Quarterly

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- Chocolate, mushrooms and cheese!
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Front cover: A model of servants making bread and brewing. Ancient Egyptian early X11 Dynasty model from Beni Hasan Tomb 366. See article on p. 3. Photo courtesy of the Fitzwilliam Museum, Cambridge.

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EDITORIAL

Database Copyright

Last December the World Intellectual Property Organization (WIPO) met in Geneva. Not an event to trouble the world of microbiology unduly, you might think, but this particular meeting carried the threat of considerable impact on the way many of us work, as well as being of substantial importance to the development of electronic publications.

WIPO is an intergovernmental organization, one of the 16 specialized agencies of the UN, responsible for the promotion of the protection of intellectual property throughout the world and with a substantial part of their resources focused on the developing world. Intellectual property comprises two main branches, industrial property and copyright, and it is the latter with which we need be most concerned. There were three treaties under consideration; firstly, *Treaty on Certain Questions Concerning the Protection of Literary and Artistic Works*; secondly, *Treaty for the Protection of the Rights of Performers and Producers of Phonograms*; and thirdly, *Treaty on Intellectual Property in Respect of Databases*.

In the second Treaty, the main threat to academics was in Article 7, which dealt with the rights to reproduction in any form, including the digital environment. If enacted, this would have classified using a browser across the net as a digital reproduction and require that you had copyright permission to create the file necessary to read the document. The most draconian possibility was that all intermediate servers in the computer chain that brought you a given image or piece of text would also have had to obtain copyright permission: that would have made running the Web as we now know it impossible. The conference chairman clarified that the term 'copies' meant tangible objects, by which I understand that volatile transient copies stored by servers *en route* would not subject the server's administrators to checking that they had copyright permission for those particular data. Article 7 was, in fact, deleted by the conference but, on the last day, the core issue re-appeared in the agreed Conference Statement, re-asserting that 'digital copies' were bona fide copies under the existing copyright laws, but the term 'storage' in a digital sense still required definition. In the end, there are no explicit rights to control browsing the Internet or every transmission of works over digital networks, for which most computer users will breathe a sigh of relief.

Negotiation of the third Treaty, on copyright in databases, did not get started in Geneva and the Conference recommended 'future work'. This issue is far more important than the potentially disruptive Article 7 and has a curious and instructive beginning. In 1991 the US Supreme Court rejected a claim for copyright for telephone directory data, ruling that facts cannot be copyrighted and that obvious organizations, such as alphabetical listings, are not themselves sufficiently creative to warrant copyright protection. This decision rejected the 'sweat of the brow' view of copyright. Thus, large comprehensive databases, which are normally expensive to produce and to maintain, are practically beyond copyright protection because they are, almost by definition, not original in terms of their content.

Consider, then, modern science which sequences genomes, gathers comparative strain data for taxonomic identification matrices, builds epidemiological databases, compiles environmental and climatic data and so on. The value of such databases increases non-linearly with their size and it benefits the whole of the scientific enterprise that such data are made generally available for analysis (think of the BSE issue here, for example). In the USA, federally funded research is public and the results are de facto in the public domain. Contrarily, in Britain those whose work is funded by the Research Councils are obliged to exploit (i.e. charge for) the results of their research whenever possible. If copyright laws were to be put into place to protect telephone lists what would the consequence be for academic databases?

Currently, commercial data providers use individual customer contracts to protect their investments and prevent disclosure of their data and data structure. By way of illustration, in the USA West Publishing produces federal circuit and district court opinions and all state court opinions. The page numbers of the West court reports are used for authoritative citations by scholars and lawyers. Court judgements and opinions are, of course, public documents and West Publishing is seeking to preserve its position by preventing others from using their page numbers. The company has been very successful in lobbying the US and in the EU to maintain their market sector. If the database Treaty went ahead in its draft form, then West would have been given copyright protection to years of public documents. Database publishers are seeking a new *sui generis* property right (Latin meaning 'one of a kind' and describes statutory protections which are not defined under patent, copyright or trademark laws).

This is the major danger for academic collaborations. Say for instance, EMBL were to be privatized; its data could become EMBL copyright and licence fees charged for its use. There is no plan to do such a thing, but this Treaty would make it possible and I cannot help but wonder how long it would be before this little money-spinner occurred to a Treasury mandarin. However, given the dire circumstances in which SWISS-PROT recently found itself, scientific value is no defence.

This whole matter is now to be debated thoroughly and, I trust, openly. Clearly there are arguments to be made on both sides and some form of protection should be available to database compilers, commensurate with the effort they have put in and the value they have added to the data. It is also necessary that private companies should not be able to hijack data placed in the public domain. The Treaty not discussed in Geneva can be found on http://www.loc.gov/copyright/wipo6.html. The nature of information exchange is changing rapidly in this digital age and the basis for handling it in law, as though it were still on paper, is clearly inadequate. The technology is advancing faster than the law can be changed and we need to debate what exactly we want the law to protect and most importantly for the academic community, what exceptions we want to cover.

Dave Roberts

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

This issue of the *Quarterly* focuses on some microbiological food and drinks. The first article deals with one of the earliest examples of biotechnology – brewing!

Fermentation Technology 3,000 Years Ago – The Archaeology of Ancient Egyptian Beer

Delwen Samuel

There are two types of evidence about mankind's past: written records and archaeological remains. From written records, we know that fermented beverages have played a major role in many different societies. To name just a few, the social custom of the Greek symposium revolved around wine, beer was a staple foodstuff in ancient Mesopotamia, the Incas of South America cemented social and political relationships with chicha, a fermented maize drink, and the ancient place of wine in Jewish and Christian religious practice is still important today.

Documents frequently do not record all the information we would like to know about ancient food fermentations. At the most basic level, the way in which fermented beverages were made is often not mentioned, or such ambiguous or scanty details are provided that the method can no longer be understood. If this is not known, then it is impossible to answer other questions in any detail. For example, what nutritional and medical effects did fermented drinks have? Were different beverages produced for different social classes, and if so, what distinguished them? What role did the production and consumption of fermented beverages have in the economic structure of past societies?

To find out how fermentation was used, we must turn to archaeological evidence. Technologies such as fermentation can leave behind many clues which, when recovered and pieced together by the archaeologist, allow their reconstruction. However, the study of ancient food production presents several challenges. Evidence of prepared food is likely to be very rare because most is either eaten or decays. Whatever might survive on an archaeological site may be not be very recognizable. Also, profound physical and chemical changes generally occur when the raw ingredients are processed, often in several stages, into the final food. Finding the archaeological evidence for each step and being able to link each food processing stage together may be very difficult.

One region where these problems are somewhat less acute is Egypt. The very arid climate desiccates organic material. In the right circumstances – outside the flood zone of the Nile and protected from termites and other insects – organic remains, including food , have been preserved for thousands of years. These have been found in tombs as well as from excavations of villages and cities, places where people lived, worked, prepared food and ate. In Egypt, sophisticated civilisations have flourished for thousands of years. This long history of occupation has left abundant archaeological material behind. These two circumstances increase the chances of finding rare food remains.

For some years I have been investigating ancient Egyptian brewing. Beer, together with bread, was the most important item in the diet of the ancient Egyptians. Everyone, from Pharaoh to farmer, drank beer and no meal was complete without it. The extent to which it was consumed meant that it must have played a major role in nutrition. The fermentation process was probably also important to produce liquid which was safe to drink. For the Egyptians, though, beer was much more than just a foodstuff. In a cashless society it was used as a unit of exchange, its value fluctuating just as currencies do today. It has been difficult to assess these changes, because quantities of raw ingredients and the labour needed to brew have not been known. A variety of beers are named in documents, but we do not yet know exactly what may have distinguished the brews. Perhaps different classes of society had access to different qualities or types of beer; we do not know whether this is the case, nor what the differences might have been. No doubt, just as in recent times, beer helped to act as a social lubricant. Furthermore, beer played a central role in religious belief and ritual practice. Offerings to the gods or funerary provisions included beer, either real or magical. Since beer played such a major role in ancient Egyptian society, beer and brewing need to be investigated.

Egyptologists have indeed studied the topic, and most of the information now available about ancient brewing has been based on a rich assemblage of art. The ancient Egyptians decorated their tombs with reliefs, paintings or models depicting familiar activities, in order that these occupations might continue in the afterlife. Brewing is often depicted, but despite superficial agreement, scholars rarely concur in their interpretations of the process. I decided to turn to the archaeological evidence to see whether new insights could be gained.

The most direct evidence about ancient Egyptian brewing comes from the remains of beer itself, preserved by the arid climate. The liquid and volatile components have long since evaporated, but the solid matter has formed crusts on the interior sides and bases of beer-holding vessels. Bowls and jars were sometimes filled with large quantities of coarsely ground and cooked cereal and placed in

Fig. 1. A typical thin crust of residue sticking to the interior surface of an ancient Egyptian pot sherd from the Workmen's village at Amarna.

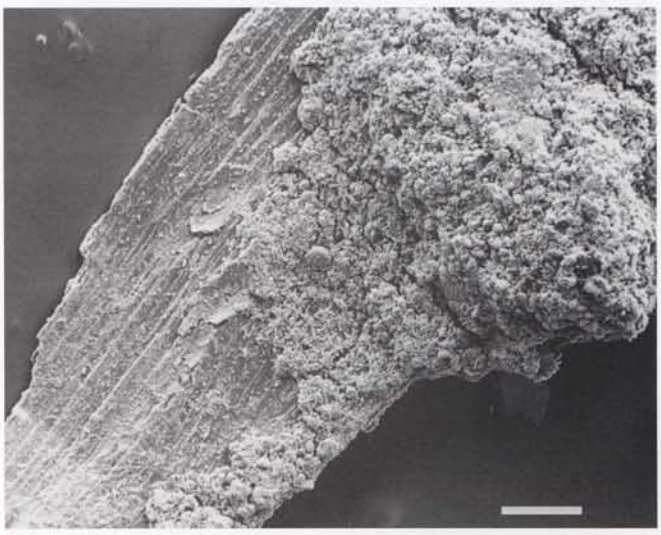

Fig. 2. A fragment of cereal chaff from a 3,300-year-old ancient Egyptian beer residue, excavated from the Workmen's village at Amarna (TAVR92-49). A lump of residue material is stuck to part of the chaff. Bar, 100 µm.

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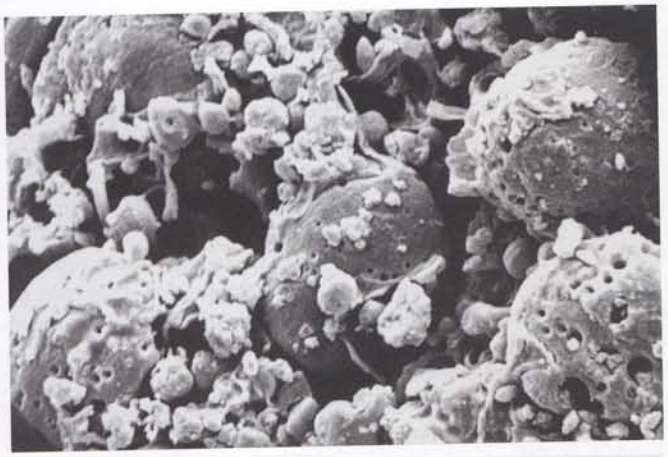

Fig. 3. A closer view of the residue shown in Fig. 1. The large starch granules are covered in pitting, indicating that they were attacked by enzymes, and therefore come from sprouted grain.

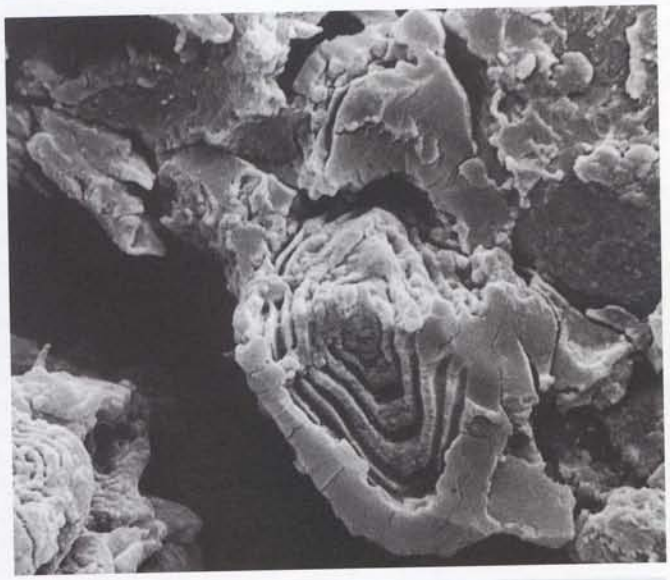

Fig. 4. Starch granules heavily attacked by enzymes show concentric rings. The central granule has a fused outer layer, indicating that it had also been exposed to heat in the presence of water. From a residue excavated from the Workmen's village at Amarna (TAVR92-42).

tombs. These seem to be from intermediate stages in brewing, or the by-products of preparing strong beer. In villages and towns, people discarded pots once they were damaged or broken, and these sometimes have thin coatings of beer still adhering (Fig. 1).

Beer residues often have fragments of grain and chaff embedded in them (Fig. 2). The cereal used for brewing can then be identified by looking for diagnostic features. The ancient Egyptians only cultivated two cereals. These were barley, which is used for brewing today, and emmer wheat (Fig. 3), now very rare, but one of the original domesticated crops which was dominant throughout much of the Old World for several millennia. Since barley is the main cereal of modern beer, it has generally been assumed that barley was also brewed by the ancient Egyptians. The ancient residues show that barley was certainly used, but that emmer was also made into beer, and sometimes the two were mixed and brewed together. The choice of the two cereals may be one of the characteristics which distinguished ancient Egyptian beers.

The aridity of Egypt's climate has preserved not only the gross structure of these residues, but also the microstructure. As a result, a wealth of information about the ancient brewing process has been preserved. Earlier this century, a German microbiologist named Johannes Grüss examined ancient Egyptian beer remnants with the light microscope and discovered plant tissue fragments, starch granules, yeast cells and bacteria. This was a great breakthrough in the study of ancient desiccated foods, but he did not expand his study to develop a model of ancient Egyptian brewing.

I have been able to collect a wide range of brewing remains from tombs and settlement sites dating to a particular time in ancient Egyptian history called the New Kingdom. This period lasted from about 1550 to 1070 BC. The light microscope has been a useful tool, but scanning electron microscopy has proved a particularly powerful method of examining the microstructure of the ancient remains. As Grüss observed, they contain starch granules, yeast cells, bacteria and different tissues from cereal grains, as well as plant tissues which have not yet been identified.

When yeast and bacteria are present, they are normally in such large colonies and form such an integral part of the residue structure that they must have been part of the original food, rather than representing later contamination or spoilage micro-organisms. Particularly for the thin residues on broken pot sherds, these colonies are most unlikely to have formed after the vessels were thrown away, for the food deposits would have dried up very rapidly. The bacteria are slightly elongated oval shapes, about 1–2 μm in length, suggesting that they might be lactic acid bacteria. This cannot be confirmed by morphology alone, but given the close association with yeast in a starchy matrix, it seems a reasonable assumption.

The structure of ancient starch matches that of modern starch very closely. Starch granules change their morphology according to the conditions to which they have been exposed. So, for example, modern starch which comes from sprouted cereal – used to make malt for brewing today – shows pits on the surface (Fig. 3) and, inside, channels in concentric rings (Fig. 4). Starch heated in a limited amount of water swells and bends, while starch cooked in an excess amount of water fuses together. These changes in starch structure can also be seen in the ancient beer residues and so the

Fig. 5. Modern emmer wheat growing at the National Institute for Agricultural Botany, Cambridge.

Fermentation Technology 3,000 Years Ago – The Archaeology of Ancient Egyptian Beer

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processes used to make the beer can be interpreted. I have worked out what I think is the New Kingdom ancient Egyptian brewing process by examining many beer residues with the scanning electron microscope, making careful observations on their microstructure, and comparing them to modern starch which has been treated in known ways. Some processes which the ancient Egyptians appear to have used are not commercial methods for cereal foods today, and have not yet been scientifically studied. Some experimentation is thus required to confirm how the starch structure might be altered by the ancient processes. Nevertheless, the microscopy of ancient beer remains has established the basic ancient Egyptian brewing system.

The first step was malting the grain. This is evident from the abundance of pitted and channelled starch granules in virtually all the beer residues. At least some of the malt was set aside. The remainder of the malt, or instead, unsprouted cereal, was well cooked in plenty of water. The two batches – uncooked malt and cooked malt or cooked unsprouted grain – were then mixed together. The enzymes from the malt would easily be able to degrade the cooked starch into simple sugars, providing a rich source of food which yeast, and possibly lactic acid bacteria, would convert to alcohol.

This reconstruction of the ancient brewing process, based on the direct evidence of preserved beer remains, is quite different to most published interpretations. It may be time to re-evaluate the artistic record in the light of archaeological findings. That this procedure can yield a palatable product has been tested. In the spring of 1996, Scottish and Newcastle Breweries, who sponsored this research, re-created the recipe in their Edinburgh pilot brew house with modern emmer wheat grown especially for the purpose at the National Institute of Agricultural Botany in Cambridge (Fig. 5). Using modern equipment, the brewers followed the ancient Egyptian procedure (described in Fig. 6), creating an unusual but tasty beer named 'Tutankhamun Ale' The limited edition of 1,000 bottles went on sale at Harrods in the summer, where it caused tremendous press interest, and sold out within three weeks!

There is an exciting range of options for future research on ancient fermentation. In Egypt, earlier periods have yet to be investigated to see how the brewing process may have evolved over time. Some ingredients may not be detectable by visual means; for example, additions such as syrups might only be identified using chemical analysis. Ancient foods from less arid climates will not be so well preserved, but their examination with microscopy may nevertheless provide some information on ingredients and preparation processes. Some work has been done on chemical analysis of fermented beverages from the fringes of ancient Mesopotamia, with claims that the earliest wine and beer date to 3500–3100 BC, from an excavation in the foothills of the Zagros mountains of north east Iran. Much more work can be done to expand on the research already in progress. In particular, the methods by which archaeologists recover preserved foodstuffs and analyse it can be developed and refined. This is especially needed for areas which do not have unusually good preservation.

One area which I hope to explore next is the nutritional value of ancient fermented foods. Next to nothing is known at present about the nutritional impact of fermentation on ancient diet and health. From the study of modern traditional diets, it has been well established that the process of fermentation has a critical effect on nutrition, making raw foods more easily digestible, breaking down toxins and harmful components, and boosting levels of essential nutrients such as vitamins and amino acids. Perhaps food fermentations of the past may prove to be worth reviving for the benefit of people in the present day.

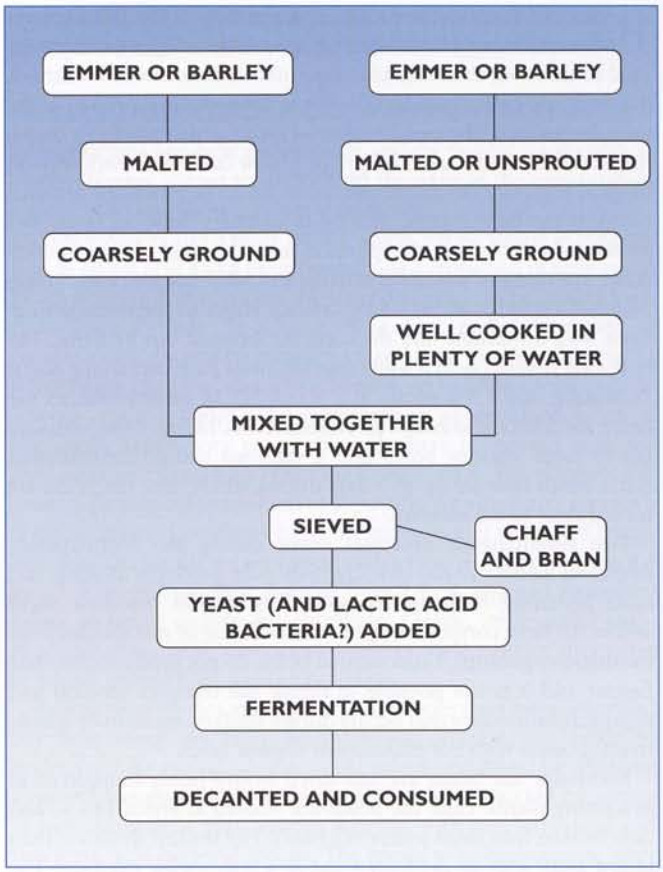

Fig. 6. A model for New Kingdom ancient Egyptian brewing, based on the microscopy of many ancient desiccated residues.

ACKNOWLEDGEMENTS

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Microbiology and Physiology of Cocoa Fermentation

Rosane Freitas Schwan

Chocolate can only be produced after a complex natural fermentation. Understanding of this process is leading to improvements in the quality of the product.

Fermented foods and beverages represent some of the oldest sources of nutrition and pleasure known to mankind. Cocoa products are used in the food, chemical, pharmaceutical and cosmetic industries, but it is chocolate, produced after a fermentation, which is the most important. The tree *Theobroma cacao*, which produces cocoa, originated in the Amazon basin but is now cultivated worldwide in tropical regions. Like coffee, raw cocoa has to be processed or cured before it can be marketed. Curing is normally done on farms and involves fermentation, the physical and chemical changes which occur as a result of microbial activity, and subsequent drying. Cocoa pods, which weigh about 0.5 kg, contain about 40 seeds and are cut open with a macheté and the contents scooped out by hand. The beans are covered with a white mucilaginous pulp containing about 14% sugar and 1.5% pectin at a pH of 3.5. In many countries the beans are collected in heaps on banana leaves. In Brazil the beans are put in large wooden boxes and a vigorous natural fermentation starts which lasts for up to 7 days during which time the beans are turned daily to aid aeration.

Two simultaneous processes occur during the fermentation: microbial activity in the mucilaginous pulp produces alcohols and acids liberating heat, and complex biochemical reactions occur within the bean cotyledons due to the diffusion of metabolites from the micro-organisms. Unfermented beans do not produce chocolate flavour and it is not possible to mimic the complex physical and organic biochemistry that occurs during the fermentation by simply treating beans with hot ethanol and organic acids.

Eventually the beans are sun-dried before being transferred to processing plants. Here the beans are roasted at about 135 °C and then broken into small pieces (kibbled). The broken shells are then blown away with an artificial wind in a winnowing machine. The remaining small pieces (nibs) are reduced to a thick liquid called cocoa mass which contains about 55% cocoa butter. About half of the cocoa butter is removed by pressing and used to make chocolate bars. The remaining mass is ground to a powder for making cocoa for beverages and cooking.

MICROBIAL SUCCESSION

What happens to the microbial flora during the fermentation? Fig. 1 summarizes the key processes that occur during fermentations in Brazil. Yeasts dominate the fermentation over the first 24 h, producing ethanol and pectinolytic enzymes. They are then briefly eclipsed by lactic acid bacteria which produce lactic acid from sugars. As the pulp disappears, oxygen penetrates the box and acetic acid bacteria then start to dominate, converting sugars and ethanol to acetic acid. During this time the temperature rises to about 50 °C and the heat and acid perform chemical reactions in the bean known as curing. Lastly, spore formers appear and some of them, together with moulds which may appear on the surface, can lead to the production of off-flavours. The three key metabolites in the pulp, ethanol, lactic acid and acetic acid, show sequential rises and falls during the fermentation but only acetic acid is still present in excess at the end. Although the microbial succession has been defined, the exact roles of the large numbers of species are still unclear.

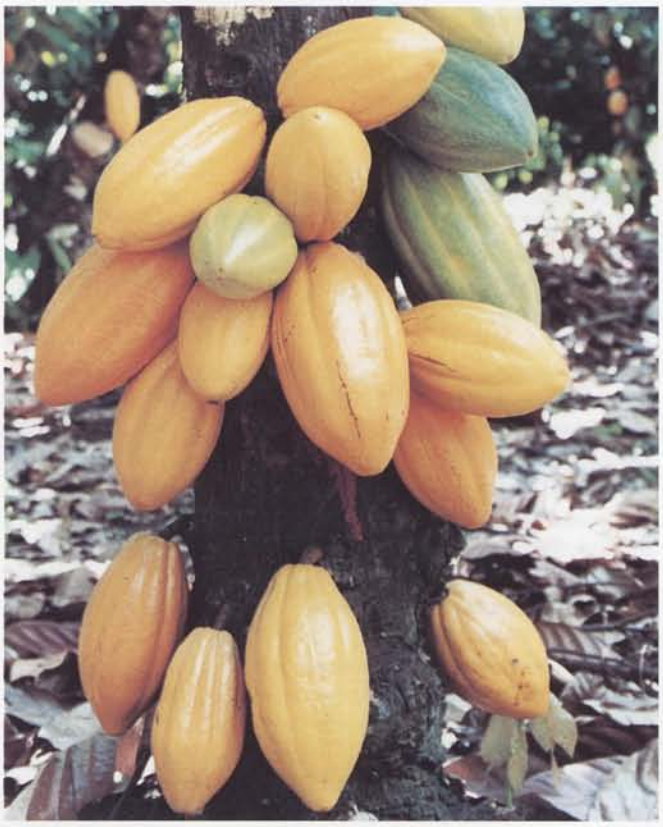

Fig. 1. Cocoa beans growing on a tree.

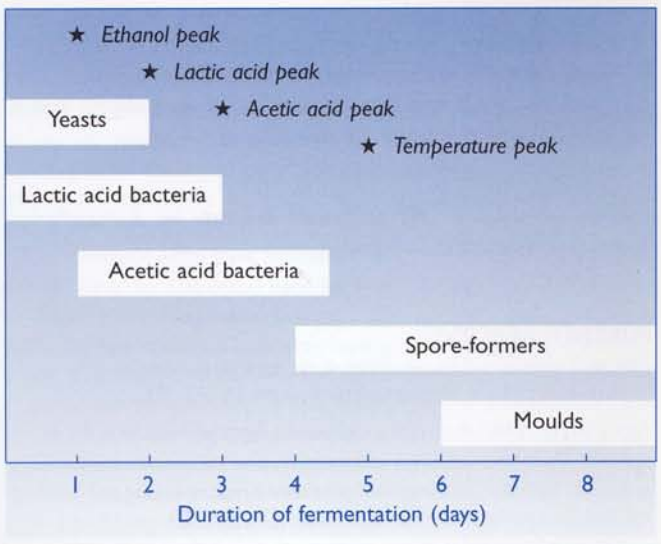

Fig. 2. Schematic of a cocoa fermentation. The boxes show the dominant micro-organisms. The stars indicate the time of maxima of key chemical and physical conditions in the cocoa pulp.

ROLES OF YEASTS

What are the roles of yeasts during the fermentation? The high initial yeast viable count is due to a combination of contamination from pods, machetés, hands and the fermentation box itself followed by subsequent growth of cells. After an initial growth of yeasts during the first 24 h, there is a dramatic decline by four orders of magnitude over the next day as the yeasts are killed by a combination of high ethanol concentration, acetic acid and high temperature. A slower decrease leads to a final population of as little as 10 viable cells per gram of pulp. The rise in numbers of yeasts at the end of the fermentation is of both thermotolerant yeasts and survivors from the cooler external layers of the box. Although ethanol penetrates the cotyledons, it is reputedly the acetic acid that kills the beans. Table 1 lists the 12 most commonly found yeast species in order of appearance, with *Saccharomyces cerevisiae* being the most abundant. The most important roles of these yeasts seem to be (i) breakdown

MICROBIOLOGY AND PHYSIOLOGY OF COCOA FERMENTATION

Rosane Freitas Schwan

TABLE 1. YEAST SPECIES ISOLATED DURING COCOA FERMENTATIONS IN BRAZIL

Kloeckera apiculata	*Candida bombi*
Kluyveromyces marxianus	*Candida rugopelliculosa*
Saccharomyces cerevisiae	*Candida pelliculosa*
Saccharomyces cerevisiae var. *chevalieri*	*Candida rugosa*
Pichia fermentans	*Torulospora pretoriensis*
Lodderomyces elongiosporus	*Kluyveromyces thermotolerans*

of citric acid in the pulp leading to a rise in pH from 3.5 to 4.2, which allows growth of bacteria, (ii) ethanol production, (iii) production of organic acids (oxalic, phosphoric, succinic, malic and acetic), (iv) production of some organic volatiles which may contribute either to chocolate flavour or, more likely, to precursors of chocolate flavour, and (v) secretion of pectinases. It is likely that yeasts which perform these five biochemical functions are essential for the fermentation but the other yeasts are probably unimportant.

PECTINASES

Pectin is the major plant polysaccharide which confers viscosity on the pulp. This viscosity needs to be reduced to allow sufficient aeration for the acetic acid bacteria to grow. Additionally the pectin has to be hydrolysed in cocoa juice if it is to be successfully pasteurized and processed. Four of the yeasts produced a pectinase which was shown to be endopolygalacturonase (endoPG) in all cases. EndoPG hydrolyses the β-1,4 linkages of polygalacturanan, reducing chain length and viscosity. *Kluyveromyces marxianus*, an abundant yeast in the early fermentation, produced the most stable enzyme with the highest activity and all the enzyme was secreted into the medium comprising 85 % of total secreted protein! The enzyme is constitutively produced, is not induced by pectin nor repressed by the sugar concentration in cocoa pulp. Unusually, *K. marxianus* does not utilize the products of endoPG since it cannot grow on galacturonic acid. Unlike plant pathogens, which produce abundant pectinases and can utilize endoPG products, yeasts need access to sugars which are trapped in a pectinaceous network and need to be released. The major function of the enzyme in cocoa fermentations is therefore to reduce viscosity of the pulp allowing the increased aeration required by acetic acid bacteria.

ROLES OF BACTERIA

Over 30 different species of bacteria have been isolated from fermentations. The great majority of lactic-acid bacteria utilize glucose via the Embden–Meyerhof–Parnas pathway, yielding more than 85 % lactic acid. However, some species utilize glucose via the hexose monophosphate shunt forming 50 % of the lactic acid and ethanol, acetic acid, glycerol, mannitol and carbon dioxide. Citric acid is first produced, leading to an increase in acidity, and then metabolized, liberating non-acid by-products and lowering the pH. Acetic acid bacteria are responsible for the oxidation of ethanol to acetic acid and further oxidation of the latter to carbon dioxide and water. The exothermic reactions of the acetic acid bacteria raise the temperature of the fermenting mass. The acidity of cocoa beans, the high temperature in the fermenting mass and the diffusion and hydrolysis of protein in the cotyledons has been attributed to the metabolism of these micro-organisms. Aerobic spore-forming bacteria such as *Bacillus* spp. produce a variety of chemical compounds including 2,3-butanediol, pyrazines, acetic and lactic acid under fermentative conditions which may contribute to the acidity and perhaps, at times, to off-flavours of fermented cocoa beans.

BIOTECHNOLOGY OF COCOA FERMENTATIONS

Fermentations are done on-the-farm and the results are variable in quality. Having started to understand the basis of the fermentation process, it is possible to consider ways in which it can be manipulated and improved to give a more reliable result. Excess sugars in the pulp lead to excess acid and a poor product, so a reduction in pulp could be advantageous. In addition, the separated pulp can be used as fresh cocoa juice for sale. To achieve these aims, pods are washed to remove excess natural microbial flora and then the beans are put in a depulping machine which can remove up to 20 % of the pulp as a white viscous liquid. The fermentation of depulped beans is not totally satisfactory since, although there is reduced acid, the remaining mucilage slows down the fermentation. The viscosity still needs to be reduced in addition to depulping. An alternative approach is the addition of pectinase to the fermentation of untreated beans. This time the results are very good with a final pH increase from 4.8 to 5.5, fermentation time reduced from 7 to 4 days and fermented beans of better quality for chocolate. Clearly, an endoPG over-producer strain of *K. marxianus* would provide a better alternative to added, commercial, impure pectinase.

Twelve yeast species and 30 bacterial species have been identified but how many are truly essential? An attempt was made to understand the ecological roles of the micro-organisms by replacing a natural fermentation inoculum with a defined cocktail consisting of one pectinolytic yeast species together with one lactic acid and two acetic acid bacterial species. The results were encouraging since the fermentation occurred normally, producing an acceptable product. Clearly there is room for improvement using different (and perhaps more) species and different inoculation rates but it does indicate that representatives of the three major groups may be sufficient to complete the complex fermentation.

The alcoholic beverage industry has replaced traditional natural fermentations with defined inocula, high quality raw materials, strict control of the fermentation, better treatment of the final product and diversification of the market. Cocoa fermentations have a long way to go before they reach that stage, but at least it is now possible for the first time to start such trials with a view to improving the quality of chocolate which was the theme of the last International Cocoa Conference held in Brazil in 1996.

The craving of 'chocoholics' is well known and may be due to the presence of cannabinoids in the chocolate. Another member of the same genus, called cupuaçu (*Theobroma grandiflorum*), produces a bean which, when treated in the same way as cocoa, can be made into 'cupulate' which is delicious and might become as popular and addictive as chocolate!

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FURTHER READING

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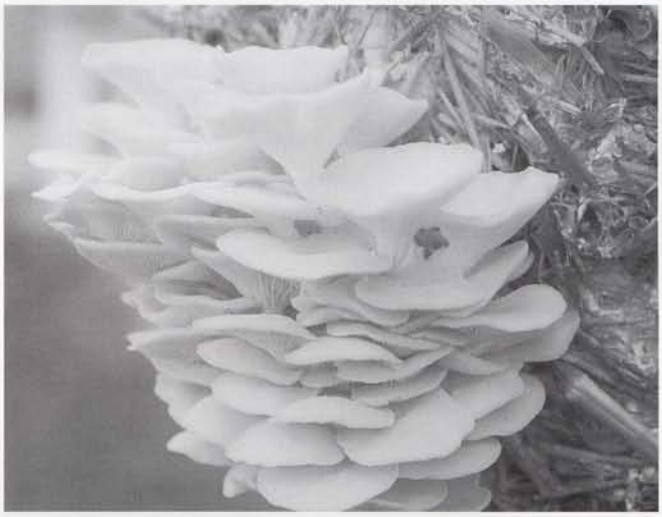
MUSHROOMS

Tim Elliott

Mushrooms are an important and undervalued food crop. They can convert low value wastes into high value food and provide dietary variety.

Since man was a hunter-gatherer, mushrooms have been collected and eaten; on occasion with dire consequences as a result of misidentification! Most mushrooms are edible or harmless; a few, such as *Amanita phalloides*, the death-cap, are deadly poisonous (the term toad-stool is usually reserved for these types, though it has no scientific status). Some are highly prized for their flavour, e.g. the chanterelle (*Cantharellus cibarius*) and the cep or penny bun (*Boletus edulis*). It is one of the perversities of life that many of the most esculent species are not amenable to cultivation and the tradition of collecting from the wild persists in varying degrees around the world. However, the commercial production of mushrooms as a food crop has developed into a major world-wide industry. The principal mushroom of cultivation is the white button mushroom (*Agaricus bisporus*) but there is significant production of other species, including oyster mushrooms (*Pleurotus* spp.) the padi-straw mushroom (*Volvariella volvacea*) and the Japanese forest mushroom, the 'shii-take' (*Lentinus edodes*). A further dozen or so species, such as the velvet-shank (*Flammulina velutipes*) are grown on a smaller scale. In many countries there is a culture of eating a wide range of different mushrooms. This interest in so-called 'exotic' mushrooms is spreading and increasing as the consumer, stimulated by travel and experience, demands more novelty and variety in food products.

Mushroom cultivation as a biotechnological process was well developed before the term 'biotechnology' was coined: the first description of the cultivation of *A. bisporus* dates to the 17th century and the shii-take has been cultivated for considerably longer. The production of *A. bisporus* has become the most highly developed, is highly mechanized and carried out in purpose-built structures world-wide. In the UK, *A. bisporus* is the single highest value crop of all fruit and vegetables, with a farmgate value of c. £165M. This equals the total value of all UK fruit production. World-wide the annual value of the *A. bisporus* industry is c. £2500M and for all cultivated mushrooms c. £3500M.



The yellow oyster mushroom, *Pleurotus citrinopileatus*.

The most widely grown oyster mushroom, *Pleurotus ostreatus*.

MUSHROOM GROWING

The commercial cultivation of all types of mushrooms involves three elements: substrate preparation, inoculum (or to use the industry's jargon 'spawn') preparation and mushroom production. The nutrient value of the substrate is the major determinant of mushroom yield. The substrate for *A. bisporus* is a compost made from cereal straws and animal manures. For oyster mushrooms, the usual substrate is pasteurized wetted straw. For the shii-take mushroom the substrate is basically wood in the form of cut logs or sawdust. The traditional substrate for the padi-straw mushroom is, of course, rice straw but it will grow well on cellulose-rich materials such as cotton waste. A key property of any substrate is that it must favour the growth of the mushroom mycelium above that of other competitor microbes. For *A. bisporus* and *Pleurotus* spp. this selectivity is helped by a pasteurization phase which eliminates competitor microbes and gives the mushroom inoculum a head start. The most common inoculum is colonized cereal grain and this can be used for a range of species in a range of substrates. Colonized plugs of wood are often used for the inoculation of logs for shii-take production.

Fruiting normally follows the full colonization of the substrate in response to eventual nutrient depletion. It can be manipulated by a variety of environmental parameters including light, temperature, humidity and CO_2 concentration. The control of fruiting in *A. bisporus* is particularly interesting as the colonized compost has to be covered with a layer of a peat and chalk mixture called the casing. This layer has a number of functions. The casing is nutrient-poor in comparison with the compost, thus promoting the transition to the fruiting phase. It also provides a physical structure which supports the developing fruiting-bodies. The bacterial microflora present in the casing layer is also essential for fruiting and is believed to metabolize or bind a self-inhibitor of fruiting produced by the mushroom mycelium.

FOOD VALUE

Mushrooms are eaten in both processed and fresh forms and the proportions of product used in each way vary from country to country; in the UK for example, 90 % of the home-grown product is eaten fresh. Mushrooms are on a par with most other vegetables with regard to general nutritional value. Approximately 30 % of the dry matter is protein. Essential minerals and vitamins are present; mushrooms are particularly rich in some of the B vitamins. The energy value of mushrooms is less than most vegetables which makes them a useful component of low calorie diets. The rôle of mushrooms in the general diet differs between the developed and the developing world. In the developed world they provide interesting variety as an addition or substitute for other vegetables. In the developing world they can provide an additional source of protein, particularly in vegetarian cultures.

MUSHROOMS

Tim Elliott

Some mushrooms contain compounds which can make a contribution to general health. The shii-take mushroom has been shown to contain cholesterol-lowering and anti-cancer compounds, and aphrodisiac properties are claimed for many mushrooms!

MUSHROOM RESEARCH AND DEVELOPMENT

Edible mushrooms can be regarded both as micro-organisms (as mycelia) and crop plants (as fruiting-bodies). R&D activity is in general directed at improving crop performance, though some studies have contributed to our understanding of the basic biology of this group of fungi. As with other crop plants, improvements in yield and quality, in the broadest sense, are sought. For species with highly developed cultivation technologies such as *A. bisporus* and *Lentinus edodes* a high quality product is essential to ensure profitability. For other species the aims of improving yield and maintaining consistent performance currently have a higher priority.

R&D activities fall into three main categories; strain improvement, crop agronomy, and pest and disease control.

For strain improvement, traditional breeding methods based on crossing and selection are being used to produce new strains. In *A. bisporus* this has led to the production of new hybrid strains improved in both yield and quality. Significant effort is also being directed at developing genetic engineering technologies for this group of fungi. In addition the number of species being taken into cultivation is still increasing as opportunities arise with the development of new cultivation technologies. Some species remain recalcitrant and as a consequence can be extremely valuable; the Japanese matsu-take, a *Tricholama* species, commands £500 per kilogram. Some R&D has the objective of reducing unit production costs, for example by the development of more productive substrates or by better control over the production environment. Pests and diseases pose a constant threat and include viruses, bacteria, fungi and flies. Fungal diseases pose a particular microbiological challenge due to the problems associated with controlling fungi growing on fungi. Research is directed at understanding the epidemiology of the pathogens and developing methods of control based on better use of pesticides, or their replacement by biological controls. For example, insect parasitic nematodes have been developed at Horticulture Research International as a commercial product for the control of mushroom fly pests.

The shii-take mushroom, *Lentinus edodes*, growing on compressed sawdust.

WHAT NEXT?

It is certain that the range of mushrooms available to the consumer will continue to increase and these mushrooms will provide variety in terms of form, flavour and texture. In the developed world the industry seeks to add value to its mushrooms by developing novel products and we will undoubtedly see mushrooms presented in more varied and interesting ways on our supermarket shelves. For the developing world, mushroom production can be a potential source of revenue in the form of exports and provide a dietary addition for the local population. R&D continues to play an important rôle in the development of the world-wide mushroom industry. A key technological log-jam is the lack of a facile transformation system which limits the general development of the biology of this group. Developing cultivation methods for species such as the chanterelle, the cep and the matsu-take is high on 'wish-lists' but remains biologically intractable. But above all else these earthy excrescences, as mushrooms have been described, continue to be a source of fascination to the consumer, producer and researcher.

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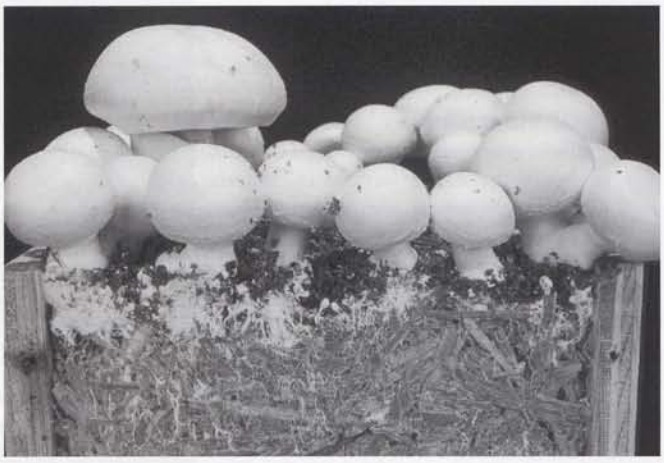

The growth and development of *A. bisporus* through compost and casing.

Commercial production of *A. bisporus* in plastic bags.

Cheese

Fran Mulholland

In this age where the manufacture of foods using products of genetic modification is upon us, cheese, together with bread, wine and beer can be considered one of the original biotechnologies.

Microbiology, biochemistry and chemistry combine with subtle changes in manufacturing, to make a wide range of different fermented food products that go under the general title of cheese (Fig. 1). The preparation of cheese probably dates back thousands of years to the nomadic tribes of the Eastern Mediterranean carrying milk from their domesticated animals in natural sacks derived from animals, such as the stomach. This led, together with natural fermentation by indigenous bacteria, to the souring of the milk and the subsequent formation of a curd which could be dried and stored for later consumption.

Simply put, cheese combines three classical methods of food preservation; fermentation, salting and a reduction of water activity to convert a short-term commodity, milk, into a product of great nutritional importance which can, depending on the variety and storage conditions, be kept for several years before it is consumed.

There are three main classes of cheese; soft, blue-veined and hard-pressed. These vary widely in moisture content (the major factor in keeping quality) and in the mechanisms of ripening (flavour development). Although it varies between different varieties of cheese, a typical nutrient content for Cheddar cheese is (per 100 g): 26 g protein and 33.5 g fat, providing 406 kcal. Cheese is also a very important source of important micro-nutrients such as calcium, iron and some vitamins.

Cheesemaking is initially based on the actions of two distinct biochemical/metabolic processes as follows.

1. An acid fermentation by bacteria utilizing the milk sugar, lactose, converting it to lactic acid, hence the name, lactic acid bacteria (LAB) for the micro-organisms responsible.
2. The clotting of milk proteins called caseins by an added enzyme, chymosin. This enzyme causes a specific cleavage in one of these proteins, κ-casein, the product of which destabilizes the colloidal suspension of casein micelles that form milk. leading to the formation of a gel. This then forms the structural basis of the cheese curd.

In the case of hard-pressed cheese, such as Cheddar, there then follow several processing steps, including salting and pressing to the desired moisture level, before the raw cheese is stored at 6–8 °C. It is during this storage period that enzymic and chemical reactions occur, converting the firm, rubbery and bland tasting pressed curd into crumbly, highly flavourful cheese.

Whilst this article does not intend to describe the actual process of cheesemaking, it will try to highlight areas where science has played a key role and where modern science is possibly taking cheese manufacture in the future.

Four science-based developments towards the end of the nineteenth century have been widely credited with influencing cheesemaking practice to give a relatively consistent product. Other associated advances have allowed large-scale manufacturing to be feasible.

1. Pasteurization. The use of pasteurized milk for cheesemaking is now commonplace, although many traditional cheeses are still made with unpasteurized milk. Pasteurization destroys the indigenous bacteria in milk and whilst some claim this has reduced the range of flavours found in cheeses, it has undoubtedly improved the consistency of cheese manufacture. One of the aims of modern cheesemaking is to try to obtain the flavour quality of raw milk cheeses whilst retaining the consistency of pasteurized milk cheese.
2. The use of pure cultures of LAB (starters). Historically, cheesemaking relied on the indigenous bacteria present in milk to carry out this fermentation. This, however, would be unreliable and inconsistent for modern manufacture and impractical when combined with the use of pasteurization which would kill the indigenous bacteria. Prior to the availability of pure cultures, the cheesemaker maintained a stock of soured milk and whey that had previously made good cheese to induce further acid fermentation in new batches of cheese. This was inconsistent, and could become

Fig. 1. Cheese, one of the oldest biotechnologies.

CHEESE

Fran Mulholland

contaminated with other bacteria or by bacteriophage. The use of pure cultures is now an accepted procedure, often with the use of a culture being added directly to the milk vat without any prior sub-culturing. The strains used depend on the type of cheese being made. A cheese such as Cheddar uses mesophilic LAB such as *Lactococcus lactis* subsp. *cremoris*, whilst cheeses such as Emmental and Parmesan, made using higher 'cooking temperatures' during manufacture use thermophilic LAB such as *Streptococcus thermophilus, Lactobacillus helveticus* and *Lactobacillus bulgaricus.*

Bacteriophage infection still remains one of the cheesemaker's greatest worries and research to understand and develop bacteriophage-resistant strains of culture bacteria has a high priority.

3. Chymosin extraction. A reliable method for extracting the clotting enzyme, rennet or chymosin, from calves stomach and its standardization for use in cheese manufacture was developed by Hansen in Denmark in 1870. This led to better curd quality and less microbial contamination from the stomach extracts. More recently, a further development in this area has been the use of GMO-derived chymosin. This has become widely used and cheese was the first food to apply the products of genetic technology in the UK. In some ways it was an ideal choice of product to be used to introduce the concept of using GMO-derived products in food manufacture, having some clear consumer benefits. It replaced a product that relies to a large extent on the veal trade and is also accepted as suitable for vegetarians. It also gives the manufacturer a much more consistent, non-seasonally dependent, supply of the enzyme.
4. Acidity and temperature control. The development of an acidimeter to measure acidity during manufacture allowed the cheesemaker to know when the fermentation had reached its optimal point for the variety of cheese being made. Also important was the earlier introduction of thermometers to help control temperature during manufacture. Temperature plays an essential role in manufacture but even into the middle of the last century, it was usually estimated by the cheesemaker dipping their elbow into the cheese vat.

In commercial terms, probably one of the most pressing needs of manufacturers is to be able to reduce the time it takes for hard and semi-hard cheeses to mature. Long periods of maturation of 6 months or more causes a considerable tie up of capital. This increased rate of ripening, however, must be achieved without noticeably affecting the shelf life of that product. It should be remembered that cheese is a live product. It continues to ripen in the shop and in the home and there is little point in decreasing the maturation time if the product will not remain at its best until the consumer wishes to eat it. Several approaches to accelerating the ripening of Cheddar cheese have been considered. Increasing the temperature during storage is the simplest and to many experts, the most effective. This is particularly the case for Cheddar cheese which is traditionally ripened at 6–8 °C. By increasing the temperature to 13 °C the ripening time could be reduced by 50%. The milk required for these purposes, however, needs to be of good compositional and microbiological quality to ensure that adventitious bacteria which may be able to flourish at the higher temperatures do not cause undesirable off flavours.

To achieve these aims a better understanding of the processes occurring in ripening is required. Of the biochemical and metabolic processes occurring during cheesemaking and especially for maturation, proteolysis is considered to be pivotal and is the subject of intense research throughout the world. The role of the proteolytic enzyme, chymosin, has already been mentioned in the formation of the curd. The proteolytic enzymes of the starter bacteria also play a significant role. Their involvement in the process has to be considered in two distinct but ultimately linked parts.

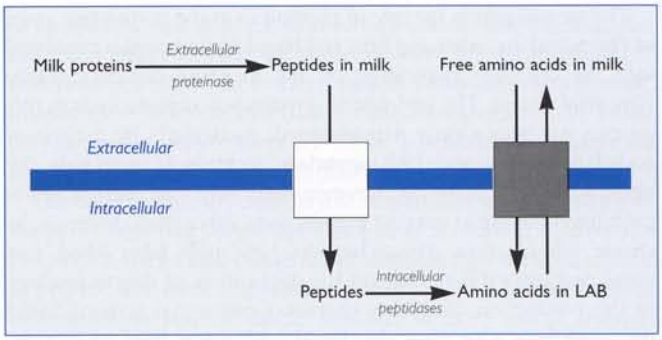

Fig. 2. The proteolytic system of LAB. □, peptide transporters; ■, amino acid transporters; ■, cell membrane.

The first part is the role of proteolysis in providing the nutrients required for the growth of the bacteria, essential for the acidification of the milk. LAB are auxotrophic organisms requiring some essential nutrients, including several amino acids, which they cannot synthesize. Milk, as their natural growth medium, does not contain enough free amino acids to meet this requirement but is a rich source of protein. LAB, therefore, have evolved a proteolytic system capable of providing these amino acids from the milk proteins (Fig. 2). The proteolytic system comprises an extracellular proteinase which breaks down milk proteins to peptides, specific peptide transporters which are capable of translocating peptides up to 10 amino acids long into LAB, and a range of intracellular peptidases to break down these peptides to their constituent amino acids for use in protein biosynthesis. To date, at least 12 different peptidases (Table 1), each with their own specificity towards peptides, have been identified and characterized in LAB.

TABLE 1: PEPTIDASES CHARACTERIZED FROM LACTOCOCCI

Peptidase	Abbreviated name*	Specificity
Aminopeptidases		
Aminopeptidase N	PepN	X ⇓ Y–Z.....
Aminopeptidase C	PepC	X ⇓ Y–Z.....
Glutamyl aminopeptidase	PepA	Glu(Asp) ⇓ Y–Z...
Pyrrolidone carboxylate peptidase	PCP	pGlu ⇓ Y–Z
Tripeptidase	PepT	X ⇓ Y–Z
Dipeptidase	PepV	Y ⇓ Z
Endopeptidases		
Neutral endopeptidase (NOP)	PepO	–W–X ⇓ Y–Z.....
Oligopeptidase	PepF	–W–X ⇓ Y–Z.....
Proline-specific peptidases		
X-Prolyl dipeptidyl aminopeptidase	PepX	X–Pro ⇓ Y–Z...
Prolidase	PRD	X ⇓ Pro
Proline iminopeptidase	PIP	Pro ⇓ X (–Y)
Aminopeptidase P	PepP	X ⇓ Pro–Pro–Y–Z...

**The prefix 'Pep' indicates that the corresponding peptidase gene has been sequenced.*

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The second part is the role of proteolysis at the maturation stage of cheesemaking, when the firm and bland-tasting curd is converted into the crumbly (depending on the moisture content), highly flavourful cheese. The undoubted importance of proteolysis in this process has been clearly demonstrated, particularly by the use of added proteinase and LAB peptidase cocktails to accelerate the ripening process. In the UK, however, there were legal barriers which prohibited the use of enzyme preparations, other than chymosin, in cheese manufacture. Those barriers have now been lifted, but some problems still remain on the application of this technology to the production of quality cheeses. Commercial systems based on proteolysis have been developed with some level of success, particularly in the rapid generation of cheese flavour for flavourings. The accelerated ripening work, whilst emphasizing the importance of proteolysis *per se*, has failed to identify exactly what is being accelerated in the ripening process or which individual enzymes are involved.

In both areas where proteolysis is involved, molecular biology is now being employed to improve our understanding of the role individual proteolytic enzymes play in this procedure. One of the most powerful techniques is to specifically remove the enzyme activity by disrupting/excising the gene encoding the peptidase activity from the organism and then studying the effect this has on growth of the organism and on cheesemaking. This approach has been particularly applied to growth studies where the extracellular proteinase and the oligopeptide transporter are essential for growth of lactococci in milk. In terms of the peptidases, only when multiple peptidase deletion mutants were used, i.e. when more than two peptidases were specifically removed, was a clear effect on growth demonstrated. To date, no one individual peptidase appears to be essential in this process. This is thought to be due to the overlap in specificity that exists between peptidases, Also, the essential amino acids are not provided by only one single substrate, but from a variety of peptides which are then hydrolysed by different peptidases when taken up by LAB.

One area where it is expected that GMO technology will be influential is in cheese manufacture. It provides the opportunity to introduce or modify LAB so that they have all the desired traits for good cheesemaking. Currently, a great deal of effort is being put into the development of 'food-grade' expression systems for application in LAB and presumably in cheese manufacture. Self-cloning systems where no foreign DNA, such as antibiotic resistance markers commonly used as selective markers, have been specifically developed for this purpose. Accelerated ripening studies using over-expression of the peptidases in LAB which employ these food-grade systems have yet to generate much information, although the author is aware that such studies are well advanced.

Molecular biology, however, has to be supported by a good in-depth knowledge of the biochemical and physiological processes going on during manufacture and, scientifically, cheese itself remains a great challenge. Despite many years work, and a general understanding that certain processes such as proteolysis, are crucial, much knowledge of the finer details is still lacking. For example, why are some LAB strains better than others at making cheese and what are the fine differences in the enzymes (specificity, activity and amount) between these strains? Are other physical parameters important? Just how do the intracellularly located peptidase enzymes interact with their substrates, which are essentially extracellular in the cheese matrix? What is the role of cell lysis during ripening in this process?

These questions and more will provide researchers with challenges for some time to come. We also remain largely ignorant regarding which compounds generated during maturation combine to give the overall flavour sensation associated with cheese. It is clear that simple proteolysis in the production of peptides and amino acids is not the final answer to cheese maturation/flavour development but provides the feedstocks for further reaction mechanisms. The role of amino acid catabolism is just beginning to be investigated and provides, I believe, the important cross-over point to the generation of more volatile aroma compounds, such as the formation of volatile thiols, e.g. methanethiol from the degradation of methionine.

Fran Mulholland, Department of Food Macromolecular Sciences, Institute of Food Research, Reading Laboratory, Earley Gate, Whiteknights Road, Reading RG6 6BZ, UK.

New Schemes from the Wellcome Centre for Medical Science

SCIENCE FOR ALL

DO YOU THINK your area of research is exciting? Do you want to tell everyone about it? Well, now's your chance, thanks to the Wellcome Centre for Medical Science's new initiative, *Science for All*.

Some of the most exciting new research is discussed in the hundreds of scientific conferences and meetings that take place across the country each year, yet people outside the scientific community seldom share this knowledge with the public. *Science for All* aims to redress this imbalance by providing grants and support of up to £1,000 to scientists and conference organizers who include public sessions at their meetings. These sessions could be lectures, demonstrations or even question times, but the important thing is that they are attractive, accessible and relevant to the general public.

If you are organizing an event that you would like to be considered for support from this scheme, or would like further general information, please contact Melanie Smallman, Outreach Officer, at the address below.

SCI~ART

Call for ideas from partnerships in science and art

THE WELLCOME CENTRE is providing funds for developing the ideas of scientists and artists working in partnership. Three to six ideas may be funded with amounts ranging from £5,000 to £50,000. Scientists and artists with an active interest in the subjects of biology, medicine and health are invited to submit their ideas to *SCI~ART*. The closing date for applications is **14 February 1997**. Anyone interested should send for full details of the rules from *SCI~ART* at the address below.

THE WELLCOME TRUST PRIZE

COULD YOU WRITE the next best-selling popular science book? The Wellcome Trust Prize is a unique opportunity for professional life scientists to realize their dream of telling the world about their work. The Prize of £25,000 will enable the winner to take a break from their job to write a book about the work to which they are devoting their career. The aim is to write a book that will educate, captivate and inspire the non-specialist lay reader. It will be published and promoted by Harper Collins/Flamingo. The closing date for entries is **7 March 1997**. For full details contact the Communication and Education Department at the address below.

Wellcome Centre for Medical Science, 210 Euston Road, London NW1 2BE.

National Committee of Inquiry into Higher Education

The President, Professor Tony Trinci, wishes it to be made clear that the submission was debated fully by Council at its November 1996 meeting and it represents a consensus of their views. Unfortunately the timescale was such that it was impossible for the membership as a whole to be consulted before the Society's comments were sent to the Dearing Committee.

SGM RESPONSE TO THE REQUEST FOR EVIDENCE

As described in the November 1996 *Quarterly* (see p. 130) an inquiry has been set up under the chairmanship of Sir Ron Dearing to make recommendations on how the purposes, shape, structure, size and funding of higher education, including support for students, should develop to meet the needs of the UK over the next 20 years. The Inquiry Committee set out the *Request for Evidence* in the form of a questionnaire and the Society's comments were made under the numbered headings provided. The questionnaire was in five sections with 31 sub-headings, but only topics judged to be relevant by the SGM working party were covered in the Society's submission.

EXECUTIVE SUMMARY

1. Microbiology is a subject within the life sciences where there will be a strong demand for highly trained graduates during the next 20 years.

2. Due to the rapid expansion of knowledge in this area of life science, microbiology students require a substantial theoretical training. They also need a thorough grounding in practical laboratory techniques. The existing pattern of first and higher degrees is not adequate to provide this training.

3. Standards of science degrees are falling and graduates do not meet the needs of employers. The Society is concerned that unless adequately trained microbiologists are produced in the UK at both graduate and postgraduate level, then companies will relocate their research and development to Continental Europe or North America.

4. At least some graduates in microbiology should have a standard of practical training which is comparable with international standards.

5. Higher education institutions are the best location for curiosity-driven research.

6. The reduction in the HEFCE capital grant to universities will seriously undermine the standards of teaching and research in microbiology.

SECTION 2

Teaching and Research within Higher Education

3. What forms of higher education provision will students need access to over the next 20 years?

(b) The level of provision (e.g. sub-degree, degree and postgraduate etc.).

The Society considers that access to BSc, MSc and PhD courses is necessary to produce microbiologists with the appropriate skills to meet the needs of employers.

(c) The methods of delivery (e.g. distance learning, work-based learning, more traditional patterns of attendance etc.).

Education should be available via wide-ranging methods of delivery according to the abilities, ambitions and life style of the student and to the facilities available.

(e) The length of courses.

Microbiology is a laboratory-based science with very specialized experimental techniques, some of which also underpin the work of related disciplines such as molecular biology and genetics. The experimental skills have to be taught and reinforced by practice. Constraints imposed by inadequate resources and high student numbers are reducing the amount of time spent on laboratory practicals. It is estimated that the time spent on practical work is now about one-third of what it was 20 years ago (2). Many universities, due to insufficient staff and lack of recurrent consumable funding, also can no longer provide all students with the opportunity of undertaking a third year research project involving practical work. Instead these students often carry out non-experimentally based projects and so, where there are no set practicals, they receive no practical training whatsoever in their final undergraduate year.

The Society attaches considerable importance to practical work. We have recognized the present deficiencies in training at university and, within the limited means at our disposal, have set up a scheme to provide 6–8 week studentships in the vacation before the final undergraduate year to enable students to carry out a research project. Since its inception in 1995 the scheme has provided vacation studentships for 39 young people at a total cost of £30,800. However, this in no way makes up for the deficiencies in funding of universities and provides laboratory experience for a very small proportion of the total number of microbiology students.

In addition, the vast advances in knowledge made in biology in recent years, particularly in the areas of cell and molecular biology, have made it difficult to teach the necessary range of core information to bioscience undergraduates within the time available. Thus, it is almost impossible to cover the essential theoretical and practical training within a 3 year degree programme as presently funded.

This is borne out by the experience of microbiology graduates who wish to make their career in scientific research and subsequently register for a PhD. They often lack the knowledge base and practical skills necessary to proceed without difficulty. Postgraduate supervisors find that new students are insufficiently prepared for research, making it almost impossible for them to complete a suitably demanding project within the 3 year period of their studentship.

Clearly, the UK standard of a 3 year first degree course followed by a 3 year postgraduate studentship is inadequate today in producing a well-trained professional microbiologist. This is reinforced by feedback from industry where employers cite an inability to handle the quantitative aspects of science, a limited understanding of experimental design, insufficient experience with modern equipment and poor knowledge of safe laboratory practices in recent graduate life scientists (1, 2, 3). Indeed some companies are relocating their R & D bases away from the UK, partly because of the difficulties experienced in recruiting suitably qualified scientists. A recent example in the pharmaceutical industry is SmithKline Beecham.

The current degree structure should be replaced by a more flexible system to allow for varying levels of specialism. The first degree could take from 2 to 4 years, according to the needs of the student. The shorter courses would have a reduced practical content and a greater emphasis on transferable skills, whilst students intent on a research career in microbiology should have intensive practical training in the third and fourth years, to be followed by a 3 year PhD. Such degrees would have different titles e.g. General BSc and Honours BSc. An alternative model would be a 3 year first degree followed by a 1 year MRes, followed by a 3 year PhD (2). Either of these options could be accommodated largely within existing funding patterns. A 4 year BSc for all students, or a 4 year PhD, would require significant extra resources. Whichever pattern of higher education is chosen, it must include sufficient time and funding for the essential practical training which is currently lacking.

These are not just local problems. Overseas students are attracted to UK higher education institutions by their good reputation in the world, which has been achieved over many years. Scientists in continental Europe and North America are seriously questioning the standards of most UK PhD graduates. A continental PhD is now considered by some to be equivalent to a UK PhD plus 2 years postdoctoral experience and most universities in mainland Europe

will not accept UK bioscience graduates on PhD courses without postgraduate qualifications such as MSc degrees. The recent decline in standards affects the international standing of our courses; bad opinions are unlikely to be easily reversed and the welcome funding that overseas students bring to UK higher education is at risk of being lost.

(f) The balance of subject provision and, how an adequate supply of specialist graduates (e.g. scientists, engineers and technologists) can be ensured.

Microbiology is typical of specialist scientific subjects. However, its significance is likely to grow in the next 20 years. More high quality microbiologists will be needed, not only to work as biotechnologists to ensure wealth creation for the country from that source, but to solve the problems caused by micro-organisms that will increasingly affect man and his food supplies. Examples of newly emerged diseases of microbiological origin that have taxed all the skills of scientists in the past few years are AIDS and BSE. Only a higher education system which is appropriately structured and funded and where research is an important feature can produce microbiologists of the calibre necessary to meet such challenges.

4. What knowledge, skills and aptitudes will those leaving higher education need over the next 20 years and how can these best be delivered?

(c) The balance between the provision of a broad knowledge base and highly specialized knowledge.

It is important for people to have a basic understanding of microbiology as it is relevant to everyday life. Food safety is a good example of an aspect of microbiology that is of significance to everyone. Microbiological training is necessary within a general life science education to ensure that appropriate knowledge is passed on by teachers and to the general public. Well-trained professional microbiologists can also play their part and the SGM attempts to promote microbiology education by funding public awareness events and publications, offering grants to educators and encouraging its members to disseminate information.

(d) Who should shape or determine the curriculum content (e.g. teachers, students, employers, professional bodies)?

It is felt that university teachers are best placed to determine curriculum content, provided they take account of the needs and advice of employers, professional bodies and students. The SGM strives to bring together industrial microbiologists and academics, not only through its meetings and publications but also by funding relevant initiatives.

6. What is the place of scholarship (as opposed to teaching and research) in higher education?

(a) The relationship between teaching, scholarship and research.

(b) How much time should be devoted to scholarship?

There should always be scholarship. Some scholarly activity is an essential part of education. This statement is based on the collective experience of the SGM membership. It is felt that strong, well-funded research and scholarship feed teaching and that both play an important role in higher education. Without a research base in universities, it will not be possible to attract university teachers of appropriate calibre.

7. How can the standards of degrees and other higher education qualifications be assured and maintained?

(a) Whether standards have changed and the reasons for the changes.

Some comments on standards have been made in 3(e) where the length of degree courses was considered. It is the experience of SGM members that the standards of science degrees have declined significantly in recent years and will decline still further during the next 3 years as the unit of resource declines. Students beginning first degree courses enter higher education today with widely varying skills and knowledge. Undergraduate teaching practices must accommodate these variations which only serve to exacerbate the problems caused by the huge increase in student numbers over the past few years. There is also a requirement to learn 'transferable skills', such as communication and problem solving. It is impossible for students of specialist subjects like microbiology to also cover the vast and rapidly growing body of technical and practical knowledge that make up modern life science. The 'knock-on' effect to post-graduate degrees has already been described and is to be deplored.

It should be noted that HEFCE funding for medical and dental courses has declined much less than for science courses in recent years and that this is illustrated by the differing student/staff ratios in these subject areas (see 7d). It would appear that, in order to maintain the standard of education of medical and dental students, it is recognized that the unit of resource has to be largely maintained, whereas it is claimed that the standard for science degrees can be maintained despite draconian reductions in the unit of resource. This policy must be reversed for specialist sciences like microbiology, a subject which actually underpins many areas of modern medicine, including the growing field of gene therapy, and should be treated with the same importance.

Universities have made enormous efficiency gains in the past 20 years but are now beyond the point where further funding cuts can be made without a further dramatic decline in the quality of science graduates.

(b) Whether it is feasible to have national standards of qualifications.

(c) Whether it is necessary to have national standards of qualifications.

It is felt that with the wide range of institutions awarding degrees today, national standards of qualifications would be impossible to achieve. Courses are so diverse in microbiology, which contains many specialisms within it, that a standardized qualification is not only impracticable but also unnecessary. Should national standards be imposed, independent assessment would be required to run alongside internal monitoring, which is adequately covered by the use of external examiners at present.

(d) Implications for standards if participation in higher education continues to expand.

Student/staff ratios in life sciences are now two-and-a-half times (from 8 : 1 to 20 : 1) what they were in the 1970s and are increasing. It is inappropriate to expend a high proportion of existing funding on expansion of student numbers whilst the need to maintain standards is ignored. Without additional funding it is also impossible to expand without compromising standards. However, not all areas of science are treated equitably and in clinical medicine the student/staff ratio is relatively low.

The Society recognizes that the Government cannot afford the increased number of students attending university whilst at the same time maintaining the unit of resource per student at historical levels. We accept that some decline in standards is inevitable, particularly in practical training. Nevertheless, we believe that in order to meet the needs of the country and the industrial sector, it is important to train at least some graduates and postgraduates to historical and internationally accepted high standards.

(f) The role of professional bodies.

The role of professional bodies like learned societies should be complementary to the maintenance of degree standards. The Society has a membership representing most academic and industrial organizations involved in microbiology world-wide and can make authoritative judgements, but it is not a chartered institute which awards or validates qualifications.

9. How should research carried out in higher education institutions fit with the wide spectrum of research undertaken in the UK?

(b) The distinctive role played by higher education institutions.

(c) The balance between research providers in conducting basic, strategic and applied research.

Curiosity-driven research is still very important in higher education institutions and it has helped to attract some of the most gifted research workers and teachers. Universities are often the only places where the appropriate facilities may exist to conduct such work. Whilst there is a place for strategic and applied research in higher education institutions in order to exploit commercial potential, it should complement that being carried out in industry. It will not necessarily be best selected by Government committees such as the Technology Foresight Panels. The intrinsic difficulty in predicting what advance will lead to the next major technological

innovation makes it essential that government continues to fund a wide range of blue skies research. The best place where this can occur is higher education institutions where academic freedom is firmly entrenched. Even the Technology Foresight Panels have recognized the importance of curiosity in basic research and are providing support through, for example, special equipment grants to smaller universities.

10. How should public funding for research in higher education institutions be distributed?

(a) How national need should be determined and defined?

There should be strategic planning for subjects like biological science. It is vital that expertise in basic skills and fundamental subject areas is preserved within the university system. For example, there are some fields of microbiology which may currently be considered 'unfashionable' for which only one or two senior scientists receive funding. When they retire, no-one will be left who is studying these organisms and, without planning, important expertise will disappear.

(b) The consequences of concentrating research resources or of dispersing them across many institutions or centres.

The present funding available cannot fund quality research in the number of universities that exist today. Some mechanism of concentration of research activity has to be found: this would be beneficial both to the institution and research. Sudden changes in the public funding for research are damaging and a clear policy should be decided and adhered to.

(c) The effectiveness of the dual support system.

Recent changes to the dual support system have had implications for the future success of scientific research in university departments. The size of the block grant allocated to higher education institutions by the HEFCs to fund premises, staff and equipment, etc., is now related to the volume and quality of research, as measured by the Research Assessment Exercises, and to student numbers. Total Government funding to HEFCs has declined from £953m in 1990/91 to £873m in 1994/95, whilst the funding to research councils, which provide awards to supplement core funding of institutions, along with money from charities and industry, has increased during the same period (4). Thus, not enough funds are being made available for the modern equipment and infrastructure that are required to make advances in science today (3, 4). The Private Finance Initiative is unlikely to provide funds to make up this shortfall in equipment over the coming decades.

Higher education institutions have recently received a further disastrous blow from the cut in the capital (=equipment) grant imposed by the DfEE in the November 1995 budget. The Society can conceive of no other cut in funding which would have such a serious, quick-acting and deleterious effect on university research and education than the proposed 47 % cut in capital grant over the next 3 years. Indeed, if the DfEE was seeking a means of damaging the system, the Society could not envisage a more effective mechanism than this. The rest of the dual support system is being gradually eroded away and it is feared that curiosity-driven research in particular will suffer as a result.

(d) The effectiveness of the Funding Councils' Research Selectivity Exercise.

The present mechanism, the Research Assessment Exercise, although time-consuming, is adequate. The allocation of resources should be as fair as possible. The parameters being used may pervert the system. Both research quality and volume should be measured to avoid potential damage. The processes must be open.

It is particularly important in subjects like biology which are so diverse that the RAE Panels are fully representative of all important specialist areas. For example, there is no virologist on the current RAE Biology Panel. In the future, because of the increasing demands of the work involved, it is going to be very difficult to persuade scientists to participate in an RAE panel.

11. How should the organization of research activity be developed over the next 20 years?

(a) Arrangements which provide a good basis for universities and colleges to plan and manage long-term research.

Sudden changes are the most disruptive to the work of researchers. The equipment funding cuts proposed for 1996/97 are the latest example and will have damaging consequences. In the recent PREST Survey of Research Equipment in UK Universities (3), equipment deficiencies, lack of technical support and maintenance problems were cited as being the greatest constraints upon research in departments. Seventy-nine per cent of departments in the survey reported that critical experiments in areas of current research could not be carried out due to lack of equipment funding.

(e) How to maintain international standards of research excellence.

There is no possibility of this unless facilities and resources in UK universities are broadly equivalent to those found in similar institutions overseas.

12. How can the quality of research in higher education best be maintained and enhanced?

(a) The training of future researchers.

This has already been considered in 3(e) and 7(a). More skilled researchers are required in microbiology. These can only be provided by improving the quality of first and higher degrees through appropriate structuring and funding to produce graduates who have been able to achieve their potential. In addition, it cannot be stressed too much that microbiology students must receive appropriate experimental, practical training, which in the case of this specialist science requires reinforcement by practice of particular skills.

(b) The career structure of research staff.

There is a lack of permanent posts and young researchers find it difficult to progress from a series of short-term contracts. This demoralization has persisted for many years.

SECTION 4

The Wider Contribution of Higher Education to National Life

24. How can UK higher education capitalize on the fact that higher education is an international activity?

See 3(e). If standards continue to be eroded, then overseas students will go outside the UK. Standards have an international basis and we must be competitive. Excellent students have been recruited from overseas in the past. Links with other European Union countries and schemes such as ERASMUS and SOCRATES should be extended. British Council input is important and must be maintained. Provision must be made to retain the Overseas Research Students Awards, administered by the Committee of Vice-Chancellors and Principals, which make up the difference in tuition fees between the overseas rate and the home rate for postgraduate students.

SECTION 5

Funding Issues

26. How can institutions which offer higher education best ensure that they have an expert and effective workforce?

Everyone recognizes, including industry, that the salary structure for academics has deteriorated over the past 10 years. Their standard of living has fallen to contribute funding towards the expansion of higher education. A pay review body is the fair way out of this situation. For example, there is a disparity between the salaries of clinical and non-clinical scientists which is a source of discontent. Clinical scientists are better rewarded because the NHS has a pay review body.

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Stationary Phase: Entry, Residence and Exit

Alan Wheals

The Main Symposium at the SGM meeting at the University of Essex in September 1996 addressed new ideas about stationary phase in both prokaryotes and eukaryotes.

Stationary phase can be defined as the cessation of growth (biomass increase) and division while long-term viability is maintained. For some cell types this occurs after differentiation into a specific resting structure, such as a spore, whereas for many other cell types, cell morphology changes little but the cell becomes more resistant to environmental stresses. Recent successes in analysing the cell cycle of proliferating cells has obscured our ignorance of what happens in stationary phase which, according to the novel view of Maggie Werner-Washburne (see Fig. 1), represents a significant fraction of the life of a typical cell. The major themes which emerged from the presentations were (a) the need for good markers of stationary phase, particularly for eukaryotic cells, (b) the importance of heterogeneity in populations under starvation conditions, and (c) interactions between cells.

Malcolm Stratford (Unilever) drew attention to the diverse physiological causes which could give rise to stationary phase characteristics in yeast cells. These included nutrient limitation (typically carbon and nitrogen), toxins (such as ethanol), pH, high CO_2, high (and low) O_2 and heat. In some cases the genetical and biochemical basis of the responses have been clarified. For example, low pH stimulates the H^+-ATPase (to counteract the proton gradient), low O_2 changes membrane composition and nitrogen starvation can induce pseudohyphae. Different sensors are required to monitor these stresses but do cells respond in similar ways so that stationary phase cells induced by different methods are truly equivalent? There is some evidence in yeasts that carbon starvation is qualitatively different from other starvation signals. Since many physiological responses are not specific to stationary phase, for example alterations in wall structure can also be found in slow-growing yeast cells, the quest for good markers of stationary phase is very important.

By analysing mRNAs specifically induced on entry into stationary phase by *Saccharomyces cerevisiae* cells, a gene family called *SNZ* (for snooze!) has been found by Maggie Werner-Washburne (New Mexico). Remarkably, they represent the most highly conserved genes across the three domains. *SNZ1* is linked to another gene, *SNO1*, which is also highly conserved in bacteria and yeasts. Although the genes are specifically expressed in stationary phase, their functions remain to be determined. Some progress is being made with *S. cerevisiae* in identifying genes with particular roles in exit from stationary phase. Gcs1, which is required specifically for exit from stationary phase but not for exponential growth, is a GTPase-activating protein for a class of GTP-binding proteins known as ARF. Gerry Johnston (Dalhousie, Nova Scotia) reported that this function is performed in growing cells by a related gene called *GLO3* which is not needed for exit from stationary phase. There are thus a pair of genes with complementary functions for cell proliferation. *GCS1* is still the only clearly defined genetic marker of stationary phase in yeast!

One of the aspects emphasized by Douglas Kell (Aberystwyth) was the notion of reversibility. 'Dormant' cells can be resuscitated, which is in contrast to the concept of Viable But Non-Culturable (VBNC) cells which, he argued, are not 'alive' since colony-forming ability is the only useful operational definition of whether a cell is alive or not. What is certainly clear, as shown by Michael Barer (Newcastle), is that VBNC cells are metabolically active and responsive. Furthermore, he emphasized the need to study individual cells. Measurements of populations give you averages. Flow cytometry allows you to look at the dispersion of properties and that reveals heterogeneity. The basis for this heterogeneity needs to be determined: it could be stochastic, historical (genealogical), a function of cell cycle stage or something else. Roberto Kolter (Harvard) has been analysing adaptive changes in slow growing

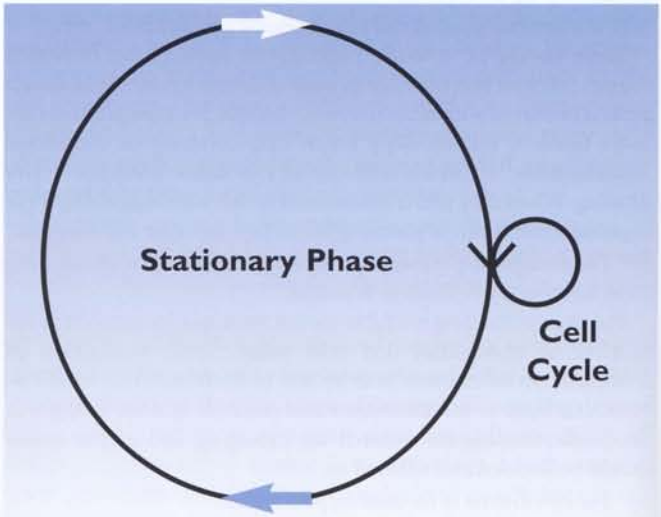

Fig. 1. Relative importance of stationary phase and the cell cycle.

cultures of *Escherichia coli* and he essentially maintains that they undergo rapid evolutionary change by selective mutation of the starvation response system. If that is the case, then it means that genetic variability is a possible cause of heterogeneity and needs to be considered if we are to understand what has been described hitherto as physiological adaptation. Resolution of these issues has implications for a more precise understanding of relevant ecological and biotechnological problems.

Kolter went on to describe how in *E. coli*, the response to starvation is mediated by the σ^S subunit of RNA polymerase. Expression of σ^S is induced by homoserine lactone, a metabolite synthesized from intermediates in threonine biosynthesis. Homoserine lactone-dependent synthesis of σ^S was prevented by over-expression of a newly identified protein, RspA. The function of *N*-acyl homoserine lactone in many cell-density-dependent phenomena and the similarity of RspA to a *Streptomyces ambofaciens* protein suggests that synthesis of homoserine lactone may be a general signal of starvation. Douglas Kell also drew attention to his work on the secretion of a pheromone from *Micrococcus luteus* cells which aids resuscitation. Together these two talks open the possibility that both entry into and exit from stationary phase are truly communal activities of bacteria.

It is still too early for stationary phase research to yield important applications, but it is possible to see where they might lie. Firstly, understanding heterogeneity and exit from stationary phase might help to 'revitalise' VBNC resuscitation research. Secondly, some cell types do not survive stationary phase well and genetic modification with genes which do confer those properties could be useful in biotechnology. Thirdly, stationary phase cells are often recalcitrant to the effects of antimicrobials, but if some gene products are only expressed in stationary phase cells they could become new targets for antimicrobials. Finally, non-growing yeast cells are used in the food industry as dried and fresh yeast and in the brewing industry as re-pitching yeast. High viability and vitality characteristics are desirable and simultaneous attainment of both might be helped by this research. This well-attended meeting demonstrated the interest in the subject and how stationary phase research was certainly not standing still.

Dr Alan Wheals is in the School of Biology and Biochemistry, University of Bath, Bath, BA2 7AY, UK (Email bssaew@bath.ac.uk). He is Convener of the Cells & Cell Surfaces Group.

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Letter to the Editor

Paperless Proceedings

IN THE AUGUST EDITION of the *SGM Quarterly*, Dave Roberts' editorial *Too Many Books, Too Many Meetings* addressed the increasingly vexed issue of publishing symposia proceedings. Many contributors continue to see symposium proceedings as a significant channel for the publication of their work, but against this there are the many difficult issues of publication: timeliness, access, cost and even sheer physical storage problems. Some computer science and physics conferences have solved this problem by publishing their proceedings on-line (and indeed frequently abandon a physical meeting altogether). Their output represents the ultimate in timeliness and dissemination, but readers must connect to the Internet to retrieve the information; there are bandwidth restrictions, especially for large amounts of graphical material and the information is potentially volatile since it exists only as a magnetic image. There is also the issue of how the publisher (who maintains the computer information server) and those who carry out the (still significant) procedures of editing can be paid by those receiving the information.

As organizing chairman of an annual protein science conference, I decided to swap the printed proceedings book for a half-way house. Not a magnetic image on the Internet, but a permanent imprinting on CD-ROM. To obtain the benefits of existing electronic networks for access to the contents, the publication was set in HTML, the native 'language' of the World Wide Web (WWW). A 'user-friendly' interface was built into the publication in the form of a table of contents and indexes. This uses standard WWW hyperlinks and is not provided by special software. The book encompasses the full papers, all 200 poster abstracts and, since there was still so much space on the CD, specially commissioned features on biological databases and extensive indexes to bioscience resources on the Web. The bioscience indexes gave the final publication more general appeal beyond the topics covered in the papers. The final product is classed as a book, has a unique ISBN number and has been sent to Chemical Abstracts for abstracting.

Now CD-ROM publications are not new and all the big publishers are turning them out. Generally they are 'closed systems' requiring you to download licensed reader software to your computer. In the philosophy adopted for the *Proceedings of the 5th International Perspectives on Protein Engineering*, no software was bundled. Without the need for special programmes, the capacity of CD-ROM for simple HTML and graphics is huge and subsequent proceedings volumes could be successively accumulated on the same small plastic disc for many years. The CD content is read with the same, usually free, viewers ubiquitously available for surfing the Internet. Current versions of these viewers are so powerful that they can convert simple text and compressed graphics into coffee table quality presentations which can be read on screen or printed in full colour. The viewers used are not only faster than the conventional electronic book readers and operate to a universal standard, they are much more powerful, able to launch multimedia applications such as 3D interactive presentations and sophisticated searching. Relative to the Internet, the information on CD-ROM is accessed very much faster and is non-volatile. However, the 'killer' feature of this publishing strategy is that, when loaded, the publication becomes part of the global network. For example, links can be set up by a contributing author which allow the reader to retrieve 'live information'. The infamous 'in press' or even 'submitted for publication' could now be made to live up to their darkly hinted promise by becoming links to a real citation (or even the information itself) on the server of the author's institution. CD-ROM is cheap to produce, post and has low storage volume requirements. For the needs of those who would publish scientific symposia (where 100 % of the community have computers and, probably, also Internet access) it would seem the ideal form. It could easily be factored into the cost of the meeting and given to all delegates. Shelf life is at least 100 years (far exceeding the shelf-life of the content). In the information age to which we are rushing headlong it is hard to see how this form of publication can fail to contribute positively to the conservation of trees.

If anyone is interested in obtaining a copy of the (CD-ROM-based) *Proceedings of the 5th International Perspectives on Protein Engineering*, details are on the Web at http://www.biodigm.com/ or from the author at the address below.

A review of the CD will appear in the May issue of the *Quarterly*.

Dr Michael J. Geisow, 64 Langdale Grove, Bingham, Notts NG13 8SS.

SocietyNews

November Council Meeting

Dearing Submission

COUNCIL CONSIDERED AT LENGTH a draft submission to the Dearing Inquiry into Higher Education (see pp. 13–15). Perhaps the strongest feelings emerged about the dangers of falling standards, which members felt should now be acknowledged as already well underway, particularly in practical training in the universities. Council views this exercise as one of the most far-reaching and important challenges affecting the future of university teaching and research, and sanctioned the publication of the full text of the Society's submission in this issue.

Journal Matters

THE SOCIETY'S JOURNALS continue to feature strongly in the publicly visible profile of Society activities, and Council is always aware of the need to provide the best possible service to authors and readers. Recent changes to Editorial Board Memberships approved by Council will enhance the level of service, partly through increased numbers and partly through a greater international repesentation. This is especially the case on the Board of the *Journal of General Virology*, reflecting the Society's wish to foster the European dimension in virology. At the same time, Council has considered very carefully the staffing needs of the publishing operation at Marlborough House. Discussion focused on the need to balance excellence in editorial standards with the sometimes conflicting needs of authors and readers for prompt publication, and the need to operate on a par with other learned societies and commercial publishers in the field. Council was satisfied that some adjustments to working practices and management will enable the Society to continue to publish first class journals on time, with the existing complement of editorial staff.

Hotline To Europe

FOLLOWING HIS APPOINTMENT as International Secretary, Professor Almond outlined a mechanism for transmitting concerns which members might have about microbiological issues to European politicians, via FEMS. Council agreed that antibiotic abuse was one such issue which justified further exposure. Participation of Society members at large in discussion of this or other matters would be welcomed.

Charles Penn, General Secretary

Nominations for Members of Council

THREE MEMBERS OF COUNCIL, Professor F.G. Priest, Dr G.M. Schofield and Dr U. Desselberger, retire from Council in September 1997. Professor Priest and Dr Schofield are not eligible for re-election, but Dr Desselberger, having filled a vacancy for one year which arose when Professor J.W. Almond was elected to the post of International Secretary in September 1996, is eligible for immediate re-election.

Nominations are invited from Ordinary Members to fill these three vacancies. All nominations must include the written consent of the nominee and the names of the proposer and seconder, both of whom must be Ordinary Members. Members submitting nominations should indicate the main area of microbiological interest of their nominee, who must have been a member of the Society for at least two years.

Nominations should be sent to the SGM General Secretary, Dr C.W. Penn, School of Biological Sciences, Biology West Building, University of Birmingham, Birmingham B15 2TT, to arrive **no later than 25 April 1997.**

EUROPEAN STUDENT MEMBERSHIP

The new category of European Student Membership came into operation on 1 **January 1997.**

Please contact the Membership Office for details.

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)

Notices

Our New Web Site

THE SGM HAS NOW ESTABLISHED its very own site on the World-Wide Web. The address is http://www.socgenmicrobiol.org.uk – you only have to type it once before adding to your bookmark collection!

Since February 1995 our home page, in fact our only Web page, had been hosted by Pharmweb (www.pharmweb.net) and we are very grateful to them for doing this. The new Web site is mounted on the server of the Biochemical Society in London (www.biochemsoc.org.uk) and controlled remotely from Marlborough House.

We supply information about the SGM, a meetings calendar, details of membership, monthly tables of contents and abstracts of papers in JGV and *Microbiology*, sample articles to download, instructions for authors and much more.

Microscene Noticeboard

AT THE SPRING MEETING of the Society to be held at the Heriot-Watt University, a board will be set up with advertisements of jobs, postdoctoral positions, studentships, courses, conferences, etc. The notices should be in a standard format: 6" × 4" card with details of the post or meeting and name, address and telephone number of the advertiser. A4 size posters are also acceptable. There will be a small charge for commercial organizations. Contributions for the board may either be brought to the meeting or sent beforehand to Janet Hurst at SGM Headquarters.

1997 Colworth Prize Lecturer

THE 1997 COLWORTH PRIZE Lectureship has been awarded to Professor Gordon S.A.B. Stewart, Department of Applied Biochemistry and Food Science, University of Nottingham, for his contribution to the application of molecular biology in practical bacteriology.

He will receive the prize of £1,000 and deliver his lecture at the Society meeting at Heriot-Watt University on Tuesday, 25 March 1997 at 1715.

A biography of Professor Stewart will appear in the May issue of the *Quarterly*.

SocietyNews

Grants & Awards

Marjory Stephenson Prize Lecture

NOMINATIONS ARE NOW INVITED for the Marjory Stephenson Prize Lecture to be delivered at the Society meeting in April 1998. The Marjory Stephenson Prize Lecture is the Society's principal award and is awarded biennially in recognition of an outstanding contribution in any area of microbiology. The award is made for a specific piece of research which is currently giving rise to important developments in microbiology, rather than to honour a distinguished scientific career.

The value of the Prize is £1000 and the recipient will be expected to deliver the Marjory Stephenson Prize Lecture at the Spring meeting of the Society following the announcement of the award. He/she will be encouraged to publish the Lecture in one of the Society's Journals.

Nominations from members of the Society, in accordance with the rules set out below, should be sent to the General Secretary, Dr C.W. Penn, School of Biological Sciences, Biology West Building, University of Birmingham, Birmingham B15 2TT by 2 May 1997. The General Secretary will be pleased to advise any member who is thinking of making a nomination.

Rules

1. The Marjory Stephenson Prize Lecture shall be awarded biennially for an outstanding contribution of current importance in microbiology, without restriction on the area of microbiology in which the award is made.
2. Nominations for the Marjory Stephenson Prize Lecture shall be invited by a notice in the *SGM Quarterly* and by whatever means the Officers of the Society shall consider suitable.
3. Nominations for the Marjory Stephenson Prize Lecture shall be made by any two members of the Society; the nominee need not be a member of the Society. Nominations should be accompanied by a statement of the contribution to microbiology made by the nominee, supported by reprints or other appropriate documentation. A brief *curriculum vitae* of the nominee and a full bibliography of his or her work should also be included. (The General Secretary will be pleased to advise members preparing nominations about the information to be supplied.)
4. There shall be no restriction by means of age or nationality of those eligible for the Marjory Stephenson Prize Lecture. Recipients of the Lectureship may not be nominated on a subsequent occasion.
5. Nominations shall be sent to the General Secretary of the Society before a closing date to be specified in the notice inviting nominations. The recipient of the Marjory Stephenson Prize Lectureship will be expected to give a lecture based on the work for which the Prize Lectureship has been awarded to a meeting of the Society, normally the spring meeting following the announcement of the award. The recipient will be strongly encouraged to publish the lecture in either *Microbiology* or the *Journal of General Virology*, whichever is the more suitable. The choice will be at the discretion of the Editors of the two journals.
6. The announcement of the successful nominee shall be made in the *SGM Quarterly*.
7. These rules shall be published at the time of inviting nominations. They may be modified at any time by the Council of the Society, but such modifications shall be published at the time of or before the invitation for nominations on any particular occasion.

The Watanabe Book Fund

A GENEROUS DONATION to the Society by Professor T. Watanabe of Japan has enabled us to set up a fund to make annual awards for the benefit of members in Developing Countries. This is distinct from our own International Development Fund.

Members of the Society who are permanently resident in a Developing Country may apply. The purpose of the fund is to enable members involved in higher education and/or research to acquire for their libraries books or possibly journals relating to microbiology.

Applications should include:

1. A list of the publications required together with an estimate of their cost (the total cost for any one application should not exceed £350 sterling).
2. A letter from the Head Librarian of the organization certifying the need for the books and the address to which the books should be sent, a statement on where the books will be kept and an outline of the loan arrangements for members of the organization.
3. A description of the member's organization and its involvement in microbiology, the number of staff and students and details of the nature of any microbiology courses provided by the organization, i.e. BSc Microbiology, technical training, etc.
4. A *curriculum vitae* of the principal applicant.

None of these items (1–4) inclusive should exceed one side of A4 paper each.

The closing date for applications is **3 October 1997**. Applications (single copies) should be sent to the Grants Office, Society for General Microbiology, Marlborough House, Basingstoke Road, Spencers Wood, Reading RG7 1AE (Fax 0118 988 5656).

Awards 1996

Only one application to the Fund was received in 1996. An award of publications to the value of £300 was made to Dr Shahida Hasnain, Department of Botany, University of the Punjab, Lahore, India.

Postgraduate Student Meeting Grants

POSTGRADUATE STUDENT MEMBERS of the Society currently resident in the UK or another European Union country are eligible for a grant to cover the costs of accommodation and travel in attending one of the following SGM meetings: Heriot-Watt University, March 1997; Southampton, September 1997, Bradford, January 1998 and any other Society Group or Branch meeting in 1997. An application form giving full details of the scheme was sent to each Student Member with their subscription invoice in October 1996. Student members should submit their applications well in advance of a meeting if they wish to ensure that the grant is received before making their booking.

Application forms are available from the Grants Office, Society for General Microbiology, Marlborough House, Basingstoke Road, Spencers Wood, Reading RG7 1AE (Tel. 0118 988 5577; Fax 0118 988 5656).

SocietyNews

INTERNATIONAL DEVELOPMENT FUND

AT THEIR MEETING IN NOVEMBER, Council was pleased to approve the awards below from the Society's International Development Fund. Demand was very high in 1996, with 14 applications being received. The Fund exists to provide training courses, publications and other assistance to microbiologists in developing countries. The Rules for the 1997 Fund will be advertised in the May issue of the *Quarterly*.

Dr S. Gillespie, Department of Medical Microbiology, The Royal Free Hospital School of Medicine, London has been awarded £2,385 to run a course on Acute Respiratory Infections at the Kilimanjaro Christian Medical Centre in Tanzania.

Dr J.M. Thresh and *Dr J.D.A. Hughes*, International Institute of Tropical Agriculture, Chatham, Kent have been awarded £860 towards the expenses of running a workshop on plant virus diseases in Nigeria.

Dr K. Jones, Institute of Environmental and Biological Sciences, University of Lancaster has been awarded £5,688 to support travel and the purchase of equipment for the development of environmental microbiology at the University of Science and Technology, Kumasi, Ghana.

Dr A. Thomas, International Nepal Fellowship, Pokhara, Nepal has been awarded £4,000 to cover the recurrent costs for 2 years of training in molecular techniques to aid diagnosis and epidemiological investigations of leprosy and tuberculosis in Nepal.

Dr A. Wheals, School of Biology and Biochemistry, University of Bath has been awarded £2,000 towards the costs of running a training course in fungal cell biology and genetics in Brazil.

A report of the experiences of Dr J. Ongrádi who received an award from the 1994 International Development Fund, appears in this issue of the *Quarterly* (see p. 28).

PRESIDENT'S FUND

YOUNGER MEMBERS OF THE SOCIETY are reminded that the President is prepared to consider applications for limited financial support for one of the following:

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

Grants are usually limited to £100 for attendance at meetings or institutions in the country of residence, £155 for travel to another European country and £220 for travel outside Europe.

Applicants must be resident and registered for a PhD in a country in the European Union. Grants are restricted to applicants who have not received an award from the President's Fund to attend a meeting, visit or course in the calendar year prior to the application. The full rules of the scheme were published in the November 1996 issue of the *Quarterly*.

Application forms are available from the SGM Grants Office.

Fred Griffith Review Lecture

THE NEXT LECTURE will take place at the Society's meeting in Southampton in September 1997.

The Fred Griffith Review Lecture is a biennial lecture, which usually takes the form of a personal overview of an area of microbiology in which the speaker has been active. The invitation to give the Lecture is offered in recognition of long and distinguished service to microbiology.

The General Secretary, Dr C. Penn (School of Biological Sciences, Biology West Building, University of Birmingham, B15 2TT) would welcome suggestions for this year's lecturer, which should be sent to him **by 21 March 1997**.

News of Members

Dr D.C. Kelly, Defence Microbiology Division, CBDE, Porton Down, has been made a Companion of the Order of St Michael and St George.

Professor Christopher C. Payne, Chief Executive, Horticulture Research International, Wellesbourne, has been awarded an OBE in the Queen's New Year Honours List for services to horticultural research.

Dr David B. Archer, Genetics and Microbiology Department, Institute of Food Research, Norwich Laboratory, has been appointed Special Professor in the Department of Applied Biochemistry and Food Microbiology, University of Nottingham.

Congratulations to ***Janet Bunker*** (Education Group Convener) and husband Mark on the safe arrival of son Jonathan Mark on 25 November.

Dr Duncan J. Maskell, formerly of Imperial College of Science Technology & Medicine, has been appointed as the inaugural Marks and Spencer Professor of Farm Animal Health, Food Science and Food Safety, at the Centre for Veterinary Science, Department of Clinical Veterinary Medicine, University of Cambridge.

Dr N.F. Moore has been appointed Associate Director of the Project Management and Consultancy Group for the Defence Research and Evaluation Agency (DERA) and may be contacted at DERA Farnborough, Lockspeiser Building, Room GO16, Ively Road, Farnborough, Hants, GU14 OLX (Tel. 01252 393688; Fax 01252 393174).

The Personal Chair held by ***Professor Jon Saunders***, School of Biological Sciences, University of Liverpool has been converted to a Chair of Microbiology.

Dr Michael Wilson, currently reader in Oral Microbiology and Head of the Department of Microbiology at the Eastman Dental Institute, University of London, has been appointed to a Personal Chair in Microbiology in the Faculty of Clinical Sciences at University College London.

The Society notes with regret the deaths of ***Dr N.E. Crook*** (member since 1979), ***Dr L.R. Hill*** (member since 1957), ***Elena N. Kondratieva*** (Honorary Member), ***Dr C.H. Smith*** (member since 1945) and ***Dr L.J. Zatman*** (member since 1954).

SocietyNews

New Honorary Members

Prof. Patricia H. Clarke

PAT CLARKE graduated in Biochemistry at Cambridge in 1940. During the war she worked with B.C.G.J. Knight at the Wellcome Research Laboratories on toxins of the pathogenic anaerobe, *Clostridium oedematiens*. After the war, while her children were young, she worked part-time at the National Collection of Type Cultures. With Sam Cowan, she developed biochemical microtests for bacterial identification based on enzyme reactions. She was appointed lecturer in Biochemistry at University College London in 1953, retiring as Professor of Microbial Biochemistry in 1984. At UCL she used acetamidase of *Pseudomonas aeruginosa* as a model system for research on experimental enzyme evolution. By 1966 her research group had established that a single-site mutation could alter substrate specificity. They also showed that a succession of single-site mutations could give rise to a family of altered enzymes. A similar series of single-site mutations resulted in successive alterations in regulatory controls. Later, the genetic and biochemical results were confirmed by protein and DNA sequencing. The results of this research were relevant to understanding the ways in which novel metabolic pathways evolve in the natural environment but also had implications for the industrial use of micro-organisms. She collaborated with Malcolm Lilly and Peter Dunnill, of the Department of Chemical and Biochemical Engineering, in research on microbial products in large-scale culture and was a member of the SERC Biotechnology Management Committee.

She was elected to the Royal Society in 1976 and was the Leuwenhoek Lecturer in 1979. She was Honorary General Secretary of the SGM from 1965 to 1970 and Marjory Stephenson Memorial Lecturer in 1981. She also gave the A. J. Kluyver Memorial Lecture of the Netherlands Society for Microbiology in 1981. After retiring from UCL she was appointed Kan Tong-Po Professor at the Chinese University of Hong Kong and Adviser to the Palm Oil Research Institute of Malaysia.

Prof. J.R. Quayle

MY ASSOCIATION WITH THE SOCIETY began in January 1963 when I was a member of Sir Hans Krebs' MRC Unit at Oxford. I was invited to give a paper to an SGM Symposium on *Comparative Biochemistry of Micro-organisms*, hosted by Sidney Elsden and his staff at Sheffield. The whole country was in the grip of severe arctic weather and many brave microbiologists nearly perished in their icy hall of residence beds and on the snowbound streets of Sheffield. I did not know at the time that nine months later I would move up to Sheffield as a Senior Lecturer in Biochemistry, following the sudden departure of many of the Sheffield biochemists to the States.

In 1965 Sidney Elsden and most of his staff departed to Norwich and I stepped into his shoes as West Riding Professor of Microbiology. Several of my colleagues expressed surprise to see me proposing to profess a subject in which I knew a lot about very little. Indeed, one of my more artistic post-docs summarized the situation succinctly by sending me a hand-crafted card of congratulation on the front of which a reasonable likeness of myself could be seen surreptitiously taking from a shelf a book entitled *All About Bugs*. Another ex-research student sent me a card emblazoned with the legend 'Genius is 95% hard work – Congratulations sweaty'!

Clearly the book about bugs must have had some merit because my association with the SGM thereafter became a long and happy one, culminating in my becoming its President for three years in 1990 and being elected into Honorary Membership in 1996.

SPECIAL OFFER! – BRITISH MIDLAND FLIGHTS

137th SGM Meeting, Heriot-Watt University, Edinburgh

Discount rates for SGM delegates are offered for the following flights (Economy Class) to Edinburgh:

London Heathrow – Edinburgh return ..... £105 + tax
East Midlands – Edinburgh return..... £109 + tax

To Book...

Tel. British Midland Reservations 0345 554554 (within UK), +44 1332 854854 (outside UK) quoting reference CIC*110/305. Direct payments are required.

Fares are only valid **23–28 March 1997** and are non refundable.

NOTICE TO CUSTOMERS – Relocation of NCFB

The National Collection of Food Bacteria, formerly housed at the Institute of Food Research in Reading, has now relocated to Aberdeen where it has merged with the National Collections of Industrial and Marine Bacteria (NCIMB). Would existing NCFB customers please redirect their orders and enquiries to NCIMB at the following address: NCIMB Ltd, 23 St Machar Drive, Aberdeen AB24 3RY, UK [Tel. +44 (0)1224 273332; Fax +44 (0)1224 487658; Email ncimb@abdn.ac.uk; Internet http://www.abdn.ac.uk/~aur014/ncimb.htm

Marlborough House Staff News

AT THE 1996 ANNUAL STAFF SALARIES AND GRADING REVIEW, which takes place each September, it was agreed that a new post of Deputy Managing Editor should be created for each journal. Ian Atherton was appointed to the post on *Microbiology* and Simon Gee was appointed to the post on *Journal of General Virology*. However, since his promotion Simon has moved on to even better things and taken up an appointment as Managing Editor with International Medical Press in London. He left at the end of November and we were pleased to appoint Debbie Clegg, a fairly recent recruit to the journal, to take his place. A drive to find a new staff editor is underway. Another new face on JGV is Alison Thatcher who came as staff editor in October to replace Colin Drummond.

On the computer systems front, we were pleased to welcome Bruce Moore as Technical Assistant to Duncan McGarva. Hopefully he will get the Society's web pages to a more advanced stage as well as helping with the numerous other tasks required to keep our hardware and software running smoothly.

MICROBIOLOGY NEWS

GENE TECHNOLOGY IN MICROBIOLOGY: BENEFITS AND RISKS – FEMS REPORT

THE REPORT IS BASED on a FEMS workshop held in February 1996 and the principal author is Helena Mäkelä. SGM Council member Dr Geraldine Schofield is a co-author and she participated in the workshop.

Gene technology is a central tool of modern biology and microbiology underpins this expanding area of science. The applications of gene technology hold much promise for problem solving and wealth creation today and in the future. However, the public understanding of this aspect of biotechnology is limited and there are fears about some of the consequences. The FEMS report attempts to address these issues by surveying the role of gene technology in different areas of microbiology and examining the potentials risks associated with such applications. Topics covered include: gene technology in the study of micro-organisms; transgenic micro-organisms as research tools in eukaryotic genome work; gene technology in the control of infectious diseases; diagnostics; vaccines; gene therapy; using recombinant micro-organisms in the production of chemicals, foods, etc.; improving traditional fermentation technology with recombinant micro-organisms; recombinant micro-organisms in agriculture; and modification of environmentally important micro-organisms by gene technology. The risks assessed include: will new, dangerous infectious micro-organisms be created and spread?; unscheduled spread of recombinant micro-organisms in the environment; and genetically modified micro-organisms as agents of biological warfare. The report concludes by considering measures such as legislation, guidelines and the appropriate training of microbiologists to reduce the potential risks already described.

This interesting overview may well prove useful as a teaching aid. It is intended that FEMS will publish the report in leaflet form in due course. However, a copy of the report may be obtained now by contacting the External Relations Office at SGM HQ.

REGISTER OF CONSULTANTS

SGM MEMBERS WHO OFFER microbiological consultancy and testing services are invited to submit their details for inclusion on the register. The list includes full name, qualifications, name of consultancy, address, telephone and fax numbers and subject areas covered, together with full-time or part-time status. The list is in strictly alphabetical order by surname and no recommendation is implicit in the inclusion of any member. The Society will not accept any responsibility or liability for work undertaken as a result of inclusion in the list. Members operating a consultancy who wish their name to be added to the register should submit the information given above to the External Relations Office, SGM HQ.

SCIENTISTS MAKING LINKS WITH PRIMARY SCHOOLS

THE MRC HAS RECENTLY PUBLISHED an excellent booklet to guide scientists who wish to promote their area of science to primary school children. Such support can be very valuable as all pupils have to study science as part of the National Curriculum but not all schools have teachers who are science specialists. Copies of the booklet are free from the Publications Unit, MRC, 20 Park Crescent, London W1N 4AL.

MILLENIUM AWARD SCHEMES

Six Millenium Award schemes were launched by Virginia Bottomley, Chairman of the Millenium Commission, all linked by the common theme of *You and Your Community*. Two are of particular interest to scientists.

The Royal Society/British Association scheme will provide funding for individuals with a science, engineering or technology background, to equip, train or otherwise interact with community groups to promote science, engineering or technology. To be eligible, applicants must have established a link with a community institution such as a museum, hospital, advice centre, television station, etc., and show how they can work with the body to provide a science-related service to the community.

The Earthwatch Millenium Fellowships will fund links between teachers and education officers with responsibilities for implementing environmental education policies and scientists working in environmental science.

For further information, contact Kellie Blackmore, Millenium Commission, 2 Little Smith Street, London SW1 3DH.

OUR MAN IN HAVANA

JAMES C. HARRISON, who is not a member of SGM, has recently contacted the Society with regard to possible collaboration between a UK microbiologist and a company in Cuba. Labiofam is a large state firm in Havana with research and production covering a wide range of activities, including veterinary preparations, pharmaceuticals, plant protection, vaccines and natural products. Their research has a strong bias towards biotechnological solutions to problems. The company has 5,700 employees. Each year a'Scientific Event' is held, to which foreign delegates were invited for the first time in 1996. Mr Harrison, who is an environmental health and housing consultant, attended this meeting to give a presentation. Many of the topics covered were microbiological and the Cubans have asked Mr Harrison to help them find a microbiologist who would like to attend the 1997 'Event'. Expenses in Havana will apparently be met. Any member who is interested in making this visit should contact Mr Harrison for details at 51, Etnam Street, Leominster, Herefordshire HR6 8AE (Tel. 01568 614267, Fax. 01568 611290).

STORIES OF THE GERM LABS: 50 YEARS OF PUBLIC HEALTH

A SPECIAL EXHIBITION has opened at the Science Museum focusing on the work of the Public Health Laboratory Service (PHLS), which celebrated its Golden Jubilee at the end of 1996. It looks at the development of laboratory diagnosis and investigation and the growth of modern epidemiology. It is a story-telling exhibition, providing information about infectious diseases over the past 50 years and the role of the PHLS in protecting the public. The style of the exhibition is light, as an antidote to the hysteria so often associated with infectious disease. SGM members will be particularly interested in the information about the early days of the PHLS for the first Director was Sir Graham Wilson, who also played an important part in the foundation of the Society.

Admission to the exhibition is included within the Museum's standard admission price of £5.50 for adults and £2.90 for children. The Science Museum is open every day between 1000 and 1800 and the nearest tube station is South Kensington.

COPUS SCIENCE & TECHNOLOGY MEDIA FELLOWSHIPS

THIS SCHEME PLACES practising scientists and technologists with print or broadcast media organizations for up to two months. If you are interested in trying your hand at journalism and promoting science, why not apply? Ten fellowships are available. Send for an application form from Jane Mole, British Association for the Advancement of Science, 23 Savile Row, London W1X 2NB (Tel. 0171 973 3500).

SET97

National Week of Science, Engineering & Technology
14–22 March 1997

THE SGM WILL BE PARTICIPATING in local initiatives to promote microbiology at the University of Reading. Don't forget to let the External Relations Office know if YOU have taken part in any interesting SET events. A report for the *Quarterly* will be very welcome (with pictures if possible).

A Grand Few Days at FUNGUS 100

The Centenary Exhibition of Fungi

26–28 September 1996, Royal Horticultural Halls, London

Rebecca Jones

Paintings, stamps, models, sick-looking plants, mushrooms, dry-rot-infested planks, dyed clothes, microscope slides and computer systems, Quorn ... and all manner of fungi were represented at a three-day exhibition celebrating the centenary of the British Mycological Society. I bet the average visitor to *FUNGUS 100* had no idea of the diversity of mycology when they entered the Royal Horticultural Society Hall, but I am sure they had a better idea when they left. The background of the visitors was similarly diverse, including many keen amateur gardeners, retired people, young families, 'A'-level students, teachers, and professional and amateur mycologists.

One day of the exhibition was targeted at schools. There were talks from eminent scientists on subjects such as biotechnology and medicines produced from fungi which were designed to complement the 'A'-level biology syllabus. The winning entries from the 1996 BMS/MISAC poster competition for schools on 'Fungi: Friends and Foes' were also on display and the prizes were presented to the winners by the BMS President John Webster.

Top: David Conway, Merlewood Research Station, loading fungal DNA on an electrophoresis gel. *Photo courtesy of Glyn Hobbs.*

Bottom: Sarah Monroe, first prize winner in the BMS/MISAC competition 'Fungi: Friends and Foes' showing off her prize-winning entry.

Top: Jean Mortimer shows fabrics dyed with fungi.

Bottom left: John Schollar demonstrating a microbial fuel cell on the SGM stand. *Photo courtesy of Glyn Hobbs.*

Bottom right: The BMS fungal identification service. *Photo courtesy of Glyn Hobbs.*

Dr Stefan Buczacki, well-known gardening expert and BMS member, opened the exhibition and hosted an edition of *Gardener's Forum* for Classic FM. Another highlight was watching Antonio Carluccio, the chef, creating gastronomic masterpieces from wild mushrooms. The smell was tantalizing and a few lucky souls at the front were able to taste the dishes. Antonio later visited the SGM stand and was impressed with the size of the oyster cap mushrooms growing on kitchen roll, although he did say oyster caps always taste better when grown on real wood!

The SGM External Relations Office, with colleagues from the National Centre for Biotechnology Education, ran a stand called *Yeast Power* to explain the mysteries of yeast to the 4,000+ visitors. Most visitors were well aware of the traditional uses of fermentation – bread and beer making, but most had no idea that yeast can be used to, for example, produce pigments, esters or that yeast can run a microbial fuel cell producing 0.5 V.

The Society was pleased to support the event commemorating the centenary of the BMS and the SGM would like to wish the BMS an equally successful next 100 years. I would like to thank my colleagues Bene, Dean, Kate and John from the NCBE for helping to run the SGM stand so well.

Rebecca Jones works in the External Relations Office of the SGM.

Report of the First *Young Life Scientist of the Year* Award (Promega Prize)

Grace Alderson

The first competition for the *Young Life Scientist of the Year*, awarded by Promega, took place during the Joint Congress of the British Society for Immunology (BSI) and the Biochemical Society (BS) on 12 December 1996 in Harrogate. The afternoon was introduced by Duncan Campbell who gave the background to the Promega Prize Competition. Duncan had the heavy load of both chairing the afternoon's session and looking after the judging panel of nine. John Todd gave a fascinating plenary talk on autoimmune Type 1 diabetes and then came the competition proper. Nine young life scientists (Table 1), each of whom had won their own Society's separate award [SGM and the Genetical Society (GS), in addition to BS and BSI] presented their work by giving a 10 minute presentation and answering questions from the judging panel – and from a large audience of scientists from the Congress. Given how all competitors had arrived at this point, I was expecting that the standard of presentation would be good and it was – it was very good. All nine spoke about very interesting work and spoke with confidence and with visual aids of a standard that were an example to us all. The SGM's own competitors were Jorge Membrillo-Hernandez from King's College and Fiona Pettifer (NIBSC) who both acquitted themselves admirably.

Much of the work that was presented was very interdisciplinary, with many competitors presenting excellent data from the application of the tools of molecular biology, biochemistry, genetics, immunology and microbiology in the pursuance of their scientific goals. It will also be of interest to Society members that six of the nine presentation titles included the names of microbes or their products.

At the end of the session the judging panel (Table 2) was left alone to do its work – and what a challenge it was to find one winner out of such an excellent field. The judges had a difficult time and at one stage during our hour's deliberations it was suggested that we divide the money by nine and be done! In the event it was clear that Sarah Danes, a GS winner who had given a very confident and mature presentation in relation to her extensive work on the inherited disease Aniridia, was the first *Young Life Scientist of the Year*. She was presented with a cheque for £2000 and a unique glass model of a modern life science laboratory at an award dinner in the evening. All candidates for the award were praised for how incredibly well they had done and for the quality of their contributions.

Given that the aims of Promega in setting up this award were 'to encourage both communication skills and technical excellence for up and coming life scientists', I feel that these aims were well served by those who contributed to an outstanding afternoon of science. The SGM should be well content to continue its support for the competition in future years.

TABLE 1. CANDIDATES (IN ORDER OF PRESENTATION)

Richard Beck (BS) *(Molecular Genetics, UCL)*	cBlx: a novel metal-binding protein involved in sirohaem biosynthesis in *Bacillus megaterium*
Jonathan Beech (BSI) *(Pathology & Microbiology, University of Bristol)*	Pristane-induced arthritis: disease induction or prevention is associated with different T-helper cell subsets
Jorge Membrillo-Hernandez (SGM) *(Life Sciences, King's College)*	The *Escherichia coli* flavohaemoglobin: links with oxidative stress
Sarah Danes (GS) *(MRC Human Genetics, University of Edinburgh)*	A position effect on PAX6 in cases of Aniridia
Anna Goodall (BS) *(Cardiovascular Research, University of Leeds)*	Translocation of the PKC isoforms present in the human neuroblastoma, SH-SY5Y, following short-term treatment with the phorbol ester TPA
Sean Sweeney (GS) *(Genetics, University of Cambridge)*	Genetic lobotomies; targeted expression of tetanus toxin light chain in *Drosophila*
Carl J. Harvey (BSI) *(Infection & Immunology, University of Birmigham)*	A novel mechanism of human anti-tuberculous immunity mediated by purinergic receptors on macrophages
Fiona Pettifer (SGM) *(Bacteriology, NIBSC, London)*	Immunogenicity of a hybrid protein consisting of the receptor binding domains on tetanus and diphtheria toxins
Simon Vincent (GS) *(Genetics, University of Nottingham)*	Recombination in *Escherichia coli*: the many roles of RecG

TABLE 2. MEMBERS OF THE JUDGING PANEL

Chairman	Duncan Campbell	
BSI	Art Bovlston	Mike Kemeny
BS	Steve Higgins	Norma Ryan
SGM	Grace Alderson	Tony Trinci
GS	Simon Baumberg	Peter Young
Promega	Sean Donnelly	Ruth Tolcher

Grace Alderson is Convener of the Systematics & Evolution Group and helped to judge the competition.

Society Information Leaflets

MEMBERS MAY BE UNAWARE of the numerous and wide-ranging enquiries handled regularly by the External Relations Office on topics such as careers, courses, funding and microbiology generally. Leaflets and information sheets have been compiled to cover some of these subjects, as listed below. Copies are available, free of charge, from Janet Hurst at the Society's Headquarters.

Short Courses

This factsheet lists short courses on topics related to microbiology run by UK higher education institutions and other bodies. These courses, which may last for a few days, or be spread over a number of weeks, do not lead to a qualification but provide training in specialist subjects for scientists who need to learn about a particular technique or field for their job. The list is by no means comprehensive, and it is impossible to keep it up-to-date because the courses offered are changing all the time. However, it is checked annually. Notification of future microbiologically oriented short courses for inclusion in the factsheet would be very welcome.

Funding

This factsheet gives the names of pertinent funding bodies, the awards on offer and the conditions of the various grant schemes. In view of the vast area covered by this topic, the sheet is necessarily selective, and there may be funding bodies of which we are not aware. The factsheet therefore also includes an annotated bibliography of relevant books and directories of grant-making bodies, which may assist the award seeker in identifying other sources of funding. The list will principally interest postgraduates and postdoctoral workers, but it may also be of use within departments as an extra source of information. There are also a few entries concerning undergraduate sponsorship.

Reciprocal Attendance at Meetings Held by Other Societies

Student Members of the SGM already know about the excellent range of benefits to which they are entitled, including post-graduate conference grants, President's Fund awards and reduced prices for Society publications. Now a further concession is available.

Arrangements have been agreed with five fellow societies –

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

for student members to have reciprocal rights at each other's meetings. This means that no registration fees will be charged to SGM Student Members attending meetings held by any of the organizations listed above.

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.

A Web site is being set up to publicize future meetings of the various societies, but for the present Student Members will have to find out this information for themselves.

The 1996 Irish Lecture Tour

Dr Jim Hope (Institute for Animal Health, Compton) went on the road in November giving a lecture on *Scrapie, BSE and CJD: a tale of mice mad cows and brain disease* for the Society's 1996 Irish Lecture Tour. The hectic five-day schedule included venues in Belfast, Coleraine, Dublin, Galway and Cork. Lecture theatres were packed with undergraduates, postgraduates, microbiologists, and other interested scientists and medics from a wide range of hospitals, research institutes, and university and government departments.

The content of the lecture, which incorporated video clips, had something for everyone which made for lively and extended question sessions in all locations. The tour certainly raised the profile of microbiology and the good news is that Jim survived and enjoyed the experience.

PROMEGA PRIZE

137TH SGM MEETING, HERIOT-WATT, 24–27 MARCH 1997

Postgrads/First Postdocs

Are you presenting your work (offered paper or poster) at the meeting? If so, why not enter for the Promega Prize and a chance to be *Young Life Scientist of the Year* (see p. 24)?

Contact Mary Harwood at Marlborough House for details.

European Congress of Biotechnology
Budapest, August 1997

The British Co-ordinating Committee for Biotechnology will make available a few grants to help younger SGM members resident in the UK attend the Congress.

Further details are available from: Professor Jeff Cole; Fax 0121 414 3982; Email j.a.cole@bham.ac.uk

CONTRIBUTIONS TO GRADLINE....

ARE ALWAYS VERY WELCOME FROM YOUNGER MEMBERS OF SGM. WHY NOT MAKE YOUR VOICE HEARD? SEND YOUR ARTICLES, NOTICES OR NEWS TO JANICE MEEKINGS AT SGM HQ.

SGM MEMBER RUNNER-UP IN 1996 YOUNG SCIENCE WRITER AWARD!

CONGRATULATIONS to Student Member David Harrison, a postgraduate in the Microbiology Unit, Department of Biochemistry, University of Oxford, on becoming a runner-up in the National Power/Daily Telegraph 1996 Young Science Writer competition! David's article on how bacteria swim is reproduced below. It was one of 400 entries judged by a distinguished panel which included Dr Mary Archer, Professor Heinz Wolff, Professor Lewis Wolpert and Dr Peter Briggs. Each runner-up received £100, a certificate of merit and subscriptions to *Nature* and *New Scientist*.

David is in the third year of his PhD, researching the mechanisms used by *Rhodobacter sphaeroides* to sense environmental stimuli and translate this information to produce an appropriate tactic response. He presented a poster on his work at the recent international meeting on 'Bacterial Locomotion and Signal Transduction' in Mexico.

The winning article in the competition was also on a microbiological topic – *How Fungi are Mushrooming* – which just goes to show what a fascinating science our Society represents. This success should encourage other Student Members of SGM to enter the 1997 competition (details below) and do their bit to promote the public understanding of microbiology.

SWIMMING THROUGH TREACLE

David Harrison

HOW DO BACTERIA SWIM? Why do bacteria swim? Can bacteria swim towards environments they like? And away from those they don't? And is this important to us? A team of researchers at the Microbiology Unit in Oxford University is currently tackling these questions.

Bacteria are impressive swimmers! As bacteria are so small (about one thousand times smaller than a pinhead) water is much more viscous for them to swim through. So viscous, in fact, that it's equivalent to you trying to swim through treacle! I estimate that, at best, I can swim several body lengths a second. Swimming through treacle would definitely be much more difficult and certainly rather sticky going!

Bacteria, though, can swim at quite remarkable speeds. Many species easily clock up speeds of around 25 body lengths per second. Others are capable of going much faster. But when any swimming cell stops, it stops within a millionth of a body length rather than drifting to a halt. Again a consequence of swimming through a treacle-like environment.

These admirable swimming speeds are achieved by an equally striking mechanism. Many groups of bacteria swim by rotating long, thin, helical filaments – or propellers – which project from their surface. Remarkable, electrical, rotary motors at the base of these filaments drive their rotation. These unique motors (which are about 20,000 times smaller in diameter than a pinhead) are composed of several rings arranged together on a rod.

The rings of the motor spin around several hundred times a second, causing the attached filaments to turn round and round. This rotation generates a powerful force which propels the bacterium through its viscous environment.

These complex motors of bacteria are rather expensive to make and run. The individual components have to be maintained, fitted precisely together and also repaired when damaged. Driving the rings of the motor round and round also needs a constant supply of fuel.

Having this motor, however, is enormously useful. It enables bacteria to swim towards an improving environment, or to escape from a dangerous one.

Indeed, bacteria are able to sense a vast range of conditions which they may swim towards or away from. These include chemicals, temperature, light, pH and in some species the earth's magnetic fields! So a bacterium can sense where the best environment for its growth and survival is, and then swim towards it.

Over the past 20 years, this primitive bacterial sensing system has been dissected in molecular detail. Receptors on the surface of bacteria act as environmental sensors monitoring the level of key signals in their surroundings. These feed information to control the rotating motors via a processing system, akin to a primitive nervous system. This analyses and integrates signals from many receptors so the bacterium can 'decide' whether to swim in the same direction or whether changing direction would be more profitable.

Infectious bacteria are no different. They also use their rotating motors and sensing systems to locate the most favourable environments for their growth and reproduction. This is how, for example, *Vibrio cholerae*, the bacterium that causes cholera, locates the wall of the human small intestine. As it multiplies here it starts to cause an infection (resulting in vomiting and chronic diarrhoea).

So, a new strategy to prevent certain bacterial infections would be to prevent pathogenic bacteria from sensing where they want to swim to. The ultimate goal would be to design therapeutics to prevent infectious bacteria from locating and swimming towards their host. We could, for example, design drugs to stop the motor rotating, paralysing the bacterium. Alternatively, drugs which interfere with the processing system would confuse the bacterium when deciding which is the best direction to swim in.

Such therapies are currently in their infancy. However, the growing phenomenon of bacteria which are resistant to antibiotics makes the development of additional anti-bacterial weapons ever more urgent. Studying how bacteria swim through treacle is therefore both extrinsically useful and intrinsically fascinating!

THE DAILY TELEGRAPH NIREX YOUNG SCIENCE WRITER AWARD 1997

SCIENCE STUDENTS ARE INVITED to test their journalistic abilities and write a compelling article on any science-related topic. Celebrating their 10th anniversary this year, the awards are designed to encourage aspiring young science writers and offer the winners the opportunity to publish a piece in *The Daily Telegraph*.

There are two age groups, 16–19 years and 20–28 years, and the competition is open to any young scientist whether working or studying. Entries should be no longer than 700 words and present any exciting scientific discovery or topic of research in a vivid and readable style.

The first prize in each age group is an all-expenses-paid week-long trip to Philadelphia for the 1998 Meeting of the American Association for the Advancement of Science, £500 cash and an invitation to attend the British Association Festival of Science in September 1997 at the University of Leeds.

The Second prize is £250 plus an invitation to the British Association meeting and nine runners-up in each age group will win £100. All finalists receive a year's free subscription to *Nature* and *New Scientist* magazines.

For further information and an entry form telephone the hot-line on 0171 713 5525.

Full details plus previous winning articles can also be found on the Internet at http://www.science-writer.co.uk

The closing date for entries is **5 March 1997**.

A personal message from Angela Browning, Parliamentary Secretary at the Ministry of Agriculture, Fisheries and Food.

Public Appointments to Bodies Sponsored by MAFF

Angela Browning

As a junior Minister in a Department which relies heavily on scientific information in the development of its policies, I am only too well aware of the valuable contribution that is made by the independent advice we receive from the various advisory bodies which MAFF sponsors and also from the information we receive from the research undertaken or funded by some of its executive bodies.

The quality of this advice is very dependent on the knowledge and specialist expertise of those appointed to serve on these bodies. To maintain the high standard we require and also to get different perspectives so that we can achieve a balanced opinion, we need a constant flow of new people willing to put themselves forward for consideration.

Many of you reading this article may never have considered public service and I hope that by sparing a few moments to read on you will be sufficiently interested to seek more information. Membership of a Non-departmental Public Body can give a valuable insight into the practice and process of Government. Often the time commitment is small but the experience gained can be of considerable benefit. Many of the appointments are unpaid but expenses, including childcare allowances where appropriate, may be claimed. I am particularly keen to get expressions of interest from women and people from ethnic minority backgrounds as we have relatively few potential candidates from these groups on our list at present.

In the space of a short article I cannot provide details of all the bodies we sponsor which total 36 Executive bodies, 38 Advisory bodies, 4 Tribunals and a Public Corporation. The Executive bodies include establishments such as the Royal Botanic Gardens, Kew, and Horticulture Research International, and also include levy bodies which collect and manage funds for research and marketing activities from various sectors of the agricultural industry. Others are concerned with standards, such as the UK Register of Organic Food Standards and the Wine Standards Board of the Vintners Company.

The Advisory bodies cover a range of topics from consumer and food safety issues to specialist committees on pesticides, veterinary products and spongiform encephalopathies.

If you would like further information about the public appointments made by MAFF or would like an application form to enable your name to be put onto our database so that you can be considered for future appointments, please write to Mrs Sheila Martin in the MAFF Appointments Section, Room 314A, Whitehall Place (West Block), London SW1A 2HH.

Angela Browning, MP, is Parliamentary Secretary at the Ministry of Agriculture, Fisheries and Food.

Practical Course on Cytokine Production of FIV-Infected Cells and the Establishment of an FIV Collection in Hungary

Joseph Ongrádi

The newly established Immunodeficiency Research Group of Microbiology at Semmelweis University of Medicine, Budapest, Hungary, aimed to take part in studies on the feline immunodeficiency virus (FIV). An award was made from the SGM International Development Fund to enable Professor Bendinelli of the University of Pisa to give an appropriate training course.

ESTABLISHMENT OF THE IMMUNODEFICIENCY RESEARCH GROUP AND THE INSTITUTE

The Institute of Microbiology was established in 1948 and moved into its recent location in 1978 (floors 9–11 of the Preclinical Building; Fig. 1). Fourteen members of staff teach bacteriology, virology and parasitology to approximately 800 medical, dental and pharmacy students in the 3rd year of their studies. Four practical rooms and two lecture theatres are located on the first floor.

The research laboratories and offices are relatively small. Basic equipment (autoclaves, centrifuges, etc.) was purchased from other Central and Eastern European countries, mainly in the 1970s and early 80s, but the majority is out of order. Research activity is supported by the ordinary allowance obtained from the University and, in practice, it has ceased due to recent economic difficulties. Adenovirus research has survived to a limited extent by a small fund from the Hungarian Academy of Sciences. Due to poor conditions I have worked in British, Italian and American laboratories for the past 6 years. After returning to Hungary in January 1995, two of my previous co-workers, a technician and a secretary, joined me to establish the Immunodeficiency Research Group (Fig. 2). By 1996, due to a monetary shortage, only my two co-workers remained. Collaboration was established with the Dermatovenerealogy Clinics and the University of Veterinary Sciences. Some offices and laboratories were rebuilt: from a common entrance, two tissue culture laboratories, a molecular biology laboratory and a wash-room with an isotope corner were created by glass walls. We also obtained a dark room. In the future we may be able to expand to build a flow cytometry laboratory. Interestingly, the major obstacle was not financial, but rather the resistance of several co-workers who have never taken part in any research activity. Reconstruction of a microtome laboratory and a PCR laboratory is also planned , depending on available resources. Other parts of the Institute are still in ruined conditions. Until now, the Hungarian health authorities have not regarded FIV as a model for AIDS. We depend entirely on international sources.

THE IDF APPLICATION

During my stay in the laboratory of Professor A.G. Dalgleish at St George's Hospital, University of London, in 1994, I prepared an application to the International Development Fund of SGM. The conditions of the scheme perfectly matched with our aims to establish FIV studies in Hungary! Professor O. Jarrett (Department of Veterinary Pathology) and Dr J.F. Szilagyi (Institute of Virology) of the University of Glasgow also encouraged me to prepare the programme, and Professor M. Bendinelli (Department of Biomedicine, University of Pisa, Italy) was kind enough to undertake the task of running the training course. Miss Sue Ganz (Division of Oncology, St George's Hospital, London) and Mr Tom Macpherson (Department of Veterinary Pathology, Glasgow) negotiated financial matters with Philip Harris Scientific and they made an extremely good bargain. Dr J.F. Szilagyi and Dr Graham Russell at the Institute of Virology, University of Glasgow, collected

Fig. 1. The Preclinical Building of the Semmelweis University of Medicine houses nine institutes. The Ceremony Halls are on the left, teaching laboratories are located on the right side.

Fig. 2. Members of the Immunodeficiency Research Group with the new liquid nitrogen container donated by SGM. From left to right: Dr J. Ongrádi, Dr M. Csépai, Professor M. Bendinelli, Dr J. Farkas, Dr B. Lakatos.

Practical Course on Cytokine Production of FIV-Infected Cells and the Establishment of an FIV Collection in Hungary

Joseph Ongrádi

excess, unused equipment for us. Meanwhile, Dr Judith Farkas at the Institute in Hungary organized the transfer of all the equipment from Glasgow to Budapest. Everything arrived intact and in time before the course. This was a real international collaboration, for the first time in the history of our Institute! The major pieces of equipment we acquired were a complete liquid nitrogen ampoule storage system, a UV illuminator, an Eppendorf centrifuge, table-top centrifuges, electrophoresis power supplies, a microscope, radiation protection shields and a radioactivity count rate meter.

THE FIV TRAINING COURSE

The course was held between 26 and 30 June 1995 by Professor M. Bendinelli in the new laboratories. On the first day the use of FIV as a model for AIDS was discussed, the main topics being the similarities and differences in the biochemistry, genome organization and pathogenesis of FIV and HIV. It was stressed that changes in the normal cytokine profile are important in the development of immune abnormalities through the course of HIV infection and AIDS development. Anergy and apoptosis of uninfected immune cells seem to be mediated by overproduction of some soluble mediators released by HIV-infected cells. Latency or activation of HIV depend on the cellular activation, namely on the stage of the cell cycle, a process which is regulated by several cytokines and growth factors. Next, several environmental factors, among them heterologous virus infections might activate both HIV and cytokine production with the consequent rapid onset of AIDS. FIV is the principal small animal model for AIDS. To develop the feline AIDS model to be accepted world wide, one has to know geographical differences in its epidemiology, strain distribution and activating cofactors. Normal or FIV infection-altered cytokine production in cats have been little explored. The effectiveness of vaccination, chemotherapy and attempts to reverse the altered cytokine profile require an exploration of the feline cytokine system.

On the second day the collection, separation and storage of feline immune cells were discussed. Precautions of handling FIV-infected materials and the prevention of contamination with mycoplasmas were demonstrated in the tissue culture laboratory. Standardization of growth-factor-dependent cell lines in cytokine bioassays was thoroughly discussed, including problems of their sensitivity to feline cytokines.

The application of radioisotopes in bioassays (labelling, harvesting, counting) was demonstrated on the third day and safety instructions were given. Next, quantitation of cytokines in the culture medium or blood using ELISA was discussed. Examples were given of how to use standards and to apply cytokine neutralization with antibodies in determining the biological role of a particular type of cytokine. More than an hour was spent in the animal house of the Institute (on the top floor) and instructions were given on how to keep experimental cats economically in the relatively small facilities.

On the fourth day lectures and demonstrations concentrated on molecular biological techniques, especially preparation and long-term storage of nucleic acids to quantify cytokine gene expression. New methods of PCR and RT-PCR technology were illustrated, with a specific emphasis on the primers required in feline systems. For these studies, Professor Bendinelli donated several reagents, enzymes and primers to us.

On 28 June 1995 an FIV mini-symposium was held in the Protocol Hall of the Preclinical Building. Guests were invited from several institutions of the Semmelweis University of Medicine, University of Veterinary Sciences, National Institute for Animal Health, etc., and Professor Bendinelli gave a lecture on FIV, underlining its role in vaccination studies. Next, Dr J. Ongrádi summarized experimental results obtained in Pisa on the effect of cytokines and growth factors on FIV-infected macrophages. Finally, Dr B. Lakatos presented his data on FIV seroepidemiology in Hungary. A very active discussion closed this scientific session.

FIV RESEARCH IN HUNGARY

Beside my studies with Professor Bendinelli in Pisa during 1992–93, FIV studies were also initiated by Dr Béla Lakatos, a young veterinary doctor at the National Institute for Animal Health, Budapest, in 1992. He collected sera of more than 100 field cats and studied FIV seropositivity by an indirect ELISA and Western blotting in Professor Hans Lutz's laboratory at the University of Zurich, Switzerland. In all, 4 % of cats were FIV-positive. Results were published in the *Hungarian Veterinary Journal* in 1992. These studies ceased due to monetary shortage. Feline virology started again in September 1995 with the help of Professor Istvan Nasz, former head of the Institute. We decided to study the effect and possible pathomechanism of viral cofactors in feline AIDS, namely immunosuppressive adenoviruses and interleukins induced by adenoviruses. In contrast to humans and other mammals, no feline adenovirus has been revealed yet. We collected more than 500 cat sera from Hungary (Budapest), UK (Glasgow), Italy (Pisa) and The Netherlands (Utrecht) and analysed them for the presence of antibodies to adenovirus by hexon ELISA and the FIV and FeLV using commercial kits. Two SPF cats immunized with purified hexon of adenovirus human type 1 served as positive controls; their sera showed seropositivity over 1 : 50,000. Clinical specimens from different countries showed 8–20 % seropositivity for adenovirus, which is similar to that found in humans. Studies of groups of cats living in the same environment and sera obtained from cats from the same owner showed a simultaneous and higher incidence of antibodies to adenovirus+FIV or adenovirus+FeLV. In a small group of FIV-positive cats infected experimentally, adenovirus seropositivity was 80 %. It was concluded that closer and longer contact with infected animals might be a factor in promoting adenovirus spread. The route and timing of natural infections by these viruses can be different, but any single infection followed by immunosuppression might predispose animals to the infection with the other type of virus. These results were published in the *Hungarian Veterinary Journal* (September 1996) and have already been presented at two meetings.

Several hundred feline blood and other samples were collected and stored for future studies. Attempts to isolate FIV, FeLV and adenovirus from Hungarian cats have been completed successfully. We should like to use our own isolates in interleukin studies in further co-operation with laboratories in the EC.

During 1995–96, Dr J.F. Szilagyi (Glasgow, UK), Professor S. Specter (Tampa, FL, USA) and Professor H.M. Egberink (Utrecht, The Netherlands) visited our Institute and gave lectures on animal models of AIDS.

ACKNOWLEDGEMENT

I am extremely thankful to the Society for General Microbiology for the grant and to those colleagues mentioned above, who encouraged and helped in the organization of the course and technical background.

Joseph Ongrádi, MD PhD, is a Reader at the Semmelweis University of Medicine, Institute of Microbiology, Budapest, VIII, Nagyvárad tér 4, PO Box 370, Hungary 1445. (Tel. +361 210 2930 ext. 6224/6215; Fax +361 210 2959; Email ongjos@net.sote.hu).

EDINBURGH INTERNATIONAL SCIENCE FESTIVAL AND SGM MEETING COINCIDE!

From astronomy to zoology, the 1997 Science Festival has it covered!

That's the claim being made by the Edinburgh International Science Festival about the 1997 Science Festival, which takes place at venues throughout the city from 22 March to 6 April.

The 1997 talks programme is more exciting and eclectic than ever. Topics under discussion include sex and gender issues, ESP and UFOs, cyclones and earthquakes, road rage, the genetics of cancer and the science of crime. Amongst the many contributors are environmentalist Jonathan Porritt, the Met Office's Heather (the Weather) Reid, Reith lecturer Professor Jean Aitchison and former top Scottish judge Lord Hope, as well as a host of research scientists from universities worldwide.

"We're all very excited about the 1997 programme", explained Science Festival Director Dr Simon Gage. "The programming team has worked very hard to bring together some of the best speakers available and to offer talks and events on topics which people are really concerned about, like health issues, the environment and global security. I'm confident that the 1997 Science Festival will be one of the best ever."

The Science Festival is much more than a programme of talks and conferences. A series of walks and tours, which celebrate women in science, geology and the environment, to name but a few, will take place throughout the city. The Science Book Festival continues to flourish and to attract authors like John Gribbin, Mary Midgely, John Carey and Matt Ridley. The Science Film Festival, launched successfully in 1996, returns on a much larger scale than before.

For the first time ever, children's and family events are being brought together under one roof in the Georgian splendour of Edinburgh's Assembly Rooms. Bigger and better than before, Science Works is offering literally scores of hands-on science activities, workshops and science shows to suit all ages, all tastes and all pockets. Many events are free, others start at £1.00.

For a copy of the Science Festival programme, send 39 pence in stamps to EISF, 149 Rose Street, Edinburgh EH2 4LS.

This year the SGM Spring meeting at Heriot-Watt University coincides with the first week of the Edinburgh Science Festival.

To celebrate this happy coincidence and build on the success of events held in previous years, the Society is putting on a symposium in Old College, chaired by SGM President Tony Trinci, and an extended series of hands-on workshops on molecular biology. These will be run as usual by John Schollar of the National Centre for Biotechnology Education, University of Reading.

Whilst in Edinburgh, delegates to the SGM meeting may wish to attend other events at the Festival. Send for a programme from the above address (Tel. 0131 220 3977) or look at the website on http://www.presence.co.uk/scifest/index.html

SGM SYMPOSIUM:

Infectious Diseases – Advance or Retreat?

1500, Sunday, 23 March 1997
Lecture Theatre 1, Old College, University of Edinburgh

Admission free by ticket only (available on the door or from the Festival Box Office)

A few years ago most people thought that stress or diet were at the root of coronary heart disease, but now it seems that heart attacks can be caused by bacteria. And what about AIDS? Is it true that some individuals cannot catch it? How are researchers tackling the nasty infections caused by the yeast *Candida*? Despite the efforts of microbiologists to find ways of identifying, preventing and curing infectious diseases, the microbes – viruses, bacteria and fungi – will always fight back! This session will look at some recent surprise findings in medical microbiology.

Chairman:	Professor Tony Trinci (University of Manchester)
1500	Introduction *Dr Bernard Dixon*
1540	Do bacteria cause heart attacks? *Professor Michael Ward (Southampton General Hospital)*
1615	*Candida albicans*: the thrush fungus *Professor Graham Gooday (University of Aberdeen)*
1650	Who gets AIDS? *Dr Alan Cann (University of Leicester)*
1725	Discussion
1745	Close

HANDS-ON WORKSHOPS *(Suitable for anyone aged 11 or over)*

Education Centre, Royal Museum of Scotland

Admission £5.00 per person per session by ticket only

Date	10.00 am – 12.30 pm	1.30 pm – 4.30 pm
Wednesday 26 March	Anyone for DNA?	Genetic fingerprinting simulation
Thursday 27 March	Anyone for DNA?	DNA for the Connoisseur *(ends 5.00 pm)*
Friday 28 March	The Case of the Fishy Fish Fingers	Genetic fingerprinting simulation

Children enjoying some 'hands-on' experience during workshops at the 1996 Science Festival under the supervision of John Schollar.

GOLDEN JUBILEE FOR *MICROBIOLOGY*

Jon Saunders

1997 MARKS 50 YEARS of publication for *Microbiology* and, in its previous incarnation, the *Journal of General Microbiology*. Issues of the journal produced in 1997 have a special logo on the cover to mark this jubilee year. The annual design change also brings the cover of *Microbiology* for 1997 back to green, a colour that was traditionally associated with JGM.

The first issue of JGM, published in 1947, reflected a desire of the members of SGM to create a forum for the publication of high-quality research encompassing all aspects of microbiology. Looking back on the first volume, it is perhaps surprising that many pre-occupations of the contributors were the same as those of today. For example, there are papers concerned with differentiation of actinomycetes, amino acid transport, bacterial toxins, micro-manipulation, and biotechnology, including several manuscripts on large-scale antibiotic production from both fungi and bacteria. Reading the papers, one can detect the excitement generated by the rapid development of microbiology as a discipline following the restrictive conditions of the Second World War. The founding authors of Volume 1 of the Journal include names of some resonance in the history of the Society and of microbiology as a subject. They include former SGM Presidents, Marjory Stephenson, Sir Christopher Andrewes, Sir Ashley Miles, D.W. Henderson, P.W. Brian, Ernest Gale and Sir David Evans. Also present are papers by Peter Mitchell and Patricia Clarke (recently elected to Honorary Membership of the Society (see p. 21). Volume 1 is also graced with a paper by Lord Stamp on the preservation of bacteria by freeze-drying. Peers of the realm have been much less forthcoming as authors in more recent years.

JGM originally managed with just two Editors (B.C.J.G. Knight and A.A. Miles) plus seven Associate Editors, and was clearly British-based. Papers in the first volume of JGM were also predominantly by authors from UK institutions. This is in marked contrast to recent issues of *Microbiology*, where overseas contributors are in a large majority. Although the journal has its roots in the SGM, *Microbiology* is now a truly international operation, involving scientific assessment provided by an Editor-in-Chief, seven Editors and an Editorial Board of 86, over 40 % of whom are based overseas. In contrast to the very small, essentially part-time, beginnings of 50 years ago, the monthly production of *Microbiology* now depends on a highly professional team of full-time editorial staff at Reading. They continue to ensure that the journal is a high-quality product and cope with an apparently inexorable increase in submitted manuscripts.

Microbiological research has changed enormously since the birth of *Microbiology*/JGM. Reflecting general trends in biological research, there is now inevitably great emphasis on molecular biological approaches to microbiology. For example, detailed analyses of microbial genomes by experimental and computer methods now occupy microbiologists in a manner unimaginable 50 years ago. Although many microbial pathogens were identified then, few would have predicted the involvement of bacteria in such conditions as gastric ulcers. Our perceptions of the diversity of microbial life and its role in geochemical cycling have also been expanded significantly, perhaps most notably by the discovery of Archaea. Despite the ebb and flow of fashion in such research topics, *Microbiology* will continue to publish papers on any aspect of the discipline, provided they are topical and meet the highest standards of peer review.

Following the relaunch of JGM in 1994 as *Microbiology*, our editorial processes have been greatly streamlined and the journal is now largely edited on screen, giving faster production, whilst maintaining the production values that have always been its hallmark.

What will the next 50 years bring for *Microbiology*? Undoubtedly there will be scientific changes as startling as those experienced since 1947, and these will be reflected in the articles published by the journal. The challenge for both *Microbiology* and its sister *Journal of General Virology* will be to adapt to new methods of electronic publishing whilst maintaining the revenue that has so greatly benefited the finances of SGM. Although *Microbiology* will exist as a paper journal for the foreseeable future, it has moved substantially towards electronic forms of production and publication. The monthly tables of contents, the Guidelines for Authors, and PDF files of review articles are now available on SGM's Web site (http://www.socgenmicrobiol.org.uk). Archival versions of the journal will be made available on CD-ROM if there is a demand; electronic refereeing and on-line delivery of the finished journal articles are likely to be only a short step away.

Jon Saunders, Editor-in-Chief

microbiology SPECIAL CANDIDA ISSUE

THE FEBRUARY 1997 ISSUE of *Microbiology* contains 18 papers on *Candida*, recognizing the rising interest and clinical importance of *C. albicans* and other pathogenic *Candida* species. Numbers of citations of published work on *Candida* are in the top four for all micro-organisms.The content of this issue reflects the gamut of activities that are the main focus of attention for current work on the organism.

MICROBIOLOGY PLAYS A NEW ROLE IN THE STUDY OF MICROBIAL DIVERSITY

Ed Leadbetter

ONE OF THE SOCIETY'S JOURNALS, *Microbiology*, has begun to play a new role in an internationally known, intensive course focused on the comparative biochemistry, ecology, physiology and phylogeny of prokaryotes. The course, Microbial Diversity, now in its 27th year, is conducted each summer at the Marine Biological Laboratory (MBL) in the village of Woods Hole, Massachusetts, USA.

About a year ago one of the course's current Co-Directors, Professor Abigail Salyers (University of Illinois), suggested to the journal's Editors that the 20 graduate students, post-doctoral fellows, and senior scientists who come from many parts of the globe to partake in the Course would find ready access to the journal to be of extraordinary value, and this would broaden exposure for the journal as well. As a result, the Society donated a set of *Microbiology* to the MBL programme for Course use.

As Course Co-Director, I can attest to the intensive use to which the journals were put by the students both as a result of articles to which faculty had called attention in lecture sessions and also in connection with the various individual research projects which engage the students for the last half of the 6.5 week programme. Although the renowned MBL library itself carries a subscription to *Microbiology*, those issues are housed in a different building and thus not as readily usable by individuals who await the completion of an autoclaving session, or who are making a series of kinetic measurements.

Apart from seeing issues of the journal in use by students in the course's small reading room, the Co-Directors saw additional evidence of use by the frequent lack of sequential order of the issues on the shelves and the fact that nearly every number had been opened, flattened, and contained slips of paper marking the beginning, or the references, of one or another article. Several students who had had no, or little, prior exposure to *Microbiology* reported the excitement and interest generated by the scope of articles, reviews, and commentaries they examined.

Developed as a successor to the influential summer course of Professor C. B. van Niel in Pacific Grove, California, the MBL course was initiated by Holger Jannasch, of the neighbouring Woods Hole Oceanographic Institution. In keeping with the MBL tradition of regular changes in courses' leadership after about five years (as a means of keeping them current and timely), Jannasch was succeeded as director by Harlyn Halvorson, then successively by Co-Directors Ralph Wolfe and Peter Greenberg, Martin Dworkin and John Breznak, and now Leadbetter and Salyers (whose appointments end in 1999).

For the first three weeks, only Sundays are holidays that do not have a regimen of morning lectures, followed after lunch by laboratory exercises in which students carry out enrichment cultures for different types of bacteria, and in which use is made of different chromatographic methods, phase-contrast, interference and other types of light microscopy, isolation of nucleic acids from naturally occurring bacterial populations, PCR procedures, and evaluation of identity and phylogenetic relationships.

These microbiological and analytical techniques are put to use in the latter weeks of the course when students attempt to cultivate and characterize some of the microbiota they find in samples collected in the adjacent Eel Pond, the Sippewisset salt marshes, or on cruises along the eastern coast and its many inlets.

In the two most recent summers two UK graduate students, Alison George (then at Cardiff) and Rachael Greedy (Leicester), experienced the unusual nature of the course's activities. Alison described her experiences in the February 1996 issue of the *Quarterly* (23, pp. 11–12).

Of the some 50 applicants to the programme, 20 are accepted and almost all receive financial aid from funds provided by the US Department of Energy, Foundation for Microbiology, Office of Naval Research and MBL sources. Further information, application forms, etc., for admission can be obtained (Email) from admissions@mbl.edu or on the World Wide Web site http://www.mbl.edu

Faculty in residence for the 1997 course will include the Co-Directors, Dr Bruce Paster (Boston) and Dr Kurt Hanselmann (Zurich) as well as about 20 visitors who lecture in the morning series, conduct demonstrations, or take part in the different mini-symposia held on three Saturday mornings.

Professor E.R. Leadbetter is a Member of the Editorial Board of Microbiology and can be contacted at Molecular & Cell Biology U-131, University of Connecticut, 354 Mansfield Road, Storrs, CT 06269-2131 (Tel. +1 860 486 5398; Fax +1 860 486 1936; Email erl@uconnvm.uconn.edu).

The Molecular Biology and Pathogenesis of the Clostridia (2nd International Conference)

Seillac, France, 22–25 June 1997

Contact: Dr Rick Titball, CBDE, Porton Down, Salisbury, Wiltshire, UK, SP4 0JQ (Tel. +44 1 980 613301; Fax +44 1 980 613302; Email 100655.2360@compuserve.com; WWW http://www.microbiology.uokhsc.edu/clospath97/Clospath.html)

Cells & Cell Surfaces

Heriot-Watt, 24–27 March 1997

The Group will be holding a two-day symposium on *Microbial Cell Wall Biosynthesis and Regulation*, full details of which can be found in the accompanying Programme Booklet.

Southampton, 1–5 September 1997

The Group is a sponsor of the Main Symposium entitled *Checkpoints and Non-linear Dependency Relationships*. An exciting list of speakers has been invited.

Bradford, 6–8 January 1998

The Group will be holding a one-day symposium jointly with the MI Group provisionally entitled *Anaerobes*. Further details will appear in the next issue of the *Quarterly*.

Future Meetings

The Group is planning a number of symposia which include the following provisional titles: *Microbial–Host Interactions at Mucosal Surfaces*, *Membrane Transporters and Antimicrobial Resistance*, *Intracellular Pathogens* and *Programmed Cell Death, Autolysis and Senescence*. Members are welcome to contribute to the planning of any of these symposia.

Convener:
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Clinical Virology

Heriot-Watt, 24–27 March 1997

The Group symposium at this meeting is *Viral Disease in the Immunocompromised Host*. Full details are given in the accompanying Programme Booklet. This symposium is complementary to the Main Symposium and the Virus Group symposium which are both dedicated to host–pathogen interactions.

Future Meetings

The Group Committee has planned a lively programme of scientific symposia up to the next millennium. Much is being written about the importance of evidence-based medicine these days and it is essential that the practice of clinical virology should have a firm scientific basis. There is no better means of securing this than to participate in the symposia and other activities of the SGM. Please continue your support, therefore, even in these times of heavy routine and managerial commitments, and encourage your colleagues to join the Society. To promote more discussion of clinical practice at future meetings of the CV Group, it is proposed to begin a series of workshops on problems in clinical and public health virology. It is intended that these will raise current awareness of research developments and place them in the context of routine laboratory practice. The Committee looks forward to your support at these workshops.

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

Heriot-Watt, 24–27 March 1997

The Group's symposium at this meeting will be *Learning Technology* organized by Mike Tait (RGU, Aberdeen; m.i.tait@abdn.ac.uk). The half-day symposium will be followed by a hands-on workshop allowing participants to try out many of the computer-based teaching methods. Topics to be covered in the symposium are Mixed media in microbiology teaching; Interactive computer-based learning in microbiology: computers are not books!; WWW and Internet resources for microbiology teaching and research; Computer-based assessment; and The future of learning technology in microbiology.

Southampton, 1–5 September 1997

The Group will hold a Symposium on *Microbial Informatics: Data Acquisition, Management and Exploitation*. This is being organized by Peter Miller from Liverpool University and will include research, undergraduate and postgraduate teaching, and scholarship aspects of microbial informatics. In addition to Peter Miller speaking on Teaching and learning microbial informatics, other talks include Jim Prosser (Aberdeen), Modelling microbial ecosystems; Trevor Bryant (Southampton), Microbial taxonomy; Lynne Boddy (Cardiff), Neural networks and microbial identification; Pedro Mendes (Aberystwyth), Modelling metabolism; Tom Flores (EBI, Hinxton), Sequence databases and Duncan McGarva (SGM HQ), Electronic libraries and publishing. This promises to be an exciting meeting and should be attended by anyone with an interest in exploiting to the full the potential of computing in microbiology.

Convener:
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Email j.c.bunker@open.ac.uk

Nottingham, 30 March–3 April 1998

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

East Anglia, September 1998

The Group will hold a symposium on *Teaching Microbial and Molecular Genetics*, organized by Alan Jacobs (Manchester Metropolitan). It is hoped this will be a joint meeting with the Genetical Society.

Committee Membership

We welcome Helen O'Sullivan (Liverpool Hope) to the first Committee meeting since the recent elections. Liz Sockett was also elected and is also on the PB&MG Committee, so will have a very busy time on SGM duties!

The Committee extends its warmest congratulations to our Group Convener, Janet Bunker, and her husband on the recent birth of a son, Jonathan Mark.

Peter Wyn-Jones
School of Health Sciences, University of Sunderland

Environmental Microbiology

Heriot-Watt, 24–27 March 1997

The Group's joint symposium with the S&E Group at this meeting is on *Microbiology of the Gut*. Full details of the programme can be found in the accompanying Programme Booklet.

Southampton, 1–5 September 1997

The group will be holding a one-day meeting on *Waste Treatment*. Topics include: Composting and landfill, Tertiary treatment of sewage effluent, Farm wastes put to land, Microbially produced volatile organic compounds from waste, Phosphate stripping. The Group's organizer is Dr Keith Jones (Lancaster). There will be an opportunity to present papers; postgraduate students are particularly encouraged. If interested please contact the Convener or a committee member.

Future Meetings

The Group is currently planning two further meetings. (i) A two-day meeting on the *Ecophysiology of Microbial Pigments* (with an emphasis on protection) for the Spring 1998 meeting at the University of Nottingham. The Group's organizer is Dr David Wynn-Williams (British Antarctic Survey). (ii) A meeting on *Biosensors* for the Autumn 1998 meeting. We would be pleased to include your ideas at the next Committee meeting.

Convener:
Dr Hilary M. Lappin-Scott
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Fermentation & Bioprocessing

Heriot-Watt, 24–27 March 1997

The group will be holding a one-day symposium on *Yeasts as Recombinant DNA Hosts*, organized on behalf of the Group by Nigel Woods. The objective of the meeting will be to review the current position of a wide range of yeasts used for the production of protein products. Full details can be found in the accompanying Programme Booklet.

Bradford, 6–8 January 1998

In collaboration with the S&E Group we are planning a two-day symposium on *Screening for New Therapeutic Agents*. The symposium will include intercalated papers and will seek to address current approaches to natural product screening for novel biopharmaceutical discovery. We are also hoping to hold an evening debating session on *Natural Products versus Combinatorial Chemistry*. More details will appear in future issues of the *Quarterly*.

Future Meetings

The Group is currently in the process of planning two future meetings: *Towards the Ideal E. coli Expression System: Meeting the Needs of Fermentation and Downstream Processing* and *Mycelial Fermentations*.

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:
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Email r.england@uclan.ac.uk

Irish Branch

Joint Meeting with The Irish Diagnostic Virology Group: Marino Institute of Education, Dublin 16 May 1997

The meeting will encompass a wide range of virological topics. Invited speakers include J. Whitby (Addlestone, UK), Rabies – an update; and M. Zuckerman (Dulwich, UK), Molecular virological investigations of Hepatitis B transmission in a variety of clinical settings. Oral and poster communications are invited. For further information and registration, contact Dorothy Wyatt, Regional Virus Laboratory, Queen's University of Belfast, Royal Victoria Hospital, Grosvenor Road, Belfast BT12 6BN. (Tel. +44 1232 240503; Fax +44 1232 439181; Email D.Wyatt@qub.ac.uk).

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), The Chemical and biochemical degradation of PCBs; 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
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Microbial Infection

Heriot-Watt, 24–27 March 1997

A symposium on *Environmental Regulation of Virulence Gene Expression*, jointly organized with the PB&MG Group will be held at this meeting. The organizer for the MI Group is Dr Brendan Wren (St Bartholomew's Hospital, London). Offered papers and posters presented by postgraduate students will be judged at this meeting for Promega Prizes. Full details of the invited speakers and the offered papers can be found in the accompanying Programme Booklet.

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 (London), C. Raetz (USA), C. Whitfield (Canada), C. Hughes (Cambridge), E. Vimr (USA), E.R. Moxon (Oxford), J. Guard-Petter (USA), J. Kroll (London) and M. Frosch (Germany). 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 meeting on *Pathogenicity and Chemotherapy of Anaerobe Infections* is being jointly organized with the C&CS Group. Our organizer is Ian Poxton (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.

Nottingham, 30 March–3 April 1998

A two-day symposium on *Microbial Pathogens and Iron*, organized by Paul Williams (Nottingham) and Julian Ketley (Leicester) is planned.

Future Meetings

Suggestions for topics for future meetings are welcomed. Please contact the Convener or any Committee member. Some topics under consideration are *Respiratory Pathogens* and *Current Trends in Vaccine Design*.

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

Heriot-Watt, 24–27 March 1997

The group will hold a joint symposium with the MI Group on *Environmental Regulation of Virulence Gene Expression* which will appropriately complement the Society's Main Symposium *Molecular Aspects of Host–Pathogen Interactions*. Full details can be found in the accompanying Programme Booklet.

Southampton, 1–5 September 1997

The Group will hold a joint symposium with the MI Group provisionally entitled *Polysaccharides*. The Group's co-organizer is Dr Colin Hughes (Cambridge). Speakers and topics will include: A. Dell, Introduction to polysaccharides/structural determinations; C. Whitfield (Canada), Expression of lipopolysaccharide virulence determinants in pathogenic *E. coli*; C. Hughes (Cambridge), The action of RfaH/ops, a global regulator for polysaccharide synthesis; E. Vimr (USA), Thermoregulation of capsular polysialic acid synthesis in *E. coli*; E.R. Moxon (Oxford), Role of LPS in infection by non-enteric bacteria; J. Guard-Petter (USA), Polysaccharides and surface variations of *Salmonella enteritidis*; J.S. Kroll (London), Role of capsular polysaccharides in bacterial infections; and M. Frosch (Germany), Variable expression of capsule and LPS and role in infection. The invited papers will be interspersed with offered contributions. Those interested should contact one of the co-organizers, Dr Colin Hughes for the PB&MG Group as noted above, or Dr Duncan Maskell (Imperial College) for the MI Group.

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 Committee.

Convener:
Professor Simon Baumberg
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Email gen6sb@south-01.novell.leeds.ac.uk

Systematics & Evolution

Heriot-Watt, 24–27 March 1997

The Group is holding a two-day joint symposium with the EM Group on *Microbiology of the Gut* during this meeting. Full details are given in the accompanying Programme Booklet.

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*. If you would like to offer a poster on a topic relevant to this theme, then please forward your proposal, with a title and draft abstract, to the Convener as soon as possible, but **before October 1997**. In addition, along with the F&B 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 (p. 35).

Nottingham, 30 March–3 April 1998

We are planning a collaborative symposium in Spring 1998 on *Advances in Fungal Systematics* with the British Mycological Society. If you can offer a paper 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**.

Future Meetings

The Group is also planning to hold a collaborative meeting with the MI and CV Groups during 1999 on the subject of *Respiratory Pathogens*.

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

Virus

Heriot-Watt, 24–27 March 1997

The Main Symposium at this meeting, *Molecular Aspects of Host–Pathogen Interactions*, was originally suggested by the Group and it will contain several virus-orientated presentations. To complement the Main Symposium there will be a Group-sponsored symposium entitled *Virus–Host Protein–Protein Interactions in Virus Replication*. There will also be open papers sessions and evening workshops at this meeting. Full details are given in the accompanying Programme Booklet.

Southampton, 1–5 September 1997

The Virus Group will host the 2nd European Meeting of Virology to run contiguously with the normal autumn meeting of the Society. Further details of this meeting will appear in the next issue of the *Quarterly*.

Future Meetings

The Convener is always keen to hear from interested members with ideas they might have for topics for future symposia or workshops, etc. These ideas can be made directly to the Convener or through any of the current Committee members.

Convener:
Professor Malcolm A. McCrae
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Elections to Group Committees 1997

At the AGM of the Society held in September 1994, the Rule concerning elections to Group Committees was altered to allow for a postal ballot, so that more members would be able to participate. Below are listed the current Group Committees and the numbers of vacancies this year. Nominations to fill these vacancies are now invited. In making nominations, members are particularly asked to bear in mind the desirability of a breadth of scientific interest on each committee.

Nominations, including the general area of interest of the nominee, should be sent to reach the appropriate Group Convener **no later than 21 April 1997.**

Cells & Cell Surfaces — (Three Vacancies)

A.E. Wheals (C)	Univ. Bath	Yeast cell biology and genetics
J.K. Broome-Smith	Univ. Sussex	Bacterial membrane transport
A. M. Carr	Univ. Sussex	DNA repair, yeast checkpoints
M. Egerton	Zeneca Pharmaceuticals	Antifungals
H.F. Jenkinson	Univ. Otago, New Zealand	Cell adhesion, yeast/bacterial transporters
A.W.B. Johnston*	Univ. East Anglia	*Rhizobium* root nodulation
L.J.V. Piddock*	Univ. Birmingham	Resistance mechanisms; action of quinolones
K.A. Smart	Oxford Brookes Univ.	Physiology of brewing yeasts
I.C. Sutcliffe	Univ. Sunderland	Bacterial cell wall composition
M. Wilson	Eastman Dental Inst. London	Oral biofilms, antimicrobials and cytokine induction
U. Desselberger (CR)	Addenbrooke's, Cambridge	

Clinical Virology — (Three Vacancies)

P.P. Mortimer (C)	CPHL, London	Hepatitis/HIV
J.M. Best*	St Thomas's Hospital, London	Congenital infections
E.H. Boxall	Regional Virus Laboratory, Birmingham	Perinatal transmission, vaccination, hepatitis B
W.L. Irving	University Hospital, Nottingham	Hepatitis, viral immunology
J.B. Kurtz*	John Radcliffe Hospital, Oxford	Transplantation
E.A.B. McCruden	Western Infirmary, Glasgow	Diagnostic virology, hepatitis C
P. Morgan-Capner*	Royal Preston Hospital, Preston	Serological diagnosis, seroepidemiology
T.G. Wreghitt	Addenbrooke's Hospital, Cambridge	Transplantation
G.B. Clements (CR)	Regional Virus Laboratory Glasgow	

Education — (Two Vacancies)

J.C. Bunker (C)	Open University	Adult education, IT, women in science
A.E. Jacob	Univ. Manchester	Bacterial molecular genetics
P.G. Miller*	Univ. Liverpool	IT and teaching quality
H.M. O'Sullivan	Liverpool Hope Univ. College	Innovations in teaching, work-based learning
R.E. Sockett	Univ. Nottingham	Skills teaching for graduates, large class teaching
M.I. Tait*	Univ. Aberdeen	Computer-aided learning
E. Williams	Univ. Newcastle	Biodiversity, microbiology in schools
P. Wyn-Jones	Univ. Sunderland	Health-related water virology
J.C. Fry (CR)	Univ. Wales, Cardiff	

Environmental Microbiology — (One Vacancy)

H.M. Lappin-Scott (C)	Univ. Exeter	Biofilms and starvation survival
C.D. Clegg	Scottish Crops Research Institute, Invergowrie	Soil microbial ecology
J.C. Fry*	Univ. Wales, Cardiff	Genetically modified bacteria
R.J. Parkes	Univ. Bristol	Sediment and subsurface microbiology
D. Wynn-Williams	BAS, Cambridge	Bacterial survival at low temperatures
K. Jones	Univ. Lancaster	Survival of pathogens and biofilms
T. Kearney	BNFL, Preston	Biodegradation of xenobiotics
M. Bailey	IVEM, Oxford	Plant/soil/microbial interactions
L.A. Glover (CR)	Univ. Aberdeen	

Fermentation and Bioprocessing — (Two Vacancies)

R.R. England (C)	Univ. Central Lancashire	Bacterial physiology and signalling
M.E. Bushell*	Univ. Surrey	Streptomycete physiology
C.J.L. Gershater	SmithKline Beecham	Applied microbial physiology, computer control
R.A. Herbert	Univ. Dundee	Extremophiles, fungal fermentations, fatty acids
G. Hobbs	Liverpool John Moores Univ.	Fungal and actinomycete physiology and biochemistry
B. Kara	Zeneca Pharmaceuticals	Microbial physiology of yeasts and *E. coli*
D. Langley	Glaxo Wellcome	Microbial secondary metabolism
N.R. Woods*	British Biotech Pharmaceuticals	Recombinant fermentations
F.G. Priest (CR)	Heriot-Watt Univ.	

(C) Convener (CR) Council Representative *Retiring 1997

Irish Branch — (Two Vacancies)

M.A. Collins (C)	Queen's Univ. Belfast	Food microbiology
C.C. Adley	Univ. Limerick	Antibiotic resistance, bioremediation
T.G. Barry	Univ. College, Galway	Molecular microbiology
L. Cosby	Queen's Univ. Belfast	Morbiliviruses
R. Kelly*	Univ. College, Dublin	Microbial fermentation
G. McMullan	Univ. Ulster, Coleraine	Bioremediation
K.H. Mills*	Maynooth College, Kildare	Immunology
D. Todd	DANI Veterinary Sci. Div. Belfast	Veterinary virology/molecular virology
C.W. Penn (CR)	Univ. Birmingham	

Microbial Infection — (Two Vacancies)

P.W. Andrew (C)	Univ. Leicester	Pathogenicity: *Listeria, Mycobacterium, Strep. pneumoniae*
J.G. Coote*	Univ. Glasgow	Gene expression, virulence factors
D.J. Maskell*	Imperial College, London	Molecular genetics of surface polysaccharide biosynthesis
T.J. Mitchell	Univ. Leicester	Bacterial pathogenicity, virulence, transgenes, *Streptococcus*
P.C.F. Oyston	CBDE, Porton Down	Bacterial pathogenicity, *Yersinia*, vaccines
I.R. Poxton	Univ. Edinburgh	Bacterial pathogenesis, lipopolysaccharide, anaerobes, *Clostridium*
P. Williams	Univ. Nottingham	Iron transport, Quorum sensing, membrane proteins, cell envelopes
B.W. Wren	St Bartholomew's Hospital, London	Regulation of virulence determinants, bacterial toxins
C.E. Hormaeche (CR)	Univ. Newcastle	

Physiology, Biochemistry & Molecular Genetics — (Five Vacancies)

S. Baumberg (C)*	Univ. Leeds	Bacterial genetics, control of metabolism
S.J. Assinder	Univ. Wales, Bangor	Xenobiotic degradation, plant pathogenic fungi
M.X. Caddick*	Univ. Liverpool	Fungal genetics
D. Haas	Univ. Lausanne	Soil bacteria-plant interactions
I.S. Hunter*	Univ. Strathclyde	*Streptomyces* genetics, antibiotics
G.P.C. Salmond	Univ. Cambridge	Density dependent gene expression, autoinducers
R.E. Sockett	Univ. Nottingham	Bacterial mobility, *Rhodobacter*
G.S.A. Stewart*	Univ. Nottingham	Bacterial physiology/genetics/ ecology
F.B. Ward	Univ. Edinburgh	Biochemistry/genetics of cytochromes, esp. *Pseudomonas*
H.D. Williams*	Imperial College, London	Bacterial physiology, esp. redox phenomena
A.P. Wood	King's College, London	Microbial physiology, biochemistry and ecology, esp. chemolithoautotrophs
D.A. Hodgson (CR)	Univ. Warwick	

Systematics & Evolution — (Two Vacancies)

G. Alderson (C)	Univ. Bradford	Numerical, molecular & chemosystematics of medical/industrial bacteria
J. Brown*	Univ. Warwick	Culture collections, education
D.E. Buckley	SmithKline Beecham, Epsom	Microbial metabolites, pathogenicity, systematics
M. Goodfellow	Univ. Newcastle	Systematics and biotechnology, actinomycetes
W.D. Grant	Univ. Leicester	Microbes from hypersaline and alkaline environments
N.A. Logan	Glasgow Caledonian Univ.	*Bacillus* systematics, polyphasic taxonomy, identification
J. Stanley	CPHL, London	Evolutionary genetics and molecular epidemiology
B.A. Unsworth*	Metropolitan Univ. Leeds	Systematics/biotechnology, identification, education
D.McL. Roberts (CR)	Natural History Museum	

Virus — (Four Vacancies)

M.A. McCrae (C)	Univ. Warwick	dsRNA viruses
J.C. Bridger	Royal Veterinary College, London	Rotaviruses
L. Cosby	Queen's Univ. Belfast	Paramyxoviruses
I.M. Jones*	Univ. Oxford	Immunodeficiency viruses
G.P. Lomonossoff	John Innes Centre, Norwich	Plant viruses
J. McCauley	IAH, Compton	Influenza virus
V. Mautner*	Univ. Glasgow	Adenoviruses
P. O'Hare*	Oxted	Herpesviruses
G.L. Smith	William Dunn School of Pathology, Oxford	Poxviruses
C. Sweet	Univ. Birmingham	Viral pathogenesis
N.D. Stow (CR)	Inst. of Virology, Glasgow	

Book Reviews

Essentials of the Microbiology of Foods. A Textbook for Advanced Studies

By D.A.A. Mossel, J.E.L. Corry, C.B. Struijk & R.M. Baird.
Published by John Wiley & Sons Ltd (1995).

£75.00 *pp. 699* *ISBN: 0-471-93036-9*

Not just another tome on food microbiology, but a heavyweight volume considering the topic from an ecological standpoint. This has long been the platform of the senior author and certainly merits a wider consideration. Parts of the presentation seem familiar, having already appeared elsewhere, but the strength of this book lies in the coherent assembly of an awesome quantity of information, often from quite obscure sources, into a comprehensive, well-indexed treatise, making it a highly recommendable library purchase.

Martin A. Collins, Belfast

Modulation of MHC Antigen Expression and Disease

Edited by G.E. Blair, C.R. Pringle & D.J. Maudsley.
Published by Cambridge University Press (1995).

£50.00/US$79.95 *pp. 440* *ISBN: 0-521-49578-4*

Since the initial discoveries of 'transplantation antigens' and 'immune response genes' to the elucidation of their molecular structure, the study of the major histocompatibility complex (MHC) antigens and their cell-surface expression has made a major contribution to our understanding of cellular immune responses and susceptibility to a variety of diseases. This book deals specifically with modulation of MHC antigen expression by a range of factors, including viruses, bacteria and cytokines. Although too specialized to appeal to a wide audience, it should be particularly valuable to those interested in host–pathogen interaction in immunity to viral diseases.

Kingston H.G. Mills, St Patrick's College, Maynooth

Transacting Functions of Human Retroviruses

Edited by I.S.Y. Chen, H. Koprowski, A. Srinivasan & P.K. Vogt.
Published by Springer-Verlag GmbH & Co. KG (1995).

DM177.00/öS1,380.60/sFr167.00
pp. 239 *ISBN: 3-540-57901-X*

This book covers all aspects of transacting factors, not only protein : nucleic acid interactions but also protein : protein interactions and includes chapters on all three known human exogenous retrovirus families. Whilst HTLV-1 and the spumaviruses are dealt with as a whole, HIV is broken down into its individual polypeptides. An overview of how these HIV proteins work to regulate HIV would have been extremely useful to the general reader. This aside, it is a useful review and would be a good addition to a library although those in the immediate field may want a personal copy.

Bob Dalziel University of Edinburgh

The Infectious Diseases Manual

By D. Wilks, M. Farrington & D. Rubenstein.
Published by Blackwell Science Ltd (1995).

£16.95 *pp. 347* *ISBN: 0-86542-844-1*

It is compact, the large amount of information is highly condensed, though readily accessible (well-indexed and cross-referenced), and it is largely accurate but with some minor errors. The target group is harder to define. Junior medical staff, laboratory staff and teachers of academic medical microbiology (the wealth of detail will provide the latter with useful clinical perspective). Doubtful as an undergraduate microbiological text, lacking microbiological coverage in several areas. Therapeutic recommendations are detailed and generally good. However, some may date rapidly and be in conflict with individual prescribers and local antibiotic policies. Overall, good value at personal and institutional level. One criticism: the figures are poor.

David J. Platt, Glasgow Royal Infirmary

Signal Transduction Protocols. Methods in Molecular Biology, Vol. 41.

Edited by D.A. Kendall & S.J. Hill.
Published by Humana Press (1995).

US$64.50 *pp. 320* *ISBN: 0-89603-298-1*

This laboratory manual aims to provide recipe-type experimental protocols useful to those investigating the biochemistry of eukaryotic receptor-mediated cell signalling with a specific bias towards the G-protein-linked superfamily. It consists of 24 chapters ranging from an overview of classical radioligand binding assays and the assay of G-protein function to techniques for measuring nitric oxide production. Although written largely by and for pharmacologists and physiologists wishing to investigate signal transduction processes at the molecular level, this book is likely to find its way into the laboratories of microbiologists with an interest in host–pathogen and host–toxin interactions. Given the recent emergence of 'cellular microbiology' as a discipline occupying the niche between traditional cell biology and microbiology, this relatively inexpensive manual could prove to be an excellent investment.

Paul Williams, University of Nottingham

Cap-Independent Translation: Current Topics in Microbiology & Immunology, Vol. 203

Edited by Peter Sarnow.
Published by Springer-Verlag GmbH & Co. KG (1995).

DM165.00/öS1,204.50/sFr156.00
pp. 183 *ISBN: 3-540-59121-4*

The authoritative reviews contained in this timely yet slim volume focus, quite rightly, on the three well-studied examples of viruses – EMCV, poliovirus and hepatitis C – that are able to by-pass the normal cap-dependent mechanism of their hosts' translational machinery. Several of the authors reiterate the *in vitro* and *in vivo* criteria by which a cap-independent mechanism is functionally defined, a critical issue for workers in the field. Although the examples of cap-independent translation of cellular mRNAs are few, this is nevertheless an important volume for molecular biologists and virologists interested in post-transcriptional gene regulatory mechanisms.

Mick F. Tuite, University of Kent

Molecular Biology. Current Innovations and Future Trends, Parts 1 & 2. Current Innovations in Molecular Biology Series, Vols 1 & 2

Edited by A.M. Griffin & H.G. Griffin.
Published by Horizon Scientific Press (1995).

£19.99/US$32.50 each *pp. 165 & 176, respectively*
ISBN: 1-898486-01-8 (Part1); 1-898486-03-4 (Part 2)

These books are a valuable resource for the experienced researcher who wishes to try a new technique or learn more about a familiar one. Each chapter takes a particular technology and examines the theory behind it. There are then notes on practical details and some suggested protocols and product recommendations. The chapters finish with a comprehensive and useful literature review. By themselves, they would not enable a newcomer to the field to start work in the lab, although they would be useful additional reading. They do, however, provide short, readable and informative introductions to many basic and new molecular biology methods.

Helen O'Sullivan, Liverpool Hope University College

Book Reviews

Discovering Molecular Genetics. A Case Study Course with Problems & Scenarios

By Jeffrey H. Miller.
Published by Cold Spring Harbor Laboratory Press (1995).
US$59.00 *pp. 672* *ISBN: 0-87969-475-0*

What a marvellous book! It has several aims and succeeds in them all. Firstly, it sets out to illustrate the beauty and elegance of the work of the pioneering molecular geneticists and of the following generation they inspired. This is achieved by the presentation of a rich collection of their papers together with an introduction to each that gives insight into the way in which experiments were conceived and ideas developed. This also fulfils the second aim, that of stimulating students to study and learn from their work. As a guide, questions are presented that address the salient features of each paper. Answers are given in the last section of the book, which also contains questions of a far more probing nature and a series of challenging scenario problems that will probably require the collective minds of a study group to answer. Finally, it pays homage to the founders of molecular genetics. In a series of potted biographies their work and, often quite extraordinary personal lives are illustrated as an inspiration to us all. The book is a good read for all those interested in the development of molecular genetics and an essential buy for teachers of the subject. It would be an excellent main text for MSc taught courses and for final year undergraduate courses in which the subject is taught by engendering an understanding of scientific concepts and their analysis. For undergraduate courses in which didactic teaching predominates, it would be a powerful supplementary text upon which tutorial work could be based. Libraries should be urged to acquire at least one copy.

Alan Jacob, University of Manchester

Encyclopedia of Virology, Vols 1, 2 & 3

Edited by R.G. Webster & A. Granoff.
Published by Academic Press Ltd (1994).
£250.00 *pp. 3184* *ISBN: 0-12-226960-8*

At more than 2,000 pages and with contributions from over 270 authors, this text aims to provide a reference source for the full range of viruses. With so many contributors there is inevitably some variation in the balance and consistency, but nevertheless, with just two editors the production of this work must be considered as a remarkable organizational achievement. It does fill gaps which *Fields Virology* (see review on p. 42), with its emphasis on viruses of medical importance, had left out in the coverage of viruses and in doing so will provide a useful addition to large reference libraries.

Malcolm McCrae, University of Warwick

The Plant Viruses, Vol. 5: Polyhedral Virions and Bipartite RNA Genomes

Edited by B.D. Harrison & A.F. Murant. Part of the series 'The Viruses', edited by H. Fraenkel-Conrat & R.R. Wagner.
Published by Plenum Publishing Corporation (1996).
US$95.00 *pp. 362* *ISBN: 0-306-45225-1*

Six interesting, diverse and in many cases important genera of plant viruses (*Comovirus*, *Dianthovirus*, *Enamovirus*, *Fabavirus*, *Idaeovirus* and *Nepovirus*) have single-stranded, positive-sense bipartite RNA genomes and isometric virions. The treatment in this volume is very up-to-date. In 13 chapters, leading workers in the field provide a comprehensive coverage of virus identification and diseases caused, genome structure expression and replication, transmission, epidemiology and control. The book should prove invaluable to researchers working with these viruses, especially in providing an accessible overview of near and not-so-near neighbours. But there is sadly no answer to the intriguing question of what advantages, if any, underlay the repeated evolution of this type of genome structure.

Ron Fraser, SGM Marlborough House

Recombinant Vectors in Vaccine Development

Edited by Fred Brown.
Published by S. Karger AG, Basel (1994).
sFr250.00/DM299.00/US$200.00
pp. 280 *ISBN: 3-8055-5997-6*

This volume contains the proceedings of a meeting on this subject held in Albany, USA, in 1993. The first article is the Keynote address given by Max Hilleman which gives an excellent short overview of the use of recombinant vectors in the vaccine area. This is followed by articles covering the use of a range of bacterial and viral vectors. These give very good insights into the state of the field at the time that the meeting was held, but, as is inevitable in any fast-moving field such as this, the contents date very rapidly.

Malcolm McCrae, University of Warwick

Bacterial Systematics

By Niall A. Logan.
Published by Blackwell Scientific Publications (1994).
£18.95 *pp. 263* *ISBN: 0-632-03775-X*

Even allowing for the exciting developments in molecular systematics, phylogeny and biodiversity, bacterial systematics remains a challenging subject that many students find difficult. Niall Logan has produced a text on the subject that is readable and accessible, whilst remaining academically sound and scientifically critical. It comprises an introduction, four chapters covering methodologies for classification and identification along with nine chapters on the main prokaryotic groups. The text is well illustrated and there is a valuable list of further reading. As always, one could pick holes – a clear definition of systematics in an easily found glossary of terms would have been useful – but this remains a good and reasonably priced addition to the subject.

Grace Alderson, University of Bradford

DNA Tumor Viruses: Oncogenic Mechanisms. Infectious Agents and Pathogenesis Series

Edited by Giuseppe Barbanti-Brodano, Mauro Bendinelli & Herman Friedman.
Published by Plenum Publishing Corporation (1995).
US$95.00 *pp. 428* *ISBN: 0-306-45151-4*

The 21 chapters comprising this volume deal with 14 or so viruses, highlighting the molecular mechanisms by which these diverse agents disrupt cellular growth control. Additional breadth is provided by descriptions of viruses in animal cancers, their possible roles in human malignancies and prospects of vaccination for prevention and control. The individual chapters are generally well written and up-to-date, and together provide a reasonable, but not necessarily complete coverage of the field. There will be much to interest any DNA tumour virologist and the wide-ranging approach should stimulate the bridge laying between experimentalists and clinicians that is a stated aim of the series.

Nigel Stow, MRC Virology Unit, Glasgow

Book Reviews

Microbial Physiology. Third Edition

By Albert G. Moat & John W. Foster.
Published by John Wiley & Sons Ltd (1995).

£100.00 *pp. 580* *ISBN: 0-471-01295-5*

This is a reorganized and updated version of this well-known text with a significantly expanded section on the regulation of gene expression. As a textbook it has a concentrated academic style and a rather dour appearance, lacking the coloured plates and easy access of modern introductory texts, but contains significantly more detail, bridging the gap between these basic texts and the reviewing serials and journals hopefully used as source material by honours students. As a recommended text it is probably too expensive for most students but should be held by all libraries catering for degree-level students of microbiology.

David Ware, NESCOT, Ewell, Surrey

Fumonisins in Food. Advances in Experimental Medicine and Biology, Vol. 392

Edited by Lauren S. Jackson, Jonathan W. DeVries & Lloyd B. Bullerman.
Published by Plenum Publishing Corporation (1996).

US$110.00 *pp. 399* *ISBN: 0-306-45216-2*

The editors have succeeded in producing a fairly comprehensive volume of current (to April 1995) research on these relatively newly discovered (in 1988), worldwide contaminants of maize (corn). The contents are the proceedings of an American Chemical Society symposium, so there is unavoidably some repetition in the 33 papers. However, this is a minor criticism and the book contains a wealth of information (especially on risk-assessment and tolerance levels for various animal species) which is easily accessed via a short but excellent index. The book is aimed at specialists with an interest in mycotoxins. However, the price will exclude many of them (i.e. in developing countries) from benefiting from it.

Victor F.P. Medlock, Onsite Training, Maidstone

Pulmonary Infections and Immunity

Edited by H. Chmel, M. Bendinelli & H. Friedman.
Published by Plenum Publishing Corporation (1994).

US$85.00 *pp. 355* *ISBN: 0-306-44609-X*

The book begins well with a chapter on respiratory defence mechanisms and uses an organism-based approach. However, it was mystifying as to why some minor pathogens are included and other major ones were not, e.g. *Paracoccidiomycosis brasiliensis* merits a whole chapter, whereas *Pneumocystis carinii* and Respiratory Syncytial virus are omitted. The chapter on Varicella Zoster virus offers no insights on Varicella as a respiratory pathogen and scarcely mentions respiratory complications. The text is neither comprehensive enough to provide an overview of important respiratory pathogens, nor useful in providing updates on selected conditions. It is probably best aimed at clinicians who require some background on selected pathogens.

Maria Zambon, CPHL, London

Virus Separation and Purification Methods

Edited by Alfred Polson.
Published by Marcel Dekker Inc (1993).

US$99.75 *pp. 312* *ISBN: 0-8247-9149-5*

This book is a self-edited collection based on the work of Alfred Polson. The volume is divided into two main sections. The first deals with the basic methodology of the various techniques developed by Polson, the best known of which is that of polyethylene glycol precipitation. The second section addresses the purification of specific viruses, the major emphasis being on poliovirus and influenza. Dr Polson reached retirement age in 1975 and this volume gives some good historical insights into the development of some virus purification methodologies but is not a source book for virus purification methods.

Malcolm McCrae, University of Warwick

Obstetric and Gynecologic Infectious Disease

Edited by J.G. Pastorek II.
Published by Raven Press (1993).

US$157.50 *pp. 824* *ISBN: 0-7817-0023-X*

This volume is an archetypal American clinical infectious diseases textbook. Some 70 academic obstetricians, gynaecologists and paediatricians combine to provide detailed overviews of the anatomy, immunology and microbiology of the female genital tract, plus some 50 chapters on specific infections. This section will be invaluable to all clinicians and microbiologists involved in the management of such patients. For the research microbiologists working on STDs, cervical cancer, peri-partum infections, etc., the text provides ideal background reading. Less useful to researchers are the mini-reviews of microbial virulence and immunopathology which start each chapter. These tend to be stereotyped, deficient in both molecular detail and originality.

Peter Watt, University of Southampton

Medical Virology. A Practical Approach. Practical Approach Series, Vol. 147

Edited by U. Desselberger.
Published by IRL Press at Oxford University Press (1995).

£25.00 *pp. 214* *ISBN: 0-19-963329-0*

The book is concise and well written. It brings together considerable experience in the field. Chapters on modern approaches to diagnostic methods are counter-balanced by a chapter on traditional methods. Generally the theory behind the various methods is explained and each chapter is appropriately referenced. The book is packed with protocols which have been tried and tested in the authors' laboratories. Applications and troubleshooting sections are included where appropriate. I can recommend it as a useful volume for practising virologists, particularly for those involved in research and development. Some chapters may also be useful for scientists in other disciplines.

Hugh O'Neill, Regional Virus Laboratory, Belfast

Haemophilus, Actinobacillus and *Pasteurella*

Edited by W. Donachie, F.A. Lainson & J.C. Hodgson.
Published by Plenum Publishing Corporation (1995).

US$85.00 *pp. 245* *ISBN: 0-306-45104-2*

This book reports the Proceedings of the HAP94 Conference, Edinburgh, Summer 1994. The papers in the book generally attain a high standard of content and presentation and are highly informative. As with many conference reports, the book is already a little out of date, especially given the rapid progress being made in understanding this group of pathogens, (e.g. the recent completion of the genome sequence of *H. influenzae* Rd). Nevertheless, I think it is a worthwhile purchase for anyone working with these organisms. I especially like the inclusion of the Workshop Summary and Abstracts of Posters and Offered Papers.

Duncan Maskell
Imperial College of Science, Technology and Medicine, London

Book Reviews

Role of Gut Bacteria in Human Toxicology and Pharmacology

Edited by M.J. Hill.
Published by Taylor & Francis (1995).
£49.00 *pp. 286* *ISBN: 0-7484-0110-5*

This is the latest in the series of books by M.J. Hill on various aspects of normal bacteria of humans and of their effects. Previous volumes have dealt with the composition of the flora and its role in the aetiology of cancer, particularly large bowel cancer. The book focuses on the gut bacteria, the chemical reactions they mediate and the influence of these factors on human physiology and metabolism. The book will be of particular value to those working on xenobiotics, probiotics and gut ecology. Institutions with research activities in the cognate areas should add this book to the library.

Bohumil S. Drasar, Professor of Bacteriology
London School of Hygiene & Tropical Medicine

Fields Virology. Third Edition

Edited by B.N. Fields, D.M. Knipe, P.M. Howley, R.M. Chanock, J.L. Melnick, T.P. Monath, B. Roizman & S.E. Straus.
Published by Lippincott-Raven (1995).
£226.50 *pp. 3216* *ISBN: 0-7817-0253-4*

This is the second updating of the textbook which from its first appearance established itself as the 'virologist's bible'. The rapid expansion in knowledge in the five years since the last edition is reflected in 11 new chapters with all others being completely updated, leading to approximately 600 additional pages. The challenge of ensuring balance and consistency across the 118 contributors to this edition has in large been partly overcome by the Editors. The major question remaining with the untimely death of Bernie Fields is who will provide the leadership for the next update of this definitive reference text in virology?

Malcolm McCrae, University of Warwick

Fundamental Virology. Third Edition

Edited by B.N. Fields, D.M. Knipe, P.M. Howley, R.M. Chanock, J.L. Melnick, T.P. Monath, B. Roizman & S.E. Straus.
Published by Lippincott-Raven (1995).
£62.25 *pp. 1360* *ISBN: 0-7817-0284-4*

This book is a sub-set of the chapters from *Fields Virology* and has as its objective to provide for those whose primary interests are in basic rather than clinical aspects of virology, aiming to meet the needs of advanced undergraduates through to active researchers. A cheaper soft cover version of this book would merit a strong recommendation for undergraduate and postgraduate students but more than £60 for the present version is too much for students. The shift in virological research towards the analysis of pathogenesis mechanisms means that most active researchers might prefer to have the unabridged Fields as their reference text.

Malcolm McCrae, University of Warwick

Advances in Microbial Ecology, Vol. 14

Edited by J. Gwynfryn Jones.
Published by Plenum Publishing Corporation (1995).
US$95.00 *pp. 400* *ISBN: 0-306-45057-7*

Each chapter of this book presents a good review or follow-up to an area of research. As an edited book, the main thread is a strong sense of multiplicity or complexity; the interweaving strands are mixed populations, metabolisms and substrates. Modern data obtained by classical and sophisticated methods are well presented. A few chapters deal with a rather more restricted range of species and metabolisms. Speculation on future perspectives is less informative. The last chapter is elaborate and provides basics for studying tropho-dynamics and tropho-diversity, with well-organized experimental data. Recommended to both libraries and a broad range of microbiologists, from ecology- and environment-oriented individuals to physiologists.

Takeshi Naganuma, Biological Oceanography Laboratory
Hiroshima University, Japan

Medical Parasitology: A Practical Approach, Vol. 152

Edited by S.H. Gillespie & P.M. Hawkey.
Published by IRL Press at Oxford University Press (1995).
£35.00 *pp. 314* *ISBN: 0-19-963300-2*

This book is another excellent addition to the *Practical Approach* series. It is a good laboratory reference manual for use by field and health workers, diagnostic laboratories and researchers in both developing and developed countries and would be useful to students of medical parasitology. Protocols are included in each chapter, detailing techniques for isolation, culture and identification of a number of different parasites. Protocols are clearly laid out in boxes throughout the text, so that they are easy to follow. Reference lists at the end of each chapter provide useful source material.

Anne Kaukas, The Natural History Museum

Biotechnology, Second Completely Revised Edition, Vol. 9. Enzymes, Biomass, Food and Feed

Edited by G. Reed & T.W. Nagodawithana.
Published by VCH VmbH (1995).
DM520.00 *pp. 804* *ISBN: 3-527-28319-6*

This book, dedicated to the late Professor Anthony Rose, certainly provides a comprehensive coverage of the subject area in a series of succinct yet comprehensive chapters which not only serve to introduce the generalist to the topics but also bring together up-to-date information from diverse sources to form a very useful rapid database for the specialist and lecturer. User-friendly indexing ensures its utility. Thoroughly recommended for library purchase, although its price could prove problematic.

Martin A. Collins, Belfast

Two-component Signal Transduction

Edited by J.A. Hoch & T.J. Silhavy.
Published by ASM Press/Blackwell Science (1995).
£59.50 *pp. 488* *ISBN: 1-55581-089-6*

The last 10 years have witnessed an explosion in our understanding of how cells sense and respond to changing environmental conditions. In bacteria, this field is dominated by studies of the two-component histidine protein kinase-response regulator family which control essential metabolic and developmental functions as well as virulence. This excellent book offers a comprehensive insight into bacterial signal transduction systems and highlights the many questions which have yet to be answered. Throughout, the chapters are well organized and nicely illustrated, guiding the reader from a historical perspective and some general principles through to specific well-worked-out examples. This keenly priced volume is a 'must' for microbiologists interested in the molecular basis of bacterial adaptation.

Paul Williams, University of Nottingham

Book Reviews

Introductory Microbiology. Studies in Biology Series

By J. Heritage, E.G.V. Evans & R.A. Killington.
Published by Cambridge University Press (1996).
£9.95/US$19.95 *pp. 234* *ISBN: 0-521-44977-4*

This simple, affordable format should be popular with undergraduates taking subsidiary microbiology. It condenses a good range of bacteriology, mycology & virology into a 234-page paperback, covering the core of introductory microbiology courses at most British universities. The diagrams have an appealing 'hand-drawn' quality which will be far easier for students to understand and use, than the multi-coloured 3-D masterpieces in larger texts. Minor improvements would be more archaeal physiology and a topical mention of prions. Overall a valuable book, with a useful glossary of definitions that students so often get wrong! It would be an excellent revision aid, or a text for those preparing for microbiology at university.

Liz Sockett, Nottingham University

The Bunyaviridae

Edited by Richard M. Elliott.
Published by Plenum Publishing Corporation (1996).
US$89.50 *pp. 337* *ISBN: 0-306-45178-6*

The Bunyaviridae, a fascinating family of viruses (and the former Cinderellas of animal virology, according to the Editor's opinion), are represented here by an international bench of authors who have covered different aspects of 'bunyavirology' with high scientific accuracy. The composition of the book allows one to enjoy each chapter as a separate (and rather complete) story and most contributors perform in *tempo vivace*, protecting readers from being tired. The volume is addressed to students as well as to experienced researchers and lecturers who themselves should decide to become either a happy individual purchaser or a pitiful 'number in a queue'.

Alexander Plyusnin, Haartman Institute, Finland

Protocols for Gene Transfer in Neuroscience. Towards Gene Therapy of Neurological Disorders

Edited by P.R. Lowenstein & L.W. Enquist.
Published by John Wiley & Sons Ltd (1996).
£75.00 *pp. 417* *ISBN: 0-471-95766-6*

The cells of the central nervous system present a particularly challenging target for gene delivery. This book describes a wide variety of methods for achieving this goal. The protocols are very clearly explained and laid-out, with practical advice on vector design and potential problems, as well as the opportunity to interact with the authors directly for more specific advice. Although aimed primarily at neuroscientists, many of the methods are also applicable to non-neural cells. Thus, this book may also be of interest to those working in more general gene therapy fields.

Diane Wilcock, Imperial Cancer Research Technology, London

A Century of Mycology

Edited by Brian Sutton.
Published by Cambridge University Press (1996).
£60.00/US$90.00 *pp. 398* *ISBN: 0-521-57056-5*

1996 was the centenary of the British Mycological Society. This book, together with a series of centenary reviews in *Mycological Research*, commemorates this. Webster sets the scene by giving an overview of British mycology, with further historical accounts by Ingold, Pegler and Watling. The remaining eight chapters move on to consider current and future developments across mycology, with accounts of hyphal growth, conidiogenesis, zoospores, mycelial interactions, secondary metabolism, mycorrhiza, lichens and recording fungi. The book succeeds in its aim of forming a permanent record of achievements in mycology in Britain and overseas over the last 100 years, and in setting the scene for the next 100.

Graham Gooday, Aberdeen

Microbial Food Poisoning. Second Edition

Edited by Adrian R. Eley.
Published by Chapman & Hall (1996).
£21.99 *pp. 211* *ISBN: 0-412-64430-4*

This updated edition was first published in 1992 and as food safety is still making the news, the subject is just as relevant today. All the usual food-borne pathogens are covered along with food poisoning trends, epidemiology, legislation etc. The laboratory diagnosis section has been expanded and there is a new chapter on food hygiene. It is very readable and I feel that libraries who do not have a copy of the first edition should purchase this version for their medical, microbiology and food science/technology students. However, at almost £22 it is expensive for a 'black and white' paperback.

Margaret Patterson, The Queen's University of Belfast

New Editions

Brock Biology of Microorganisms. Eighth Edition

Edited by M.T. Madigan, J.M. Martinko & J. Parker.
Published by Prentice Hall (1996).
£24.95 *pp. 1038* *ISBN: 0-13-571225-4*

From the Editor...

FOR THE PAST YEAR the *Quarterly* has been keeping book reviews to only 100 words because of the large number of books that had been received. The glut has now subsided and we are able to lengthen the standard review to 150 words.

Those who review books for the *Quarterly* are asked to write their review within 6 weeks of receiving the book and in return they keep the review copy.

If you would like to review books for the Society, please complete the form in the centre of this issue of the *Quarterly* and send it back to Marlborough House. If there is a specific book you would like to review, please send the details, preferably by Email (admin@socgenmicrobiol.org.uk), to Janice Meekings at Marlborough House.

Dr D.McL. Roberts

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DIARY

Diary

SGM MEETINGS

Molecular Aspects of Host–Pathogen Interactions
Heriot-Watt, 24–27 March 1997

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

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

See pp. 34–37.

MARCH 1997

Annual Meeting of the Society of General and Applied Microbiology VAAM Major Topics: Extremophiles, Industrial Products & Environmental Microbiology
Hamburg, Germany
16–19 March 1997
Contact: G. Antranikian, Technical University Hamburg–Harburg, Technical Microbiology, Denickestr. 15, 21071 Hamburg, Germany (Tel. +49 40 77183117; Fax +49 40 77182909; Email Antranikian@tu-harburg.d400.de; http://www.tu-harburg.de/bt1/vaam)

Identification of Industrial and Food Spoilage Fungi (Course)
IMI, Egham, 17–21 March 1997
Contact: Mrs Stephanie Groundwater, IMI, Bakeham Lane, Egham, Surrey TW20 9TY (Tel. 01784 470111; Fax 01784 470909; Email s.groundwater@cabi.org)

CPD Programmes in Bioscience 1997: Immunology – A Path Through the Maze
University of Oxford
24–25 March 1997
Contact: Dominic Wynn, CPD Centre, University of Oxford, 67 St Giles, Oxford OX1 3LU (Tel. 01865 288162; Fax 01865 288163)

RMS Annual Light Microscopy Meeting
London
25 March 1997
Contact: RMS, 37/38 St Clements, Oxford OX4 1AJ (Tel. 01865 248768; Fax 01865 791237; Email rms@vax.ox.ac.uk)

APRIL 1997

BMS–FEMS Conference on Fungal Physiology and Biochemistry
University of Nottingham
4–6 April 1997
Contact: Professor J.F. Peberdy, Department of Life Science, University of Nottingham, University Park, Nottingham NG7 2RD (Tel. 0115 951 3231; Fax 0115 951 3251; Email John.Peberdy@nottingham.ac.uk)

RMS Microscopy of Biomaterials
Bath
16 April 1997
Contact: RMS, 37/38 St Clements, Oxford OX4 1AJ (Tel. 01865 248768; Fax 01865 791237; Email rms@vax.ox.ac.uk)

CPD Programmes in Bioscience 1997: Immunodeficiency
University of Oxford, 16–17 April
Contact: Dominic Wynn, CPD Centre, University of Oxford, 67 St Giles, Oxford OX1 3LU (Tel. 01865 288162; Fax 01865 288163)

The Leeds Applied Food Microbiology Course
The Weetwood Hall Hotel and Conference Centre, Leeds
21–24 April 1997
Contact: Ian Mallinson/Maria Kwater, Leeds Environment Department, Leeds City Council, 155 Kirkstall Road, Leeds LS4 2AG (Tel. 0113 247 6290/6260; Fax 0113 247 6282)

APRIL–MAY 1997

Modern Techniques in the Identification of Bacteria and Filamentous Fungi (Course)
IMI, Egham, 21 April–2 May 1997
Contact: Mrs Stephanie Groundwater, IMI, Bakeham Lane, Egham, Surrey TW20 9TY (Tel. 01784 470111; Fax 01784 470909; Email s.groundwater@cabi.org)

MAY 1997

Identification of *Aspergillus* and *Penicillium* species (Course)
IMI, Egham, 19–21 May 1997
Contact: Mrs Stephanie Groundwater, IMI, Bakeham Lane, Egham, Surrey TW20 9TY (Tel. 01784 470111; Fax 01784 470909; Email s.groundwater@cabi.org)

JUNE 1997

RMS Food Microstructure Conference
Leatherhead
9–11 June 1997
Contact: RMS, 37/38 St Clements, Oxford OX4 1AJ (Tel. 01865 248768; Fax 01865 791237; Email rms@vax.ox.ac.uk)

Gordon Conference on Viruses and Cells
Tilton, New Hampshire, USA
15–20 June 1997
Contact: Dr Peter Palese, Dept of Microbiology, Mt Sinai School of Medicine, 1 Gustave Levy Pl., New York, NY 10029 (Fax +1 212 722 3634; Email ppalese@smtplink.mssm.edu) or Dr Donald Ganem, Dept of Microbiology & Immunology, UCSF, San Francisco, CA (Fax +1 415 476 0939; Email ganem@socrates.ucsf.edu)

13th European Immunology Meeting
Amsterdam, 22–25 June 1997
Contact: Congress Secretariat, Eurocongres Conference Management, J. van Goyenkade 11, 1075 HP Amsterdam, The Netherlands (Tel. +31 20 6793411; Fax +31 20 6737306; Email eurocongres@pi.net)

JUNE–JULY 1997

6th International Conference: Perspectives on Protein Engineering
John Innes Centre, Norwich
28 June–1 July 1997
Contact: Dr M.J. Geisow, Perspectives Secretariat, 64 Langdale Grove, Bingham, Notts. NG13 8SS (Tel. 01949 876 156; Email biodigm@dial.pipex.com; http://www.biodigm.com/)

JULY 1997

CYTO 97 – Cell Signalling (Inflammation and Infection) Meeting

CRYO 97 – Low Temperature Microscopy Meeting

York
6–9 July 1997
Contact: RMS, 37/38 St Clements, Oxford OX4 1AJ (Tel. 01865 248768; Fax 01865 791237; Email rms@vax.ox.ac.uk)

8th Symposium ISVEE Epidemiology and Public Health
Institut Pasteur, Paris, France
8–11 July 1997
Contact: Convergences ISVEE 97, 120 Avenue Gambetta, F-75020 Paris, France (Tel. +33 1 43 64 77 77; Fax +33 1 40 31 01 65)

Design of Vaccination Programmes: From Sero-epidemiology to Cost-effectiveness (Course)
Warwick University
14–18 July 1997
Contact: Dr Stephen Hicks, Department of Biological Sciences, University of Warwick, Coventry CV4 7AL (Tel. 01203 523540; Fax 01203 523701; Email wupert@ dna.bio.warwick.ac.uk)

9th International Conference on Bacilli
Lausanne, Switzerland
15–19 July 1997
Contact: Secretariat, Institut de Génétique et de Biologie Microbiennes, Rue César Roux 19, 1005 Lausanne, Switzerland (Tel. +41 21 320 60 75; Fax +41 21 320 60 78; Email: Dkaramat@ulys.unil.ch

AUGUST 1997

8th European Congress on Biotechnology. Biotechnology Approaches the Third Millenium
Budapest, Hungary
17–21 August 1997
Contact: Franciska Morlin, Congress Secretariat, Coopcongress, H-1016 Budapest, Derék utca 2, Hungary (Tel. +36 1 166 8172; Fax +36 1 166 9051)

AUGUST–SEPTEMBER 1997

International Course on the Identification of Fungi of Agricultural & Environmental Significance
IMI, Egham
11 August–19 September 1997
Contact: Mrs Stephanie Groundwater, IMI, Bakeham Lane, Egham, Surrey TW20 9TY (Tel. 01784 470111; Fax 01784 470909; Email s.groundwater@cabi.org)

SEPTEMBER 1997

9th International Symposium on Phototrophic Prokaryotes
Vienna, Austria, 6–12 September 1997
Contact: Dr W. Löffelhardt, Institute of Biochemistry and Molecular Cell Biology, University of Vienna, Dr Bohrgasse 9, A-1030 Vienna, Austria (Tel. +43 1 79515 Ext 5116; Fax +43 1 799 5272)

9th International Workshop on *Campylobacter, Helicobacter* & Related Organisms
Arthur's Seat Hotel, Cape Town, South Africa, 15–19 September 1997
Contact: Mrs Sally Elliott, Postgraduate Medical Centre, UCT Medical School, Observatory 7925, Cape Town, South Africa (Tel. +27 21 406 6381 or 406 6911; Fax +27 21 448 6263; Email sally@medicine.uct.ac.za)

OCTOBER 1997

Mycorrhizas – Identification and Techniques (Course)
IMI, Egham, 13–17 October 1997
Contact: Mrs Stephanie Groundwater, IMI, Bakeham Lane, Egham, Surrey TW20 9TY (Tel. 01784 470111; Fax 01784 470909; Email s.groundwater@cabi.org)

International Symposium: Disinfection and Hygiene – Future Prospects
Wageningen, The Netherlands
16–17 October 1997
Contact: Ir. Nienke M. Brouwer, Agricultural University, Department of Household & Consumer Studies, PO Box 8060, 6700 DA Wageningen, The Netherlands (Email Nienke.Brouwer@tech.hhs.wau.nl)

Culture Preservation Techniques for Filamentous Fungi and Bacteria (Course)
IMI, Egham, 29–31 October 1997
Contact: Mrs Stephanie Groundwater, IMI, Bakeham Lane, Egham, Surrey TW20 9TY (Tel. 01784 470111; Fax 01784 470909; Email s.groundwater@cabi.org)

NOVEMBER 1997

PCR Techniques and Applications (Course)
IMI, Egham, 17–21 November 1997
Contact: Mrs Stephanie Groundwater, IMI, Bakeham Lane, Egham, Surrey TW20 9TY (Tel. 01784 470111; Fax 01784 470909; Email s.groundwater@cabi.org)

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; http://www.dechema.de)

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