example for each term, from past or present.

3. In prehistoric times, why did the hunter–gatherer lifestyle ensure a disease-free existence, in contrast to urban life? (Why does an epidemic require a certain population size?)

4. What are virgin soil epidemics? Be able to describe two examples.

5. What is herd immunity?

6. What is natural and artificial immunity?

7. What diseases are UK children immunized against and at what ages? Name the causative organisms.

8. In times of the explorers, diseases passed between them and the 'new' countries.
   What disease(s) did:
   (i) Columbus bring to North America
   (ii) Cook bring to Hawaii
   (iii) White slave traders give to their African slaves
   (iv) Slaves give to the traders.

9. Why was it easier to conquer the Americas than Africa?

10. The Europeans had to develop antimicrobial agents to combat diseases for which they had no natural immunity. Malaria and quinine is given as an example. What causes malaria? Where does quinine come from? Is malaria still a problem?

etc.

Examples of MCQs

21. *Virgin soil epidemics are:*
   (a) when freshly dug soil is contaminated with spores
   (b) when measles arrives in the Virgin Islands
   (c) when infected soil causes an epidemic
   (d) the result of a non-immune population being exposed to a disease
   (e) the result of an immunized population being exposed to a disease.

22. *Herd immunity is:*
   (a) a population being immune to a disease
   (b) achieved when animals are vaccinated
   (c) the majority of a population being immune to a disease
   (d) achieved when people get a disease
   (e) when susceptibles do not catch a disease.

23. *The difference between natural and artificial immunity is:*
   (a) one is in nature, one is in the lab
   (b) one is by catching the disease, one is by immunization
   (c) one is a real organism, one is a lab strain
   (d) one is by active immunization one is by passive immunization
   (e) one is by a live vaccine, one is by a synthetic vaccine.

24. *We are in the middle of an HIV:*
   (a) outbreak
   (b) endemic
   (c) epidemic
   (d) pandemic

etc.

Fig. 2. Examples of sample facts and questions from the *Plagues, Pestilences and People* elective.

EVALUATION

Student performances in the unit have been generally good in terms of marks. For example, in 1994/95, marks for test, video review and case study/presentation averaged at 18/30, 11/20 and 30/50, respectively (standard deviations of 5.5, 3.7 and 8.4 were each for 17–18 % of the marks). The unit mean was 65 % (+16). Some students became very excited and interested in their discoveries: others less so. Some opted out of group presentation because it was 'only 10 %'. Generally marks were fairly high, since self-motivation and diligence certainly help to ensure a good performance. The pass rate (98 %) has been very high, and therefore marks were not discriminating. This was true for all of the distance learning electives.

Case studies were successful in allowing a new breadth of exploration. Examples of case studies include:

AIDS: the virus, its history, impact in the work place and media sensationalism.

Plague: causative agent, symptoms, history, Eyam (Derbyshire, 16th century) and India (20th century).

TSEs: scrapie, BSE, CJD and transmission.

It is not easy for tutors to cope with the minimal supervision and reliance on student self-motivation (which was variable!). Case study and group meetings need careful planning, especially if participating students are on widely differing courses. In short, staff–student communication is not facilitated on distance learning units!

The aims of the elective were ably met, in that it was popular and interesting. Hopefully, it engendered an enthusiasm for microbiology at an early stage in the students' career. Certainly heavily student-centred courses such as this provide flexibility (of time, audience and content), and potential for use in other areas. At Manchester Metropolitan it is proposed that similar electives will be included for undergraduates opting for a named route rather than a biology degree. Thus a microbiology 'focus unit' will be developed for new students, addressing issues fundamental to their subject of choice (e.g. microbes in the media, microbes on the Net, importance and diversity, getting to know the staff and their interests, discussion with second and third year students, careers in microbiology, etc.). Other units in the degree are more formally taught and are broader (cell biology, biochemistry, ecology, physiology, genetics) and not slanted towards micro-organisms. It is therefore hoped that this new elective will engender in students a sense of belonging to a group within a large undergraduate cohort, and with an appreciation of the impact of their subject of choice on the world at large ... although the difficulties of combining all these noble aspirations with the practicalities of minimal contact time have yet to be reconciled!

Please send correspondence to Dr Joanna Verran, Department of Biological Sciences, The Manchester Metropolitan University, John Dalton Building, Chester Street, Manchester M1 5GD.

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1. VERRAN, J. (1984). Scientific laboratory reports: a survey of requirements as perceived by staff and student. *Natl Assoc Staff Dev* **11**, 8–11.
2. VERRAN, J. (1992). The use of video in transferable skills education for biology students. II. Production of video of professional quality. *J Further Higher Educ* **16**, 103–109.
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SocietyNews

February Council Meeting

Next President

COUNCIL MEMBERS WERE DELIGHTED to learn that Professor Howard Dalton, FRS, of the University of Warwick had accepted an invitation to become the next President of the Society. He will take up office in September at the Society Annual General Meeting. An outline of Professor Dalton's career and interests will appear in the August issue of the *Quarterly*.

Charitable Status

THE AGENDA PAPERS for the Society's 1995 Annual General Meeting included an item describing how SGM has, since 1972, consisted of two distinct legal entities, and reported progress towards unification. Since then, the Society, through its legal advisers, has been in discussion with the Charity Commission, to achieve this aim and update the Society's rules and regulations to a form consistent with the requirements of the Charities Act 1993. Council agreed that the Articles of Association and Bye-Laws of SGM as a company, with the necessary amendments, could now be submitted to the Charity Commission for their approval. Once this is given and the approved Articles are formally adopted, all members of SGM will then become members of the company and unification of the two distinct legal entities will have been achieved.

RAE 96

COUNCIL MEMBERS CONTINUE to be concerned at the outcome of RAE 96, which did not appear to give full credit to microbiology, which had been assessed as one of the constituent disciplines within Biological Sciences rather than having a separate panel. It was agreed that a submission to HEFCE outlining members' concerns, and proposing remedies for the next exercise, would be prepared as soon as possible.

Forward planning

MEMBERS AGREED that in these times of constant change, in the needs of our members, the political and economic background in the world at large and the potential of the Society to provide increasingly sophisticated services, we need to plan carefully for the future. A working group was therefore established with a remit to consider all potential developments and identify new initiatives which could be taken on during the next five years, consistent with the Society's charitable status. The views of any members who may wish to make an input into this process should be transmitted to the General Secretary who will be pleased to ensure that they are considered.

Clinical Bacteriology

AMONG MATTERS FOR DISCUSSION by the forward planning group, it was agreed, following a suggestion by an elected member of Council, that the needs of members and potential members working in the field of clinical bacteriology should be considered with a view to the formation of a Clinical Bacteriology group. At the same time other areas in which the Society might develop new groups should be considered.

Charles Penn, General Secretary

Colworth Prize Lecturer

Professor Gordon Stewart

EDINBURGH is one of the two Scottish cities that shaped the early life of Gordon Stewart. From the age of 15, George Heriot's School provided the education that led in 1970 to the University of St Andrews and after 4 years, that included the discovery of his wife Lesley, a BSc in Biochemistry. A career that began in the then Glaxo Group at Greenford under the tutelage of Dr Margaret McOnie led in 1975 to a return to academia and the start of a love affair with the bacterial spore. In the lab of Dr David Ellar at Cambridge, commencing in the old 'protein hut' but graduating to 'sky lab', the biochemistry of spore germination and the characterization of the bacterial spore coat constituted some 6 years of PhD and postdoctoral research, punctuated only by just one more short sojourn into the Greenford labs. In 1982, Fisons Pharmaceuticals of Loughborough seconded Gordon to the laboratory of Dr John Kuhn at the Technion in Haifa, Israel. His discovery of and training in molecular microbiology began there, along with an introduction to the wonders of bacterial bioluminescence that has featured so much in his subsequent research. A lectureship at the University of Nottingham in 1985 in Food Microbiology with Professor Will Waites started his focus on applying the techniques of genetic engineering to problems of specific relevance to industrial microbiology. It appears to have been a fertile field. With over 100 publications, 12 past and 15 current graduate students (many co-supervised reflecting several multidisciplinary collaborations), 10 postdoctoral research scientists and some very close colleagues, including in particular Professor Paul Williams from the Department of Pharmaceutical Sciences at Nottingham and Professor Stephen Denyer from the Department of Pharmacy at Brighton, there is an interesting story to tell.

Notices

Annual General Meeting 1997

THE ANNUAL GENERAL MEETING of the Society will be held on Tuesday 2 September 1997 at the Society Meeting at the University of Southampton. Agenda papers, including reports from Officers and Group Conveners, and the Accounts of the Society for 1996 will be circulated with the August issue of the *Quarterly*.

News of Members

The following members of the Society have been elected Ordinary Fellows of the Royal Society of Edinburgh:

Professor Ian R. Booth, Department of Molecular and Cell Biology, University of Aberdeen.

James C. Neil, Professor of Virology and Molecular Oncology and Head of the MRC Retrovirus Laboratory, Veterinary School, University of Glasgow.

T. Hugh Pennington, Professor of Bacteriology, Department of Medical Microbiology, Vice-Dean (Research), Faculty of Medicine & Medical Sciences, University of Aberdeen.

Professor Michael J. Danson, Centre for Extremophile Research, Department of Biology & Biochemistry, University of Bath, has been promoted to a Personal Chair in Biochemistry.

Professor Howard F. Jenkinson has been appointed Professor of Oral Microbiology at the University of Bristol.

Professor Patricia A. Nuttall has been appointed as Director of the Institute of Virology and Environmental Microbiology, Oxford.

On 19 March 1997 the President of the Governing Council of the University of Utrecht presented ***Professor D.A.A. Mossel BM MA PhD MD DVM(Hon) FAPHA FIFST*** with the Silver Medal of Merit of the University, in recognition of 12½ years service as the Eijkman Professor-Emeritus of Medical Food and Water Microbiology.

The Society notes with regret the deaths of ***Dr Jean-Daniel Piguet*** (member since 1967), and ***Dr R.M. MacDonald*** (member since 1980).

SocietyNews

Grants & Awards

Fund for Developments in Teaching 1997

THE AWARD PANEL met in January to consider the applications received. The awards made for the development of teaching aids are listed below.

Dr R. O. Jenkins, De Montfort University, Leicester. *Development of computer simulations of the dynamics of microbial populations.* £1,000

Dr L.V. Thomas, University of Wales Cardiff. *To produce, in conjunction with the Biodiversity Consortium, a multimedia courseware unit entitled 'Bacterial Diversity'.* £2,350

Dr J. Laybourn-Parry, University of Nottingham. *Interactive computer package for teaching microbial biodiversity.* £3,066

In addition Dr M. Roberts, Department of Veterinary Pathology, University of Glasgow, was awarded £1,500 to make an overseas study tour to Melbourne University Veterinary School, Australia in August 1997.

Fund for Developments in Teaching 1998

COUNCIL HAS ESTABLISHED A FURTHER FUND to provide grants in 1998 to support developments likely to lead to an improvement in the teaching of any aspect of microbiology relevant to secondary or tertiary (including postgraduate) education in the UK. It is also willing to provide financial support for tours to overseas higher education institutions to study methods of teaching large classes.

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

Applications from members are now invited for either category of award. The full rules of the scheme are given below.

Rules

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

2. **Practical Teaching Aids**

(a) Applicants may seek support, normally within the range £200–£3500, for:
(i) Purchase of consumable materials, but not capital equipment.
(ii) Short-term assistance, e.g. vacation employment of an undergraduate, or exceptionally a postgraduate after expiry of a studentship.

(b) Successful applicants will be notified in February to facilitate forward planning for their project. They will normally be required to make the results of their work available to Society members within 18 months of the award being made. This will include a presentation at a Society meeting and publication of an abstract in the *SGM Quarterly*. Physical materials, whether off-prints, videos, slides, computer programs, microbial strains or in other forms, should be readily available to Society members on free or low-cost loan or purchase for a period of at least 5 years after termination of the project.

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

3. **Overseas Study Tour**

(a) Applicants may seek funding of no more than £1,750 to undertake a short study tour (of no more than 4 weeks duration) to learn about microbiology teaching methods in higher education institutions outside the UK, with particular reference to the strategies of coping with large classes. The award will cover travel and accommodation expenses only, up to the prescribed limit.

(b) Applicants must provide a detailed itinerary of the proposed tour, which it is anticipated will take place in 1998, and enclose written evidence of their invitations to the scheduled institutions.

(c) Successful applicants will be notified in February to facilitate travel arrangements for the tour. A detailed report of the visit must be presented to the Society within 3 months of return to the UK. The findings of the tour will be disseminated as soon as possible to Society members, either by the presentation of a paper at a meeting and/or the publication of an article in the *SGM Quarterly*.

Application Forms

Application forms are available from the Grants Office at SGM HQ. Please state clearly whether a form is required for a teaching aid or a study tour. The closing date for applications is **31 October 1997**.

Microbiological News

MICROBIOLOGICAL POSTAGE STAMP COLLECTION

EMERITUS PROFESSOR Malcolm Woodbine (Friends Cottage, 40 London Road, Kegworth, Derby DE74 2EU; Tel. 01509 672450), who has been retired from the University of Nottingham for some years, wishes to dispose of a collection of stamps that he built up between 1950 and 1980. The stamps were assembled under the title *A Philatelic History of Microbiology* and slides of the collection were used in talks to promote microbiology to schools. Anyone interested in purchasing the stamps should contact Professor Woodbine.

PUBLIC UNDERSTANDING OF GENETIC ENGINEERING IN FOOD SCIENCE

EMER CAMPION and Susan Miles of the Institute of Food Research Reading Laboratory are researching the public understanding of the use of genetic modification in food production. The aim of the project is to compare the mental models held by scientists, people professionally concerned with environmental matters and members of the public regarding their understanding of the science and its associated risks, benefits and ethical issues. They are collecting people's views and opinions on this topic and wish to interview experts in the biosciences, particularly those with a professional interest in biotechnology. The study takes the form of an informal interview, followed by a questionnaire. The entire procedure takes about an hour and they are willing to travel to a respondent's workplace to carry out the interview. Any member wishing to take part in the survey should contact Emer or Susan for further details.

Emer Campion –
Tel. 0118 935 7029; Email
Emer.Campion@BBSRC.ac.uk

Susan Miles –
Tel. 0118 935 7005; Email
Susan.Miles@BBSRC.ac.uk

SocietyNews

INTERNATIONAL DEVELOPMENT FUND

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

Purpose

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

Guidelines

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

Applications

Applications to the Fund are now invited. Four copies, including full supporting documents, should be sent to the International Secretary, (Professor J.W. Almond, School of Animal , and Microbial Sciences, University of Reading, PO Box 228, Whiteknights, Reading RG6 6AJ). The closing date for applications is **26 September 1997**.

The Watanabe Book Fund

Members who are permanently resident in a developing country are reminded that they may apply for funding to acquire for their libraries books, or possibly journals, relating to microbiology. These annual awards are available as a result of a generous donation from Professor T. Watanabe of Japan. Full details of the scheme were published on p. 19 of the February issue of the *Quarterly*. The closing date for the receipt of applications, which should be made to the Grants Office at SGM Headquarters, is **26 September 1997**.

SEMINAR SPEAKERS FUND 1997/98

The purpose of the Seminar Speakers Fund is to promote talks on microbiological topics in departmental seminar programmes. Applications are invited from Higher Education Institutions where microbiology is taught for grants of up to £200 towards the travel, and if necessary, accommodation, expenses of an invited speaker. Applications will be dealt with on a first come, first served basis during the academic year. Written submissions should be sent to the Grants Office at SGM Headquarters for consideration. The Rules of the scheme are detailed below.

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 1997 to June 1998. It is expected that departments will collaborate in selecting a seminar speaker.
2. Applications will only be accepted from departments, not from Student Microbiology Societies.
3. Up to two speakers may be funded each year, provided the total award to the institution does not normally exceed £200.
4. Seminars must be advertised regionally as sponsored by the Society.
5. Awards will be paid retrospectively on receipt of evidence of the actual expenses incurred.
6. Applications should contain the following information.
   (a) The names and addresses of the speaker(s) to be invited and the topic of the talk(s).
   (b) Evidence, in the form of a programme, that an active seminar programme is already established in the department(s). Where no previous programme exists, good reason should be given for the request, such as the establishment of a new department.
   (c) Details of any sponsorship for seminars that the department already has (or is anticipating).
   (d) An indication of the target audience for the seminar, which may include undergraduates and postgraduates.

SGM MEMBERSHIP SUBSCRIPTIONS 1997

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

ORDINARY MEMBER		
Membership Subscription (inc. *SGM Quarterly*)	£33.00	(US$55.00)
Additional subscriptions for publications:		
Microbiology	£54.00	(US$95.00)
JGV	£54.00	(US$95.00)
STUDENT OR RETIRED MEMBER		
Membership Subscription (inc. *SGM Quarterly*)	£15.00	(US$25.00)
Additional subscriptions for publications:		
Microbiology	£27.00	(US$50.00)
JGV	£27.00	(US$50.00)

SocietyNews

The SGM Web Site:

From Berkshire to Louisiana and back in an hour

http://www.socgenmicrobiol.org.uk

THE SGM WEB SITE is attracting worldwide interest and continues to develop and expand. One of the pages is an online form you can use to send us requests, comments and other messages. The first response we got this way came from Shreveport, Louisiana, just one hour after the site had gone live on the Internet server!

The site has been set up for conciseness and speed with a realistic use of graphics, and small pictures that you need to download just once if your software uses a caching system.

Publications

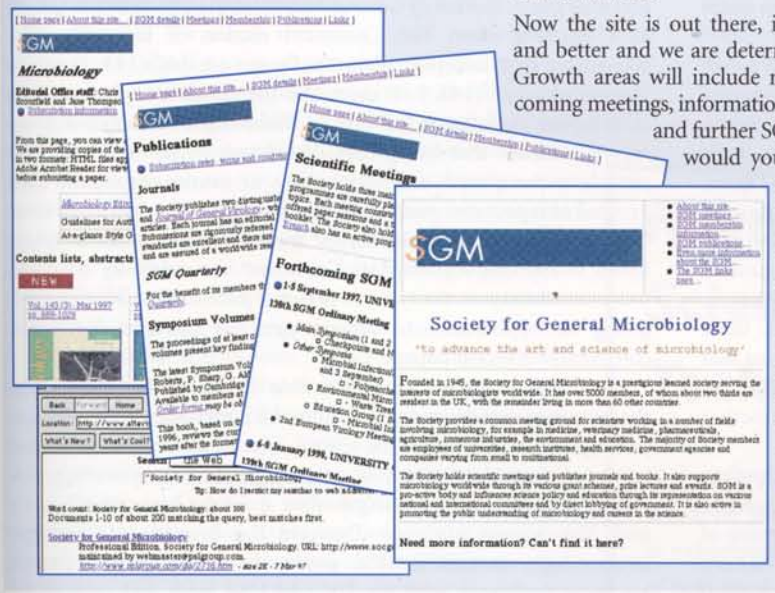
Enquiries come in from all over the world asking for a current awareness service for our journals, and this we are providing. Article headers (i.e. what's on the first page of the paper, to the end of the summary) and tables of contents for each issue of *Journal of General Virology* and *Microbiology* are available from January 1997 onwards. This information appears close to publication, weeks or months before other alerting products appear, and is more plentiful than other publishers offer for free. In addition each month anyone interested can obtain a couple of sample papers in Portable Document Format (PDF) which can be viewed using the free Adobe Acrobat reader. The aim here is to provide material that will print out to a high standard rather than for reading on screen. Whether downloading and printing work properly, within a reasonable time, depends on the speed of your connection and your particular computer setup. The journals' instructions to authors are also on the web – it is much easier to tell intending authors where to look than to put a copy in the post!

There is scope for expansion in this area of the site, and we intend to provide more information from the *Quarterly*, including a catalogued archive of book reviews.

What's Next?

We have notified the major search engines and other microbiology/virology resources of the site's existence so that our pages will become widely indexed and easier to find among the online millions.

Now the site is out there, it can only get bigger and better and we are determined to achieve this. Growth areas will include more details of forthcoming meetings, information about student grants and further SGM services. What else would you like to see? Lists of suppliers? More links? Fewer links? Specialist interest areas? Let us know and we'll put it there if we can. With your help and feedback we can make this an even more useful resource for microbiologists worldwide.



Duncan McGarva, SGM Marlborough House

Staff News

WELCOME TO SUSAN WESTGATE who has joined the Society as a Staff Editor on JGV. Susan comes to us from ISIS, which publishes scientific abstract journals, and so she already has substantial editing experience. Staying in the JGV editorial office, we offer warmest congratulations to Audrey Winterbottom on the birth of a son, James Clifford on 20 January, a brother for Jessica. Mum and baby are both doing well and have already toured SGM headquarters. Audrey will be returning to the fray after a period of maternity leave.

CONGRATULATIONS ALSO to Rebecca Jones on her appointment as Administrator in the Institute of Neuroscience at the University of Manchester. Rebecca, who has worked in the External Relations and Grants Office since 1991, will be well known to most Student Members of SGM for her patient help with their applications for Postgraduate Conference Grants and President's Fund awards. She will also be sorely missed at careers fairs and other events for the public where she has promoted microbiology on behalf of the Society with great enthusiasm. Recently Rebecca obtained the CAM Certificate in Communication Studies, covering marketing, public relations and advertising – skills she will also be able to use in her new post. Rebecca left at Easter, after a final stint for SGM at the Edinburgh Science Festival, and we wish her every success in her new job.

SGM Symposium Volumes

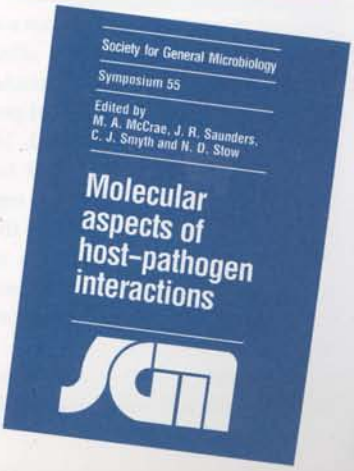
THE CONTRIBUTIONS to the March 1997 symposium on *Molecular Aspects of Host–Pathogen Interactions* are available as Volume 55 in the series. A review of the book appears on p. 76 of this issue of the *Quarterly*.

As usual, there is a 60 % discount to members buying their personal copies. The prices are as follows:

Members . . . . . £26/$46
Non-members . . . . . £65/$115
Student Members £16

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

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



"*Microbiology* Looks Better and Better With Every Issue"

Robert K. Poole

The title of this piece was contained in an unsolicited letter from a colleague in the USA, received the day before I sat down to write this look at the past few months of *Microbiology*. I cannot believe that the writer was referring only to the looks of the journal with its striking and varied cover pictures, colour-coded covers and the fancy graphics (but what is that gun sight in *Microbiology* aimed at?). Sure enough, my correspondent goes on to praise "another one of those journals where I scan every issue". The journal has been revolutionized by a larger and far more international Editorial Board and by Editors from as far away as Paris and Nova Scotia. Citation ratings, submissions and compliments are all increasing.

A look at the last six months of 1996 explains why. Short (but not micro) review articles are always valuable and the breadth of *Microbiology* was evident in their subjects, ranging from the biology of colicins, a hypothetical enzyme involved in murein growth, biocontrol of *Trichoderma*, to microbial utilization of human signalling molecules.

This period also saw the publication of a landmark special issue (November) containing 17 papers describing progress on the European *Bacillus subtilis* Genome Sequencing Project. Genes to interest all of us are revealed, including those involved in purine uptake and metabolism, sporulation, fermentative metabolism, stress responses, thioredoxin and genes in the *skin* element, which is excised during sporulation by a site-specific recombinase. Special issues are not always welcomed if they focus exclusively on something terribly interesting but of no interest to me (or you). But the November issue also contained another 20 papers in more traditional subject areas, including a review.

On the subject of paper categories, 1996 saw the launch of a new category – 'Bioenergetics and Transport'. This attracted 19 papers, covering aspects of solute transport, oxygen-binding proteins, electron transfer and other membrane phenomena. Other areas where papers would be most welcome are microbial ATPases, studies of organelles, motility and the biogenesis and evolution of bioenergetic systems. Of course, bioenergetics is not a new area at all, but one in which microbiologists have made distinguished contributions over many decades (see *Microbiology* Comment, September 1995, **141**, 2021). How appropriate it is that there should be such a section in a journal devoted to the organisms that have yielded to us the three-dimensional structures of refractory membrane protein complexes such as the photosynthetic reaction centre and cytochrome oxidase!

It is difficult (and potentially dangerous) to pick 'favourite' papers for special comment from the riches on offer in 1996. It is safer to illustrate the diversity and quality of a few. In July 1996, the group of Andrew Glenn and Mike Dilworth (Murdoch University, Western Australia) reported a regulatory system in *Rhizobium meliloti* involved in acid tolerance. About a quarter of the earth's agricultural soils are acidic. Such acidity affects the growth of soil bacteria, facilitates metal leaching (particularly aluminium) from soils, and has catastrophic effects on plant growth. Why are some soil bacteria acid-resistant? Tiwari *et al.* (**142**, 1693–1704) describe a transposon mutant of *R. meliloti* that fails to grow below pH 6.0. The Tn*5* appears to have hopped into a region having two genes, *actS* and *actR*, with striking similarity to the sensor-regulator pairs of two-component systems involved in signal transduction pathways in many prokaryotes. This work opens the way to identification of the genes regulated by this two-component system and their role in acid tolerance.

Two papers considerably advanced our understanding of nisin biology. Nisin is a lantibiotic produced by *Lactococcus lactis* and its effectiveness against a wide range of Gram-positive bacteria has led to its use as a natural preservative of food products. In January 1996, Dodd *et al.* (**142**, 47–55) described a lactococcal expression system which allows the production of novel nisins encoded by pre-nisin (*nisA*) genes. A copy of the *nisA* gene is incorporated into a *nisA*-deficient nisin operon; variant genes can be substituted for the chromosomal wild-type gene. In this approach, only the product of the variant *nisA* gene is subject to the subsequent processing specified by other Nis proteins. In September, Dodd *et al.* (**142**, 2385–2392) described another aspect of the *nis* operon, namely its autoregulation by external, mature nisin molecules. The *nisR* gene encodes the putative response regulator of (another) two-component regulatory system and *nisK* encodes the membrane-located 'sensor' that detects the stimulus. Dodd *et al.* analysed a number of enzymically generated nisin fragments and engineered nisin variants to determine the structural requirements of the inducer and found that specific parts of the nisin molecule are required for induction of biosynthesis and immunity. This approach provides a powerful method for analysing in detail the molecular interactions between the inducer – nisin – and the membrane sensor, which are not readily accessed in the case of smaller inducers, such as oxygen and nitrate, for example, in other systems. The work also has important implications for developing lactococcal production systems utilizing inducers that lack biological, i.e. antimicrobial, activity.

Of course, 1997 is the Golden Jubilee of *Microbiology* and, in its previous guise, *Journal of General Microbiology*. The year has got off to a cracking start. The Comment section of January's issue announced that "complete sequence figures are out" (**143**, 1), whilst Wainwright *et al.* (**143**, 1–3) claim that the mysterious phenomenon of mitogenic radiation is "in" (again). Wainwright and his co-authors survey evidence that living cells emit low-intensity UV light that stimulates the growth and metabolism of nearby organisms, then proceed to report new positive evidence for the effect. Which of these Comment articles will generate the more correspondence in future issues is anybody's guess, but Comment is a relatively new and welcome addition to the types of material published in *Microbiology*, giving an opportunity to present personal opinions, news and comments on recent papers.

The February issue was a *Candida* Special Issue, recognizing the burgeoning interest in, and clinical importance of, this human pathogenic fungus. Again, the special issue status has not precluded papers of general interest. Gas vesicles, metabolic engineering, new insertion sequences, pyrroloquinoline quinone biosynthesis genes and *Mycoplasma* antigens illustrate the breadth of coverage. Interestingly, in this sample, papers from continental Europe are most numerous with the UK and USA neck and neck ahead of Australia and Japan. This is a very healthy sign of the journal's ever-increasing prestige and international impact.

This issue reminds us all that microbiology and *Microbiology* are more than bacteria. Perhaps a few other reminders are in order: there are no page charges and journal sales are largely responsible for the Society's income and consequent generous support of younger microbiologists. Now back to writing (and editing) another paper.....

Professor Robert K Poole (Editor), Krebs Institute for Biomolecular Research, Department of Molecular Biology and Biotechnology, The University of Sheffield, Firth Court, Western Bank, Sheffield S10 2TN, South Yorkshire, UK [Fax 0114 272 8697 (Dept); Tel. 0114 222 4447 (office) & 2834 (laboratory)] e-mail: r.poole@sheffield.ac.uk

JGV Comment

Jim Neil

The new layout of JGV has been with us for some months now. Canvassing of opinion shows that this latest update of the journal's appearance has been well received, although inevitably approval has not been universal. My view is that a new package will do little to sell the journal if the scientific content is not up to scratch, but that we must move with other journals in adopting more interesting and attractive layouts. The 'little red book' of years past now looks rather dowdy by comparison.

Turning to the scientific content of the journal, I note that recent volumes of JGV have included a very healthy stream of topical review articles. I am sure that these reviews will be widely read and quoted by those in the respective fields, an important consideration in view of the all-pervasive impact factor which now plagues most of our academic and editorial lives. Recent offerings by virus family have included the hantaviruses (Plyusnin *et al.*, 77, 2677–2687), the enteroviruses (Hyypiä *et al.*, 78, 1–11) and the caliciviruses (Clarke & Lambden, 78, 291–301). The human health implications of these virus groups have come to the fore in recent years and these up-to-date and systematic reviews will make a very worthwhile contribution to the literature. In other issues I would draw readers' attention to two excellent topical reviews on HIV, one on the *nef* gene product (Harris, 77, 2379–2392) and the other on HIV variation, based on the 1995 Fleming Lecture (McKeating, 77, 2905–2919). Last but not least is a review of variant CJD and its relationship to BSE, a subject which will command wide interest in the virology community and beyond (Ridley & Baker, 77, 2895–2904).

To return to the staple diet of original research papers, my selection of highlights is drawn (not surprisingly) from the retrovirology contributions. The retrovirologist will find something of interest in all JGV issues, although the proportion of such papers does vary month to month. Quite a few recent papers focus on interesting aspects of virus–host interactions and the roles of specific and non-specific immune mechanisms in containing or preventing infection. For example, apoptosis of virus-infected cells has been mooted as a natural resistance mechanism. However, there is growing evidence that persistent oncogenic viruses such as BLV may be able to inhibit this process (Schwartz-Cornil *et al.*, 78, 153–162), while the accelerated death of T-cells may be a factor in the depletion of the immune system in lentivirus infection (Dittmer *et al.*, 77, 2433–2436). The molecular details of viral interference with apoptotic pathways is obviously an area which is ripe for more study. Recent months have seen an explosion of information on chemokine receptors as co-receptors for HIV entry and cell fusion, and great interest in the role of ligands for these receptors as natural antagonists of viral infection. Recent volumes of JGV show that the scope is likely to be even wider. For example, CD8 cells from HIV-infected individuals appear to produce inhibitory factors distinct from the known chemokines (Barker *et al.*, 77, 2953–2962), while FIV can be inhibited at a late stage in replication by antibodies to a distinct cell surface receptor (CD9) whose natural ligand is currently unknown (Willett *et al.*, 78, 611–618). It is also conceivable that non-specific immune mechanisms contribute to the vaccine protection conferred by attenuated strains of simian immunodeficiency virus (Stahl-Hennig *et al.*, 77, 2969–2981).

Another field which is well represented in recent issues of JGV is the study of endogenous retroviruses. The spectre of activation of endogenous viruses in xenotransplants highlights the need to characterize and understand the life cycles of these agents. However, the co-evolution of these elements with their host blurs the distinction between virus and host DNA. The demonstration that an exogenous retrovirus plays a role in lung tumours of sheep proved difficult due to the presence of closely related proviruses in healthy sheep DNA, but careful probing for distinctive features is now paying off (Palmarini *et al.*, 77, 2991– 2998). The biological significance of most endogenous retroviral families remains to be established, although the search for pathogenic or symbiotic roles continues. The subtle regulation of expression of endogenous retrovirus is illustrated in recent papers on demethylating agents which activate HERV-K in human teratocarcinoma cells (Götzinger *et al.*, 77, 2983–2990) and the down-regulation of IAP genes in melanoma cells transfected with MHC class I (Li *et al.*, 77, 2757–2765).

These highlights serve to illustrate the broad range of interests served by the journal, even in one virus subdomain, and the need for Editors to maintain a large network of referees. My thanks go to all those who assist us in maintaining the journal's high standards and returning their reviews in a timely fashion. The defaulters will remain anonymous.

Professor J.C. Neil (Editor), Department of Veterinary Pathology, University of Glasgow Veterinary School, Garscube Estate, Bearsden, Glasgow G61 1QH.

Cells & Cell Surfaces

Southampton, 1–5 September 1997

The Group is the sponsor of the Main Symposium on *Checkpoints and Non-Linear Dependency Relationships*, further details of which can be found on p. 63 of this issue.

Bradford, 6–8 January 1998

Jointly with the Microbial Infection Group, we will be holding a one-and-a-half-day symposium on *Pathogenicity and Chemotherapy of Anaerobe Infections*. The symposium is being organized by Ian Poxton, Mike Wilson and Laura Piddock. Three scientific sessions, on *Bacteroides*, *Clostridia* and oral microbiology, are being planned. There will be plenty of opportunities for both offered papers and posters. Full details of speakers will be available in the next issue of the *Quarterly*.

Future Meetings

The Group has a number of symposia under discussion including *Microbial–Host Interactions at Mucosal Surfaces*, *Membrane Transporters and Antimicrobial Resistance*, *Intracellular Pathogens* and *Programmed Cell Death, Autolysis and Senescence*. Comments and suggestions from members are always welcome.

Convener:
Dr Alan E. Wheals
School of Biology & Biochemistry
South Building
University of Bath
Bath BA2 7AY
Tel. 01225 826826 ext. 4278
Fax 01225 826779
Email bssaew@bath.ac.uk

Clinical Virology

Royal Society of Medicine, 4–6 January 1998

In January the Group held a joint meeting with the European Group for Rapid Viral Diagnosis at the Royal Society of Medicine. This was highly acclaimed and it has therefore been decided to repeat the arrangement, at the same venue. The 1998 meeting will include a symposium and round table discussion on *Viral Cross-infection in Clinical Care*.

Future Meetings

Plans are being laid for a joint meeting in January 1999 with the Microbial Infection and S&E Groups on *Respiratory Pathogens*.

Following the Spring meeting of the Clinical Virology Group at Heriot-Watt University this March, the Group is due to hold a symposium on *Virus Infections of the Nervous System* in Spring 1998 at the University of Nottingham. Dr Will Irving has kindly offered to organize this.

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

Education

Southampton, 1–5 September 1997

The Group symposium at this meeting is *Microbial Informatics: Data Acquisition, Management and Exploitation* and is organized by Peter Miller (Liverpool). The speakers and titles are as follows: Lynne Boddy (Cardiff) & Colin Morris (Glamorgan), Neural networks and microbial identification; Trevor Bryant (Southampton), The impact of IT on microbial taxonomy; Tomas Flores (EBI, Hinxton), Sequence databases: present and future; Jim Prosser (Aberdeen), Modelling of microbial interactions; Pedro Mendes (Aberystwyth), Modelling microbial metabolism with Gepasi, a user-friendly simulator; Peter Miller (Liverpool), Web-based learning environments for microbial informatics; Duncan McGarva (SGM) & Dave Roberts (Natural History Museum), Publishing *Microbiology* in the electronic era.

Nottingham, 30 March–3 April 1998

The symposium at this meeting will be *Sandwich Training in Microbiology* and will be organized by Peter Wyn-Jones (Sunderland). This will present the whole picture of work-based learning in microbiology from the perspectives of the student, employers and university supervisors. This will be an opportunity for all those involved in sandwich training to meet and exchange ideas and to discuss common issues in this important area of education.

East Anglia, 8–10 September 1998

Alan Jacob (Manchester) is organizing a symposium on *Teaching Microbial and Molecular Genetics* which it is hoped will be a joint meeting with the Genetical Society.

The Convener would like to thank Peter Wyn-Jones and Mike Tait for taking over some of her responsibilities as she gets used to her new family commitments. The Committee would like to thank Mike Tait and Peter Miller, who are retiring this year, for their hard work on the committee, especially in the area of new technologies in education.

Convener:
Dr Janet C. Bunker
School of Health & Social Welfare
Open University
Walton Hall
Milton Keynes MK7 6AA
Tel. 01908 655891/654229
Fax 01908 654124
Email j.c.bunker@open.ac.uk

Environmental Microbiology

Southampton, 1–5 September 1997

The Group will be holding a one-day meeting on *Waste Treatment* organized by Keith Jones, Lancaster University. If you wish to present an offered paper or poster, please send the title of the presentation to Keith Jones **before 31 May 1997** (K.Jones@lancaster.ac.uk).

Nottingham, 30 March–3 April 1998

The Group will be holding a two-day meeting on the *Ecophysiology of Microbial Pigments* (with an emphasis on protection). The topic headings are Photosynthetic processes, UV protection and Community ecophysiology under light regimes. It is anticipated that presentations will include; Prokaryotic photosynthesis, Phototaxis, Bacterial and cyanobacterial UV pigments, and UV resistance of microbes. The Group organizer is David Wynn-Williams (British Antarctic Survey) from whom further information may be obtained in the first instance (ddww@pcmail.nerc-bas.ac.uk).

Future Meetings

A further meeting is also being planned for September 1998, when the topic will be *Biosensors and Indicator Organisms*. There will be an opportunity to present papers; postgraduate students are particularly encouraged. If interested please contact the organizer Mark Bailey (mbj@pcmail.nerc-oxford.ac.uk). Additional meetings are also planned to cover the topics of *Detection of Bacteria in Natural Environments* and *Survival of Pathogens in the Natural Environment*. The Committee would also welcome suggestions for future meetings. There is also a vacancy on the EMG Committee: any volunteers or nominees for this position should be made known to the Convener.

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

Fermentation & Bioprocessing

Bradford, 6–8 January 1998

In collaboration with the S&E Group we will be holding a two-day symposium on *Screening for New Therapeutic Agents*. The Group's organizers are Mike Bushell, Craig Gershater and Dave Langley. The symposium will seek to address current approaches to natural product screening for novel biopharmaceutical discovery. The invited papers are as follows: S.J. Brewer (USA), Scientific principles underpinning the screening approach; R.C. Durley (Monsanto, USA), Screen management approaches – optimizing throughput; H. Gurtler (Novo Nordisk, Denmark), Screen management approaches – optimizing sample diversity; J. Johal (Xenova, UK), Innovations in screen targets; A. Buss (Glaxo Wellcome, UK), Alternative approaches to natural products screening; M. Embley (NHM, UK), Innovations in microbial prospecting; N. Magan (Cranfield, UK), Environmental influences on secondary metabolite production; K. Wilson (Merck, USA), Screening for antimicrobials – strategy and results; D. Hawksworth (IMI, UK), Where are all the undiscovered fungi?; P. Stead (Glaxo Wellcome, UK), Efficient approaches to natural product-lead discovery and optimization: biotransformation screening and focussed library synthesis; K. Horikoshi (Tokyo, Japan), title awaited; Jean Jacques Sanglier (Novartin, Switzerland), title awaited; M. Legg (Zeneca), Opportunities for microbial natural products in the agrochemical industry. If you are interested in offering a short paper (postgraduate students are particularly encouraged), please contact the Convener as soon as possible, but **before the end of August 1997**. Abstracts will be required **by 30 September 1997**. We are also hoping to hold an evening's debating session on *Natural Products versus Combinatorial Chemistry*. More details will appear in the August issue of the *Quarterly*.

Nottingham, 30 March–3 April 1988

The Group is planning a two-day meeting entitled *Towards the Ideal Escherichia coli Expression System: Meeting the Needs of Fermentation and Downstream Processing*. The meeting is being organized by Bo Kara on behalf of the Group. There will be an opportunity to present short papers and if you are interested please contact the Convener.

East Anglia, 8–10 September 1998

We are planning a one-day meeting on *Mycelial Fermentations* organized by Dave Langley on behalf of the Group. There will be an opportunity to present short papers and if you are interested please contact the Convener.

Future Meetings

The Committee would welcome suggestions from any SGM member for topics of symposia within the area of fermentation and bioprocessing. Please contact the Convener or any Committee member.

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

Irish Branch

Dublin, 18–19 September 1997

The Autumn symposium on *Micro-organisms: the Answer to Environmental Pollution?* will be held in University College Dublin. Topics will include PCB and PCP degradation, control of metal pollution, remediation of PAH-contaminated soil, and the use of white- rot fungi and composting for remediation. Invited speakers include, C. Knowles (Kent), Microbial degradation of cyanides; G. Gadd (Dundee), Microbial treatment of toxic metal and radionuclide pollution – chemical and physiological mechanisms underlying process development for contaminated soils and waters; A. Dobson (Cork), Application of white-rot fungi in biodegradation; K. Jorgensen (Finland), Application of composting techniques for the remediation of contaminated soils; A. Thomas (Turin), Bioremediation strategies for PAH-contaminated soils and groundwaters; and E. Doyle (Dublin), Microbial degradation of pentachlorophenol. The local organizer is Dr Evelyn Doyle, Department of Industrial Microbiology, University College Dublin, Belfield, Dublin 4, Ireland (Tel. +353 1 7061300; Fax +353 1 7061183; Email emdoyle@ollamh.ucd.ie).

Dublin City University, January 1998

The winter meeting on *Microbes as Vaccine Delivery Vehicles* will be held in Dublin City University. The local organizer is Dr Michael O'Connell, School of Biological Sciences, Dublin City University, Glasnevin, Dublin 9 (Tel. +353 1 7045000; Fax +353 1 7045412).

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

Microbial Infection

Southampton, 1–5 September 1997

A two-day symposium will be held jointly with the PB&MG Group on *Microbial Polysaccharides*. The MI Group organizer is Dr Duncan Maskell (Imperial College, London). The speakers will include A. Dell (Imperial College), C. Raetz (Duke), C. Whitfield (Guelph), V. Koronakis/C. Hughes (Cambridge), E. Vimr (Illinois), E.R. Moxon (Oxford), J. Guard-Petter (USDA, Georgia), S. Kroll (Imperial College) and M. Frosch (Würzburg). There will be an opportunity to present offered papers. The organizers are particularly keen to receive submissions from postgraduates and new postdocs. Those interested should send titles and abstracts to the symposium organizer by 23 May 1997.

Bradford, 6–8 January 1998

A one-and-a-half-day meeting on *Pathogenicity and Chemotherapy of Anaerobe Infections* is being jointly organized with the C&CS Group. Our organizer is Ian Poxton (University of Edinburgh). It is planned that this symposium will be complementary to the Anaerobe Society meeting to be held earlier in the year. There will be an opportunity to present offered papers. Those interested should contact Ian Poxton, to whom titles and abstracts should be sent by 22 September 1997.

Nottingham, 30 March–3 April 1998

A two-day symposium on *Iron and Infection* is being organized by Paul Williams (Nottingham) and Julian Ketley (Leicester).

Future Meetings

Planning of a meeting on *Respiratory Pathogens* in January 1999 is under way. This meeting will be held jointly with the S&E and Clinical Virology Groups. The Microbial Infection Group organizer is Tim Mitchell (University of Glasgow). Please contact him if you have any suggestions. Ideas for topics for future meetings are always welcome. Please contact the Convener or any Committee member.

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

Physiology, Biochemistry & Molecular Genetics

Southampton, 1–5 September 1997

The Group will hold a joint symposium on *Polysaccharides* with the Microbial Infection Group. The Group's co-organizer is Dr Colin Hughes (Cambridge). Speakers and topics will include: A. Dell (Imperial College), Introduction to polysaccharides and structural determinations; C. Raetz (Duke), Biosynthesis and role in infection of lipid A; C. Whitfield (Guelph), Biosynthesis of O-antigen; V. Koronakis/C. Hughes (Cambridge), Action of RfaH/ops, a global regulator required for polysaccharide synthesis; E. Vimr (Illinois), Thermoregulation of capsular polysialic acid synthesis in *E. coli* K1; R. Moxon (Oxford), Role of LPS in infections by non-enteric bacteria; J. Guard-Petter (USDA, Georgia), Polysaccharides and surface variation of *Salmonella enteritidis*; S. Kroll (Imperial College), Role of capsular polysaccharides in bacterial infections; M. Frosch (Würzburg), Variable expression of capsule and LPS and role in infection. The invited papers will be interspersed with offered

Convener:
Professor Simon Baumberg
Department of Biology
University of Leeds
Leeds LS2 9JT
Tel. 0113 233 3080
Fax 0113 244 1175
Email gen6sb@south-01.novell.leeds.ac.uk

contributions. The organizers particularly wish to receive submissions from postgraduates and recent postdocs. Those interested should send titles and abstracts to one of the symposium organizers, Dr Duncan Maskell (Imperial College) or Dr Colin Hughes (Dept of Pathology, Cambridge) **by 23 May 1997.**

Bradford, 6–8 January 1998

The Group plans to hold a symposium on *Post-transcription Initiation Controls of Gene Expression.* The organizer will be Simon Baumberg (Leeds).

Future Meetings

The Group Committee would be glad to hear from any SGM member with interests in the areas of its remit, of topics for symposia, workshops, etc., especially where these have not recently been covered (and do not appear to be about to be in the near future). Please contact the Convener or any member of the Group Committee.

Systematics & Evolution

Bradford, 6–8 January 1998

The Group will be hosting a one-day SGM 'Topical Special Symposium' at this venue entitled *Biology of Exploitable Bacteria in the Genus Rhodococcus.* We are currently inviting speakers to cover the following subjects: genetics; systematics; cell wall organization; ecology, including novel rhodococci from the deep sea; surface-active lipids; primary metabolism and bioremediation; degradation of chlorinated compounds; biotransformations; desulphuranase enzymes; metabolism of organic nitrogen compounds; industrial scale-up of amidases. If you would like to offer a poster on a relevant topic, then please forward your proposal with a title and draft abstract to the Convener as soon as possible, but **by 30 September 1997.** In addition, along with the Fermentation & Bioprocessing Group, SEG is jointly planning a two-day symposium programme entitled *Screening for New Therapeutic Agents* – if you are interested in offering a short paper, please see under the F&B Group News.

Nottingham, 30 March–3 April 1998

We are holding a collaborative symposium on *Advances in Fungal Systematics* with the British Mycological Society. Further details will appear in the next issue of the *Quarterly.* If you can offer a poster on a topic relevant to our theme then please forward your proposal with a title and draft abstract to the Convener as soon as possible, but **before December 1997.**

Warwick, 5–7 January 1999

At this venue the Group is planning a collaborative two-day meeting with the Microbial Infection and Clinical Virology Groups on the subject of *Respiratory Pathogens.* If you are able, then please think about offering a short paper on this theme.

Future Meetings

We are at an early stage of discussions with a view to holding symposia in 1999 and 2000 on the subjects of *Sub-specific Classification and Identification* and the *Impact of Lateral Gene Transfer on Systematics.*

Convener:
Dr Grace Alderson
Department of Biomedical Sciences
University of Bradford
Bradford BD7 1DP
Tel. 01274 383564
Fax: 01274 309742
Email g.alderson@bradford.ac.uk

Virus

Southampton, 1–5 September 1997

The Virus Group will host the **2nd European Virology Meeting** contiguously with the normal autumn meeting of the Society. The theme of the meeting will be *Virus–Host Interactions* with a total of 12 invited speakers making 40 minute presentations throughout each morning of the meeting. The current list of confirmed speakers is: A. Alcami (Oxford), E. Domingo (Madrid), R.M. Elliott (Glasgow), P. Goulder (Oxford), H.D. Klenk (Marburg), M.G. Masucci (Stockholm), A. Maule (Norwich), H. Ploegh (Boston, USA), J.G.P. Sissons (Cambridge), G.T.W. Wertz (Birmingham, USA) and T.F. Wild (Lyon). In addition to the invited speakers there will be both open paper (15 minute talks) and poster sessions during the meeting. Those wishing to make presentations during these sessions should send titles to the Convener **by Thursday 12 June 1997** with an indication of whether they would prefer to make an oral or poster presentation. Those not selected for oral presentation will be allocated to one of the poster sessions.

Funds will be available to assist a limited number of PhD students and Postdoctoral Fellows to attend this meeting. Applications for funding, with a CV, the reasons for wishing to attend and a full breakdown of the costs should be made to the Convener **by 13 June 1997.** Student members of the Society should note that they are eligible to apply for a grant from the President's Fund to attend this meeting.

Convener:
Professor Malcolm A. McCrae
Department of Biological Sciences
University of Warwick
Coventry CV4 7AL
Tel. 01203 523524
Fax 01203 523568/523701
Email malcolm@dna.bio.warwick.ac.uk

Book Reviews

Proceedings of the 5th International Perspectives on Protein Engineering CD-ROM

(ISO9660 format readable on PC, Mac and UNIX systems)

Edited by M.J. Geisow.
Published by Biodigm Ltd (1996).
£50 + VAT *ISBN: 0-9529015-0-1*

Michael Geisow introduced this novel concept in publication of conference proceedings in the February *Quarterly* (p. 17). This CD is an impressive production representing much effort. It can be used either as normal or as a hybrid CD–Internet access facility. The CD contains the full text and illustrations of all the conference papers, abstracts and much additional material. These are HTML files, to be read and used with your web browser. The CD offers a 'frames' version for screen display with windows showing the article or other material being read, contents and help or supplementary information. There is plenty to interest and inform the stand-alone reader, but the CD only displays its full merit when used with a connection to the Internet. Thousands of active links from the articles and contents list give access to a tremendous range of sources of information and means of communication. On test it generally worked very well and most servers tried established contact quickly. The 'frames' presentation enables net exploration while simultaneously retaining the CD contents as a 'home base' from which to start new links. Highly recommended to protein engineers, and to anyone as an example of the technology – will it become a standard way of producing conference transactions, or will the effort required to set up the links be too great?

Ron Fraser and Duncan McGarva, SGM Marlborough House

Understanding Antibacterial Action and Resistance. Second Edition

By A.D. Russell & I. Chopra.
Published by Ellis Horwood (1996).
£31.50 *pp. 292* *ISBN: 0-13-124827-8*

This book provided a timely and excellent overview of antibacterial action and resistance for me, as I am about to give some lectures on these topics. This second edition includes modifications and additions to cover developments since the first edition. Improvements are not just confined to this, as completely new subject matter has been included such as the development process for new antibiotics and synergy between biocides. Overall, this book is a welcome addition to other texts on antibacterial action and resistance. Although the price may be a little high, I will be recommending this book to my students.

Ian Morrissey, University of Hertfordshire

Biotechnology. Third Edition. Studies in Biology Series

By John E. Smith.
Published by Cambridge University Press (1996).
P/B £9.95/US$16.95; H/B £27.95/US$49.95
pp. 236 *ISBN: 0-521-44911-1 (P/B); 0-521-44467-5 (H/B)*

The third edition of John Smith's successful book provides an introduction to the broad range of scientific disciplines, technologies and commercial activity encompassed by the title. It is aimed at a varied readership from interested non-biologists to specialist undergraduates. This reasonably priced book is packed with useful information and is written in an easily accessible style suited to a useful course text. Longer than previous editions, it now includes expanded sections covering such important and timely topics as clean technology, gene therapy, patent protection, the release of GMOs and the application of human genetic research. Strongly recommended.

John Colby, Sunderland

Molecular Aspects of Host–Pathogen Interactions. SGM Symposium Volume 55

Edited by M.A. McCrae, J.R. Saunders, C.J. Smyth & N.D. Stow.
Published by Cambridge University Press (1997).
£65.00/US$ 115.00 (Member's Price: £26.00/US$ 46.00)
pp. 361 *ISBN 0-521-59215-1*

Ever since I can remember, and that's a long time ago – I started doing microbiology before polyacrylamide gel electrophoresis was invented – the publication of SGM Symposia have been important events in our calendar. Their quality, timing and authority have marked them out from all other reviews as demanding pride of place on our shelves as working volumes.

Malcolm McCrae and his colleagues have done it again with the 55th volume, which focuses on host–pathogen interactions at the molecular level. A strong international team has provided authoritative reviews on topics ranging from protein–protein and protein–carbohydrate recognition, prokaryote/eukaryote cell interactions (*Yersinia*, *Staphylococcus*, *Neisseria*, *Shigella*, *Escherichia coli*, *Chlamydia*), virus receptors, virus gene expression and the host cell, to the formation of protease-resistant prion proteins. What a feast! This is a book which provides not only a series of comprehensive position papers on the state-of-the-art in one of the most rapidly developing – and trendy – areas in microbiology today, but a set of meaty reviews which should also be in the hands of those of us who dabble in other areas like molecular epidemiology and clinical microbiology. I strongly recommend my colleagues in these areas to read them if for nothing but the good of their souls!

Hugh Pennington, University of Aberdeen

Fungal Genetics: Principles and Practice. Mycology Series, Vol. 13

Edited by Cees J. Bos.
Published by Marcel Dekker, Inc (1996).
US$175.00 *pp. 456* *ISBN: 0-8247-9544-X*

A major text in Fungal Genetics is long overdue. This one has an interesting, indeed novel approach, being divided into two sections. The first section deals with principles addressing both classical and molecular aspects and the second is a series of case studies focusing on individual species. The book will be useful to young researchers coming to fungal genetics, saving the time to search through large numbers of original papers. However, the cost will limit purchase to an institutional library or benevolent supervisor if such individuals still exist.

John F. Peberdy, University of Nottingham

Yeast Protocols. Methods in Molecular Biology, Vol. 53

Edited by I.H. Evans.
Published by Humana Press (1996).
US$74.50 *pp. 482* *ISBN: 0-89603-319-8*

This book contains detailed descriptions of many of the techniques currently used in yeast molecular and cell biology. Most chapters are written with *S. cerevisiae* in mind, although, as the authors point out, many of the methods could be adapted for other species. With the completion of the *S. cerevisiae* sequencing project earlier this year, things are moving quickly in yeast molecular biology and research workers in this field, at whom this volume is primarily aimed, will find some of this book already outdated. However, there is still enough useful information in this book to warrant having a copy around the lab.

Dave Gardner, UMIST

Book Reviews

Antimicrobial Resistance. A Crisis in Health Care. Advances in Experimental Medicine and Biology, Vol. 390

Edited by D.L. Jungkind, J.E. Mortensen, H.S. Fraimow & G.B. Calandra.
Published by Plenum Publishing Corporation (1995).

US$79.50 *pp. 248* *ISBN: 0-306-45207-3*

Publication in 1995 of a symposium held in 1993 seems an unpromising start for this volume. Nonetheless, this well-referenced exposition of how things were two years ago (the manuscripts were updated after the symposium) is not without value, particularly for the non-specialist. A series of reviews and reports concentrating on hot topics in resistance are on offer. MRSA and MDRTB are very minor players on this stage dominated by Vancomycin, quinolone and β-lactam resistance. Bit-parts are taken by malaria, HIV, trichomonas and fungi as well as more general management issues such as molecular epidemiology, infection control and laboratory detection. This is not a book to settle down and read; its coverage is uneven, goes to very different levels and seems to address quite different patterns of expertise. I can't really see who would want to buy it, but you might get lucky and find what you want in it.

Mike Barer, University of Newcastle Medical School

(1) Recombinant DNA and Biotechnology: A Guide for Teachers
(2) Recombinant DNA and Biotechnology: A Guide for Students

By Helen Kreuzer & Adrianne Massey.
Published by ASM Press (1996).

(1) US$39.95, plus 5% shipping/handling charge
pp. 552 *ISBN: 1-55581-101-9C;*

(2) US$35.95, plus 5% shipping/handling charge
pp. 349 *ISBN: 1-55581-110-8C*

Encouraged by a more liberal regulatory environment than exists within the European Union, laboratory work with DNA has been a feature of high school education in the USA since the mid-1980s. Together this teacher's guide and its companion volume for students provide both a textbook and practical manual for laboratory work, coupled with numerous pencil and paper simulations plus materials to stimulate classroom debate on ethical issues. Unlike those in several similar texts, all of the practical protocols are suitable for schools in Europe, although the American emphasis (particularly in the section on careers) may discourage some readers. Recommended.

Dean Madden, NCBE, Reading

Virology Methods Manual

Edited by B.W.J. Mahy & H.O. Kangro.
Published by Academic Press (1996).

£55.00 *pp. 512* *ISBN: 0-12-465330-8*

'From TCID50 to PCR'

Brian Mahy and Hillar Kangro's book mirrors the story of virology over the last 20–30 years. The manual divides comfortably without too much overlap into three sections, classical, molecular and medical virology. Classical virology sets a strong foundation of cell cultures, often considered to be more of an art than a science.

Molecular virology was very competently handled with many of the contributors parting with their tried and tested techniques in a way that cannot always be covered in original publications. The 'open-flat' spiral binding of the manual means it will be used at the bench by working virologists of all backgrounds.

Liz Boxall, Public Health Laboratory, Birmingham

Tuberculosis. Back to the Future

Edited by J.D.H. Porter & K.P.W.J. McAdam.
Published by John Wiley & Sons Ltd (1994).

£14.95/US$23.95 *pp. 285* *ISBN: 0-471-94346-0*

An excellent introductory chapter by Dixie Snider sets the tone for what's to follow in this synopsis of the London School of Hygiene's third annual public health forum which dealt with tuberculosis. Experts in the fields of chemotherapy, epidemiology, immunology and molecular biology present their views and knowledge on tuberculosis and outline the goals that need to be aimed for if weare to lessen the global burden of this disease. Discussion sections at the end of each chapter, including reports from the workshops, add considerable extra value rather than just repeating the message of the preceding chapters. Although parts, such as those dealing with the molecular biology of drug resistance, could do with updating, this volume can certainly be recommended.

Stephen Gordon, Institut Pasteur

Bacterial Growth and Form

By Arthur L. Koch.
Published by Chapman & Hall (1995).

£55.00 *pp. 423* *ISBN 0-412-02871-9*

Introducing this unique book, Ron Doyle and Lolita Daneo-Moore write "those of you who will never be able to meet Arthur (Koch) will get to know him well by studying this book". Very true. Like its author, this book is engaging, provocative, intelligent and delightful to know. The style is easy, despite rigorous theoretical analyses of patterns and mechanisms of growth of bacteria and fungi. The book blends ultrastructural studies of bacteria with the underlying 'chemistry' (thermodynamics, diffusion theory and kinetics). Who should read it? Koch provides the answer: "people who already have a fascination with bacteria". Buy it.

Robert Poole, Sheffield

Book Reviews

Strategies for Protein Purification and Characterization. A Laboratory Course Manual

By D.R. Marshak, J.T. Kadonaga, R.R. Burgess, M.W. Knuth, W.A. Brennan, Jr & S.-H. Lin.
Published by Cold Spring Harbor Laboratory Press (1996).

US$110.00 (Cloth)
pp. 881 *ISBN: 0-87969-449-1*
US$75.00 (Plastic comb binding)
pp. 881 *ISBN: 0-87969-385-1*

This book certainly succeeds as a manual to teach both the strategy and execution of protein purification by actually doing it, and experiments can be used reliably 'straight from the page'. In addition, good cross-indexing makes it a useful techniques reference source and its layout, as four self-contained units, enables entire sets of protocols to be studied without the requirement of hacking through the whole course manual. Several of our research students have also used it successfully as a self-study text when confronted by the need to purify proteins. Definitely a worthwhile purchase for any laboratory.

Martin A. Collins, Belfast

Methods in Soil Biology

By F. Schinner, R. Öhlinger, E. Kandeler & R. Margesin.
Published by Springer-Verlag GmbH & Co. KG (1996).

DM98.00/öS715.40/sFr 86.50
pp. 426 *ISBN: 3-540-59055-2*

This is a useful collection of methods for soil biologists describing a wide range of the most tried and tested methods. Each chapter is written by a recognized expert and the format is clear and easily read with clear diagrams and explanations. Compared to the American SSSA *Methods of Soil Analysis Part 2*, this new book is not as detailed nor as wide ranging but it still appeals as there are several alternative methods described and it is simpler and clearer. There are additional short chapters on soil chemistry and physics, which although not comprehensive, describe a few of the most essential techniques. Some methods books are now published on water-proofed paper in ring binders to use on the bench. *Methods in Soil Biology* is still a reference book for the shelf but its clarity and simplicity of presentation make it easy to use.

Colin Campbell, Macaulay Land Use Research Institute

Legionellae Control in Health Care Facilities. A Guide for Minimizing Risk

By M.R. Freije.
Published by HC Information Resources, Inc. (1996).
(Fax +1 317 876 5559)

US$79.00 *pp. 131* *ISBN: 0-9649926-4-7*

This short guide includes: a brief review of relevant facts about legionnaire's disease and *Legionella*; how to establish an appropriate action plan; preventative measures; planning and carrying out environmental sampling; disinfection and the response to an outbreak. Information is used from all over the world but, unfortunately, the book is biased to the North American market. Despite this it does bring together a lot of useful information in a compact and conveniently presented form. There are some divergences from UK practice which mean that it could not be used by itself for guidance in the UK. The discussions of sampling and the disinfection methods applicable to hot water systems are helpful although stabilized chlorine dioxide is not mentioned. For those with about £50 to spare it is a worthy adjunct to the existing codes of practice and guidance available in the UK, but not essential reading.

John V. Lee, Public Health Laboratory, Nottingham

Replacement, Reduction and Refinement of Animal Experiments in the Development and Control of Biological Products. Developments in Biological Standardization, Vol. 86

Edited by F. Brown, K. Cussler & C. Hendriksen.
Published by S. Karger AG, Basel (1996).

sFr345.00/DM413.00/US$300.00
pp. 374 *ISBN: 3-8055-6260-8*

The development and batch testing of biological medicines uses large numbers of animals in tests which often have lethal end-points or cause considerable suffering. These 35 papers and 26 posters by key people deal with viral, bacterial and toxoid vaccines as well as therapeutic toxins and monoclonal antibodies.

Reviews and original research, with reliable detail and useful tables, are accompanied by comprehensive analysis and historical perspective. This volume should be read by all who produce, test and regulate biologicals and by microbiologists interested in replacing animal tests. However, the price will deter individuals and even, perhaps, some libraries and institutions.

Gill Langley, Dr Hadwen Trust for Humane Research, Hitchin

Animal Cell Electroporation and Electrofusion Protocols. Methods in Molecular Biology, Vol. 48

Edited by J.A. Nickoloff.
Published by Humana Press (1995).

US$64.50 *pp. 392* *ISBN 0-89603-304-X*

This compilation of explanations and protocols follows the regular series format – soft-backed, plastic-bound and A5 size, which in our laboratory has proved to be robust and popular with staff and students. Equally popular is the wealth of technical detail, the explanatory 'Notes' and reference lists. The 'Notes' also include conceptual points which will lead the experimenter to understanding how these techniques can be adapted.

The first three chapters introduce the theoretical aspects of electroporation, how membranes may be perturbed, the bioactive molecules (DNA, antibodies, hormones) established and the instrumentation available for electric field technologies.

Nineteen chapters describe applications for animal cells and seven cover electrofusion. Although electroporation has not been exploited therapeutically, its potential for gene therapy is outlined and an interesting chapter describes the effect on cardiac tissue following defibrillation.

This volume should fulfil its aim, to "take the guesswork out of experimental trials".

Keith Thompson, Belfast

Protein Purification Protocols. Methods in Molecular Biology, Vol. 59

Edited by S. Doonan.
Published by Humana Press Inc. (1996).

US$64.50 *pp. 424* *ISBN 0-89603-336-8*

A chapter on general strategies leads on to 34 chapters dealing with individual techniques. Each chapter is self-contained and presented straightforwardly, enabling first-timers to follow the protocols readily. To further aid this target readership, the Editor has thoughtfully included a concluding chapter on 'how to do' column chromatography, neatly filling in some of the practical gaps in materials and equipment required and their use. Overall, a well presented utilitarian bench manual and a worthwhile purchase for novice and established practitioner alike.

Martin A. Collins, Belfast

Book Reviews

Human Molecular Genetics. Methods in Molecular Genetics, Vol. 8

Edited by Kenneth W. Adolph.
Published by Academic Press Inc. (1996).
US$85.00 *pp. 500* *ISBN: 0-12-044310-4*

Sections of this book deal with techniques applicable to DNA (and occasionally proteins) in general, and these will be of interest to microbiologists. The techniques described form a mixed bag, varying from the standard (Southern blotting, in the chapter on loss of heterozygosity and homozygous deletion analysis) to the intriguingly unfamiliar (such as a method for identifying optimal DNA-binding sites for DNA-binding proteins, in chapter 4). Several topics are discussed more than once: chemical mismatch cleavage, for instance, appears in chapters 1 and 5, and SSCP (single-strand conformational polymorphism) in chapters 3, 4 and 5. Nevertheless, the variations in different descriptions of the same technique are liable sometimes to be valuable in themselves. A book for the techniques-oriented molecular geneticist to browse in.

Simon Baumberg, Leeds

Molecular Biotechnology. Principles and Applications of Recombinant DNA

By B.R. Glick & J.J. Pasternak.
Published by ASM Press (1994).
US$42.95 *pp. 520* *ISBN: 1-55581-071-3*

This text is an excellent guide for undergraduates studying biotechnology and also very interesting to more advanced researchers. It addresses fundamental issues of gene cloning, transformation into suitable hosts and production of heterologous products as well as exploring the issues of regulation and patenting. It is very broad in its approach so that plant and animal systems are discussed as well as microbial biotechnology. It fills the gap between cloning texts and general molecular biology texts which should make it appeal to a wide readership. The writing and presentation styles are good and students will find the review questions at the end of each chapter helpful, although guideline answers are missing and would be useful. The review copy was the 1994 edition and it is currently being revised for 1997 which should bring it right up to date and well worth considering if you are looking for a biotechnology text to adopt.

Anne Glover, Aberdeen

The Mycota, Vol. III. Biochemistry and Molecular Biology

Edited by R. Brambl & G.A. Marzluf.
Published by Springer-Verlag GmbH & Co. KG (1996).
DM298.00/öS2,175.40/sFr260.00
pp. 449 *ISBN: 3-540-58004-2*

The fungi are a polyphyletic group consisting of an estimated 1.5 million species of which less than 5 % have been identified and classified. They are studied by mycologists/microbiologists who have a wide knowledge of the group, and by biologists who, although they use them as model organisms (particularly *Saccharomyces cerevisiae*, *Schizosaccharomyces pombe*, *Neurospora crassa* and *Aspergillus nidulans*), have little knowledge of fungal diversity. The present treatise is intended to serve both groups and if it bridges this difficult divide it will serve a very valuable function.

It is interesting to compare the present volume with the 1975 Smith & Berry volume on *Biosynthesis and Metabolism*; Brambl & Marzluf's decision to focus on 'emerging topics' has resulted in relatively few subjects being covered in both volumes. Furthermore, the comparison underlines the remarkable advance in our knowledge gained from the application of molecular biology to the fungi. Important topics such as plasma membrane, mitochondrial and vacuolar ATPases, heat-shock proteins, signal transduction, chitin biosynthesis, cellulases, polyamines, and nitrogen and carbon metabolism are covered in the present volume, whilst hormone mechanisms, enzyme production and secretion, lipid biosynthesis, and steroid and polypeptide biosynthesis will presumably be covered in later volumes. At over £100 a copy, the book is destined for the library shelf rather than the academic's office. Let us hope it is used there and increases the interest of researchers in this important group of micro-organisms.

Tony Trinci, Manchester

Biodiversity, Science and Development. Towards a New Partnership

Edited by F. Di Castri & T. Younès.
Published by CAB International in association with the International Union of Biological Sciences (1996).
£65.00 (US$120.00 Americas only)
pp. 672 *ISBN: 0-85198-973-X*

In September 1994 there was a DIVERSITAS meeting (an IUBS–SCOPE–UNESCO programme on biological diversity) for which this is the proceedings. Although IUBS President F. di Castri singles out marine and microbial systems as needing special attention, the majority of chapters devote themselves to macroscopic, terrestrial systems. For microbial interest, turn to chapters by Colwell (pp. 456–468) and Comer & Debus (pp. 488–499) which both focus on biotechnology.

Many of the book's contributors discuss the inadequacy of species richness as a biodiversity measure which comes as welcome relief from the more common (voluble?) 'count-'em' school of biodiversity. The book lacks the detailed data of UNEP's *Global Biodiversity Assessment* but provides a useful set of authoritative opinions, excellent illustrative examples and highly quotable passages. When writing about biodiversity at a general level (e.g. backgrounds and introductions to research papers), this is a book to which you should have access.

Dave Roberts, Natural History Museum

Books Received

Handbook of Fluorescent Probes and Research Chemicals, Sixth Edition

By R.P. Haugland.
Published by Molecular Probes Europe BV (1996).

The first copy of the Handbook (pp. 679) is sent free to customers. An electronic version of the entire Handbook and bibliographies for all products are also available through the Molecular Probes' Web site (http://www.probes.com).

Corona- and Related Viruses. Advances in Experimental Medicine and Biology, Vol. 380

Edited by P.J. Talbot & G.A. Levy.
Published by Plenum Publishing Corporation (1995).
US$139.50 *pp. 615* *ISBN: 0-306-45117-4*

DIARY

Diary

SGM MEETINGS

Checkpoints and Non-linear Dependency Relationships
Southampton, 1–5 September 1997

***2nd European Virology Meeting:* Virus–Host Interactions**
Southampton, 3–5 September 1997
Further details can be found on the web at http://www.socgenmicrobiol.org.uk/evirfli.htm

***Joint meeting of the SGM Clinical Virology Group and European Group for Rapid Viral Diagnosis:* Viral Cross-infection in Clinical Care**
Royal Society of Medicine, 4–6 January 1998

Biology of Exploitable Bacteria in the Genus *Rhodococcus*
Bradford, 6–8 January 1998

Microbial Responses to Light and Time
Nottingham, 30 March–3 April 1998

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

Contact: Meetings Administrator, SGM, Marlborough House, Basingstoke Road, Spencers Wood, Reading RG7 1AE (Tel. 0118 988 5577 ext. 153; Fax 0118 988 5656; Email meetings@socgenmicrobiol.org.uk; Web http://www.socgenmicrobiol.org.uk/meetings.htm).

See pp. 72–75.

MAY 1997

Disease Prevention: Scientific Controversies
Castelvecchio Pascoli, Italy, 24–29 May
Contact: Dr J. Hendekovic, European Science Foundation, 1 quai Lezay-Marnésia, 67080 Strasbourg Cedex, France (Tel. +33 388 76 71 35; Fax +33 388 36 69 87; Email euresco@esf.org)

Management Forum Conference: Rapid Microbiological Techniques in the Pharmaceutical Industry
London, 28 May 1997
Contact: Management Forum Ltd, 48 Woodbridge Road, Guildford, Surrey GU1 4RJ (Tel. 01483 570099; Fax 01483 536424; Email management_forum@psilink.co.uk

JUNE 1997

Control of Metabolic Flux: Approaches for Understanding the Control of Flux in Yeasts and Fungi
Giens (near Toulon), France, 14–18 June 1997
Contact: Dr J. Hendekovic, European Science Foundation, 1 quai Lezay-Marnésia, 67080 Strasbourg Cedex, France (Tel. +33 388 76 71 35; Fax +33 388 36 69 87; Email euresco@esf.org)

JUNE–JULY 1997

6th International Conference on Perspectives in Protein Engineering: Engineered Proteins from Microbes & Plants
John Innes Centre, Norwich, 28 June–1 July 1997
Contact: Secretariat: POPE '97, c/o Biodigm, 64 Langdale Grove, Bingham NG13 8SS (Fax 01949 876 156; Email biodigm@dial.pipex.com; Web http://www.biodigm.com/pope/pope6.htm)

JULY 1997

The Biochemical Society Meeting
University of Dundee, 29–31 July 1997
Contact: The Meetings Office, The Biochemical Society, 59 Portland Place, London W1N 3AJ (Tel. 0171 580 3481; Fax 0171 637 7626; Email meetings@biochemsoc.org.uk)

AUGUST 1997

Treatment and Utilization of Agro-Industrial Waste for a Cleaner Environment and Sustainability. ICRO/UNESCO Training Course
Hat Yai, Thailand, 4–16 August 1997
Contact: Dr Poonsuk Prasertsan, Dept of Industrial Biotechnology, Faculty of Agro-Industry, Prince of Songkla University, Hat Yai 90110, Thailand (Fax +66 74 212 889)

Molecular Biology Techniques. ICRO/UNESCO Training Course
Nairobi, Kenya, 14–28 August 1997
Contact: Dr O.J. Ochanda, Biotechnology Group, Dept of Botany and Biochemistry, Chiromo, PO Box 30197, Nairobi, Kenya (Fax +254 2 336 885/449 616; Email botany@ken.healthnet.org)

AUGUST–SEPTEMBER 1997

46th Harden Conference: Structure and Mechanism of Oxidases and Related Systems
Robbins Hall, University of Plymouth, 28 August–2 September 1997
Contact: Michelle Mandale, The Biochemical Society Harden Conferences, 59 Portland Place, London W1N 3AJ (Tel. 0171 580 3481; Fax 0171 637 7626; Email: meetings@biochemsoc.org.uk)

SEPTEMBER 1997

Second International Virus Assembly Symposium
The Canary Islands, 14–19 September 1997
Contact: Professor Polly Roy, NERC Institute of Virology & Environmental Microbiology, Mansfield Road, Oxford OX1 3SR (Fax 01865 559962)

The Second United Kingdom Symposium on Health-related Water Microbiology
University of Warwick, 17–19 September 1997
Contact: Dr Ray Morris, 142 Hinckley Road, Barwell LE9 8DN (Tel/Fax 01455 842145; Email: wmorris@cix.compulink.co.uk)

47th Harden Conference: Regulation of Carbohydrate Metabolism in Normal and Diseased States
Royal Agricultural College, Cirencester, 21–25 September 1997
Contact: Michelle Mandale, The Biochemical Society Harden Conferences, 59 Portland Place, London W1N 3AJ (Tel. 0171 580 3481; Fax 0171 637 7626; Email meetings@biochemsoc.org.uk)

Emergence and Re-emergence of Negative Strand Viruses: Tenth International Conference on Negative Strand Viruses
Dublin, Ireland, 21–26 September 1997
Contact: Dr B.W.J. Mahy, PO Box 33799, Decatur GA 30033-799, USA (Tel. +1 404 728 0564; Fax +1 404 728 0032; Email nsv@aol.com)

SEPTEMBER–OCTOBER 1997

37th Interscience Conference on Antimicrobial Agents and Chemotherapy
Toronto, Canada, 28 September–1 October 1997
Contact: ASM Meetings Department, 1325 Massachusetts Avenue NW, Washington DC 20005 (Tel. +1 202 942 9248; Fax +1 202 942 9340; Email meetingsinfo@asmusa.org)

OCTOBER 1997

Second European Meeting on Diagnostic PCR
Kurhaus Hotel, The Hague, The Netherlands, 16–17 October 1997
Contact: Huub Schellekens, Tinbergenpad 6, 2912 BH Nieuwerkerk a/d Ijssel, The Netherlands (Tel. +31 180 313630; Fax +31 180 318795; Email huubs@xs4all.nl; GSM mobile phone +31 654686557)

NOVEMBER 1997

6th International Symposium on dsRNA Viruses
Cocoyoc, Mexico, 9–13 November 1997
Contact: Drs Susana López or Carlos F. Arias, Instituto de Biotecnología/UNAM, Apartado Postal 510-3, Colonia Miraval, Cuernavaca, Morelos, Mexico (Tel. +52 73 29 1661; Fax +52 73 17 2388; Email dsrna@ibt.unam.mx)

JANUARY 1998

International Congress on Extremophiles
Yokohama, Japan, 18–22 January 1998
Contact: Mr Katsumi Sakakura (Fax +81 468 66 5306; Email shimizut@jamstec.go.jp)

MAY 1998

4th International Symposium on Viruses of Lower Vertebrates
Weymouth, 12–15 May 1998
Contact: Prof. Barry Hill or Dr Peter Dixon, CEFAS Weymouth Laboratory, Barrack Road, The Nothe, Weymouth, Dorset DT4 8UB, UK (Tel. 01305 206600; Fax 01305 206601; Email b.j.hill@cefas.co.uk or p.f.dixon@cefas.co.uk)

JUNE 1998

2nd International Workshop on Bemisia and Geminiviral Diseases
San Juan, Puerto Rico, 7–12 June 1998
Contact: Mrs D. Guy, Secretary-Treasurer, IWBGD, 2120 Camden Road, Orlando, FL 32803-1419, USA (Tel. +1 407 897 7304; Fax +1 407 897 7337; Email rmayer@ix.netcom.com; Web http://www.wisc.edu/plhealthser/gv-wf/index.htm)

AUGUST 1998

Eighth International Symposium on Microbial Ecology – Microbial Biosystems: New Frontiers
Halifax, Nova Scotia, Canada, 9–14 August 1998
Contact: Dr Colin R. Bell, Microbial Ecology Laboratory, Dept of Biology, Acadia University, Wolfville, Nova Scotia, Canada B0P 1X0 (Tel. +1 902 542 2201 ext. 1328; Fax +1 902 542 3466; Email isme8@acadiau.ca; Web http://dragon.acadiau.ca/~cbell/isme8.html)

SEPTEMBER 2000

BIOTECHNOLOGY 2000: 11th International Biotechnology Symposium and Exhibition
International Congress Centre (ICC), Berlin, Germany, 3–8 September 2000
Contact: DECHEMA e.V., c/o 11th IBS, Theodor-Heuss-Alee 25, D-60486 Frankfurt am Main, Germany (Tel. +49 69 7564 241; Fax +49 69 7564 201; Email info@dechema.de; Web http://www.dechema.de)

Officers:

President	*School of Biological Sciences,* 1.800 Stopford Building, Oxford Road, University of Manchester, Manchester M13 9PT	Tel. 0161 275 3893 Fax 0161 275 5656 Email tony.trinci@man.ac.uk
Treasurer	*Department of Molecular and Cell Biology,* Institute of Medical Sciences, University of Aberdeen, Foresterhill, Aberdeen AB25 2ZD	Tel. 01224 273143 Fax 01224 273144 Email w.a.hamilton@abdn.ac.uk
General Secretary	*School of Biological Sciences,* Biology West Building, University of Birmingham, Birmingham B15 2TT	Tel. 0121 414 6562 Fax 0121 414 6557 Email c.w.penn@bham.ac.uk
Meetings Secretary	*The Wellcome Trust,* 183 Euston Road, London NW1 2BE	Tel. 0171 611 8690 Fax 0171 611 8363 Email p.goodwin@wellcome.ac.uk
International Secretary	*School of Animal and Microbial Sciences,* University of Reading, PO Box 228, Whiteknights, Reading RG6 6AJ	Tel. 0118 931 8901 Fax 0118 931 6671 Email j.w.almond@reading.ac.uk
Professional Affairs Officer	*Microbiology Group,* Division of Life Sciences, King's College London, Kensington Campus, Campden Hill Road, London W8 7AH	Tel. 0171 333 4276 Fax 0171 333 4500 Email christopher.thurston@kcl.ac.uk
Publications Officer	*Department of Zoology,* The Natural History Museum, Cromwell Road, London SW7 5BD	Tel. 0171 938 8790 Fax 0171 938 8754 Email d.roberts@nhm.ac.uk
Editor-in-Chief, *Microbiology*	*Department of Genetics and Microbiology,* School of Life Sciences, University of Liverpool, PO Box 147, Liverpool L69 3BX	Tel. 0151 794 4416 Fax 0151 794 4401 Email jrs@liverpool.ac.uk
Editor-in-Chief, *JGV*	*Molecular Biology,* Wellcome Research Laboratories, Langley Court, Beckenham, Kent BR3 3BS	Tel. 0181 658 2211 Fax 0181 663 3532

Members:

	Regional Virus Laboratory, Ruchill Hospital, Bilsland Drive, Glasgow G20 9NB	Tel. 0141 946 7120 Fax 0141 946 2200
	Regional Public Health Laboratory, Level 6, Addenbrooke's Hospital, Hills Road, Cambridge CB2 2QW	Tel. 01223 216816 Fax 01223 242775
	School of Pure & Applied Biology, University of Wales College of Cardiff, P.O. Box 915, Cardiff, CF1 3TL	Tel. 01222 874190 Fax 01222 874305 Email fry@cardiff.ac.uk
	Department of Molecular and Cell Biology, Institute of Medical Sciences, University of Aberdeen, Foresterhill, Aberdeen AB25 2ZD	Tel. 01224 273099 Fax 01224 273144 Email l.a.glover@abdn.ac.uk
	School of Biological & Medical Sciences, Irvine Building, University of St Andrews, St Andrews, Fife KY16 9AL	Tel. 01334 463396 Fax 01334 463400 Email rth@st-and.ac.uk
	Department of Biological Sciences, University of Warwick, Coventry CV4 7AL	Tel. 01203 523559 Fax 01203 523701 Email dm@dna.bio.warwick.ac.uk
	Department of Microbiology, University of Newcastle Medical School, Framlington Place, Newcastle upon Tyne NE2 4HH	Tel. 0191 222 7704 Fax 0191 222 7736
	Department of Biological Sciences, Heriot-Watt University, Riccarton, Edinburgh EH14 4AS	Tel. 0131 451 3464 Fax 0131 451 3009 Email f.g.priest@hw.ac.uk
	Department of Microbiology, University of Leeds, Leeds LS2 9JT	Tel. 0113 233 5641 Fax 0113 233 5638 Email d.j.rowlands@leeds.ac.uk
	Colworth Laboratory, Unilever Research, Colworth House, Sharnbrook, Bedfordshire MK44 1LQ	Tel. 01234 222131 Fax 01234 222539
	MRC Virology Unit, Institute of Virology, Church Street, Glasgow G11 5JR	Tel. 0141 330 4017 Fax 0141 337 2236
	Department of Biological Sciences, University of Warwick, Gibbet Hill Road, Coventry CV4 7AL	Tel. 01203 523184 Fax 01203 523701 Email eg@dna.bio.warwick.ac.uk