Crossing the divide – promoting microbiology in schools

Concerns about recruiting microbiology undergraduates are rife; universities are axing courses and replacing them with more popular subjects such as forensic science or sports studies. Yet there has never been a greater need for microbiologists. What can SGM members do? One successful approach is to interact with local schools and enthuse the pupils about microbiology. Microbes are fascinating and affect all of us daily. Kids relate particularly well to young scientists telling them about the subject as it knocks on the head their perceptions of boffins in white coats! Here we describe some ways to promote microbiology in schools.

Keep up-to-date with what's happening in microbiology education. Schools Membership costs only £10 a year. For this, a named teacher representative will receive *Microbiology Today* each quarter, advance copies of new teaching resources and discounted fees on SGM INSET courses. To join see **www.sgm.ac.uk/membership**

Enquiries:
education@sgm.ac.uk

Education website:
www.microbiologyonline.org.uk

Working in schools

People working with children may need to be vetted for a criminal record. It is important to check this out with the school. See also **www.crb.gov.uk**

Honours projects with a difference

University of Sheffield

The Department offers school-based projects as an alternative to the conventional final year laboratory investigation. In the 2 years that we have run these, 19 students (out of around 200) have taken the school option. Of the ten students who carried out school projects in 2002/2003, five are now training to be teachers. Early indications suggest that a similar number will enter teacher training from the current cohort.

We have mainly dealt with primary schools, but this year we included one secondary school. Almost all the projects have been based on microbiology, because it became clear in initial discussions with schools that this was an area that they found difficult to teach and where the resources of the university could be used to most effect. The SGM *World of Microbes* booklet has been used as the basis of the teaching sessions, but in all cases the students were required to produce their own material.

Students and the academic staff involved had a session with the LEA Science Advisor to discuss the National Curriculum (NC) science requirements for primary school pupils before pairs of students were assigned a school. Further discussions followed with the class teacher and then the students were required to prepare a minimum of three afternoon lessons for their class. Students also attended lessons before and after their allotted slots. The teacher was present at all times, which avoids any problems with the students not having been vetted.

Assessment of the projects is as follows:

(a) the final teaching session is observed by a member of university staff and with comments from the class teacher constitutes 15 % of the mark

(b) the students prepare a presentation to their peers and staff (5 %)

(c) the students write a 5,000–8,000-word report, which must include the background of the NC, all methods used in class experiments, all worksheets used, the outcome of the lessons and a discussion of whether their aims and objectives were met and what would they do differently if running the lessons again. The students also submit a laboratory book which details the development of their teaching sessions by making contemporaneous notes (80 %).

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The students' views

Emily Stringer (Ecclesall Junior) – Biochemistry; **Sarah Thompson** (Dore Primary) – Genetics; **Anna York** (Dore Primary) – Genetics/ Microbiology; **Emma Farley** (Netherthorpe Primary) – Genetics; and **Leanne Sunter** (Chaucers Secondary School) – Biochemistry/ Microbiology gave their opinions of the scheme.

Why choose a school-based project?

Three of the students were considering becoming teachers anyway, and thought it would be useful experience. The others were not so keen on lab work and valued the opportunity to try something different. As Sarah said, '*I am interested in several non-lab-based careers, including teaching, and thought that this project would allow me to develop skills required for these careers as well as have an insight to a teacher's everyday tasks*'.

The type of school and age range taught

Emily and her partner were allocated a class of 30 year 5 children (aged 9–10), whilst Sarah and Anna taught a year 4 (aged 8–9) class. '*The school decided this would be the best class for us to work with as the Year 6 class were busy revising for SATS tests*.' Emma was based at a primary school with eight students of mixed ethnic and social backgrounds, aged 10. Leanne was the only student to work in a secondary school. '*If I did go into teaching I would want to teach secondary, so this gave me the most relevant experience. I worked with a year 8 class, aged 12–13, and a year 10 class, aged 14–15*'.

The basis of the research project

The amount of microbiology in the NC is small and clearly defined. In the official *Schemes of Work*, NC Unit 6B Micro-organisms is used with Year 6 children. The students working in primary schools had to devise their lessons within this framework and found the teaching resources given by the SGM useful. These packs (which are free on request by emailing education@sgm.ac.uk) include the *World of Microbes* pupil book, a *Cold Wars* factsheet, *Food Microbiology* and *Classifying Microbes* posters. However, the students had to produce their own material, so mainly used the pack for inspiration, guidance and visual aids. '*The pictures in the booklet were a great resource, as the children were fascinated by them*.' Emily picked three areas from the book that would fit in with an experiment and some microscope work, whilst Sarah and Anna had to adapt the material for a younger age group from the one targeted by the book. '*Information was extremely simple to find especially with the use of the internet and the QCA website*.'

At secondary level, as well as the NC, teachers have to meet examining bodies' specifications for GCSE and post-16 courses. Leanne used these to design an investigation for Year 10 which had to give them access to high marks in all four areas of coursework assessment. '*For Year 8, I used NC guidelines as a basis. Information on food and digestion was very easy to find, but the Year 10 exam information was more problematic*.'

Project objectives

At primary level the basic learning objectives were to introduce the idea that microbes are small living organisms that come in many forms; some are beneficial and others are harmful. Emily also had to complete a scientific investigation and to produce an activity book, which proved to be very popular with the children. She felt that the objectives were met. Sarah and Anna could not cover all the topics in Unit 6B due to time constraints, but they also taught about hygiene and how disease microbes are passed from person to person. They had pupils of widely differing abilities to cope with, leading to three bands (levels) of work being produced.

Emma felt that the main objectives were achieved successfully and that the children understood the importance of micro-organisms in our world. '*They were able to answer questions correctly and to fill in worksheets*.'

Leanne had slightly different objectives, '*personally, to gain a real life experience of working in a school. As part of my university project, to make science more interesting for the children. I think the objectives were achieved*.'

Pupil reactions

All of the students felt that the children really enjoyed the lessons. '*They appreciated doing some practical work, were very interested in the photos of microbes and loved the opportunity to ask real scientists who wear white coats (their words) lots of questions about microbes, particularly regarding illness and food*!' (Emily). Sarah and Anna agreed and noted that pupils also liked the interactive quiz and the microscope work. Emma felt that they enjoyed learning something new, although some of the information seemed a little beyond their understanding. Leanne found that enthusiasm waned as the pupils got older: '*Year 8 definitely enjoyed it and I think Year 10 did, but they didn't want to do coursework*.'

Student reactions

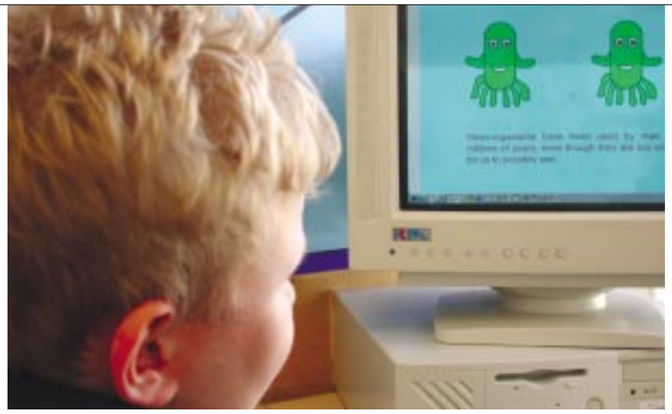
The students who worked in primary schools enjoyed their projects, although it was a busy 3 weeks and quite challenging to prepare worksheets and lessons. All the hard work was made worthwhile by supportive teachers and responsive children. '*It was really good fun*' (Emily). '*It allowed me to develop useful skills*' (Sarah). Only Leanne was a bit disappointed by the experience and did not really enjoy it.

Would the students do anything differently?

Emily felt that she needed more experience in developing effective worksheets, whereas Sarah would prepare work at different levels according to ability. They all agreed that extra time would be useful to cover more topics and activities. Leanne would try harder to make it fun and more exciting for the children.

University of Nottingham

I have been into my children's school several times to talk about microbiology and this gave me the idea of offering a school-based project to final year BSc Hons microbiology students as an alternative to the lab. The science curriculum coordinator gave permission and last year was the first time we ran the projects. As they were so successful we are doing them again in 2004.



ABOVE:
Cath Rees' son, Ben Whitaker, doing John's ICT package.
COURTESY CATH REES

The students had to research and deliver a class either to year 1 students or to year 5. John Lindley (see below) stuck to the theme of good and bad microbes for the year 1 children. One student doing the key stage 2 project chose soil microbes and the children made mould gardens to look at decay. The other did vaccination and had the students playing an infection game using coloured stickers to understand how disease spreads and how vaccination stops it. The children all enjoyed the lessons and as part of the project the students went back to see how much the pupils had retained – in all cases the response was pretty good.

The teachers were as interested in the lessons as the children and this year the students are being asked to produce a set of teacher's notes as these will be of long-term use to the school.

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Teaching Microbiology to Year 1 Primary School

Year 1 children are aged 5–6. Microbiology is not part of their key stage (KS)1 curriculum, but I decided that a microbiology practical experiment could contribute towards the goals. The KS2 section on micro-organisms, although aimed at children aged 9–10, gave me a starting point for my lesson. Other information on teaching microbiology to KS1/2 pupils was quite difficult to find and my list of references was not extensive. The internet proved to be quite useful, and the SGM www.microbiologyonline.org.uk website was very handy and perhaps one of my best sources.

In planning my lesson it was essential to find out what children already knew about micro-organisms and also what they were capable of in the classroom. I attended science classes weekly for about 3 months and observed the children, talked to them and conducted mini-experiments with one or two. I was on a steep learning curve. For example, that they did not know what '*thousands of times smaller*' actually meant when describing a microbe, and that it was easier to describe them as '*a lot, lot smaller than an ant*'. I also found out that some children did have a rudimentary knowledge of the processes of decay. Microbes were abstract concepts to them, and I began to realize that they really did need to take form in the children's minds. This gave me the idea for the microbe puppets.

My final lesson plan aimed (i) to aid children in understanding that micro-organisms are very small creatures that are all around us and (ii) that we can magnify objects otherwise invisible to us. I first engaged the pupils with the moving arms microbiology puppet I had made, before they (1) looked at some fungi/dead flies/spider legs under a microscope and drew them, (2) used an ICT programme *Mad about Microbes** I had devised, (3) used an Intel

* *Mad about Microbes*, the fun, interactive ICT package that John Lindley devised, with animation and sound, describes the activities of some good and bad micro-organisms. It includes a quiz to test children's knowledge. This will be available on **www.microbiologyonline.org.uk** soon.

New resource from SGM

- *Invited to a local school to give a talk, but don't have time to prepare one?*
- *A university admissions tutor trying to recruit students from local schools?*
- *Do you provide careers advice to schools?*
- *A teacher with little background knowledge of microbiology?*

The new SGM CD-ROM, compiled by Jane Westwell, is tailor-made for you. It includes two Powerpoint presentations suitable for promoting microbiology in schools:

Microbiology – a subject for life. An introduction to the scope of microbiology and its impact on our lives

Careers in Microbiology. An exploration of all aspects of the available opportunities for microbiologists

Each slide has attractive, high quality colour illustrations and you can use as few or as many as you need. The presentations are also provided in a format which can be printed as OHPs.

PLUS a PDF of the popular SGM 16-page booklet: *Your Career in Microbiology.*

microscope attached to a computer to find very small words printed on a piece of paper and (4) made moving arm microbe puppets.

I think I definitely achieved my objective regarding magnification, which the children found fantastic. However, they were mainly interested in the insect legs and not so much in the fungi!

Several children seemed to grasp that there are good and bad micro-organisms and gave examples to the class. However, children may also need experimental proof that micro-organisms exist; this lesson did not tackle the issue. I feel that after the lesson the children probably knew more about microbes than a large percentage of the country's adult population.

I enjoyed the project immensely. In fact, I sometimes felt a bit guilty listening to other students complaining about experiments in the lab going awry and people pinching their solutions. Some also seemed to think that I was getting an easy ride. This was definitely not the case. The title gave scope to put into the project what you wanted to get out, and I decided to maximize the benefits both for me and the children. My literature review involved looking at pedagogic theory, the importance of ICT and the teaching skills needed for primary school. I enjoyed learning how to use Macromedia Flash and also how to communicate with children. I also liked the primary school classroom environment and feel that this is a career that I might like to move into. At the moment I'm teaching English as a foreign language in Spain and I'm hoping to work with children in this field too.

As for the children, I'm sure that the majority enjoyed the lesson as there was a good buzz around the classroom. Feedback from the teacher was positive. The teacher did not have much idea about microbes before we started working together, but she too enjoyed conducting the lesson and was fascinated by the topics we covered. Her help and the good working relationship we developed were invaluable.

John Lindley (johnlindley_uk@hotmail.com)

Resources for School Members enclosed with this issue:

- *Cold Wars factfile*
- *Microbiology – a subject for life CD-ROM*

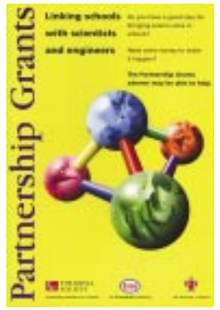
Coming soon:

- *Malaria factfile*

Researchers in Residence

This scheme, supported by Research Councils UK and the Wellcome Trust, encourages young research scientists (postgrads and postdocs) to contribute towards making school science more relevant and exciting for secondary school students. Researchers in Residence are allocated a local school where they plan activities such as a talk or practical with the appropriate teachers. They spend around 24 hours in the school. A day's briefing is provided before the first school visit. The scheme is run by the Centre for Science Education at Sheffield Hallam University. Contact Laura Doleman (Tel. 0114 225 3785; email l.j.doleman@shu.ac.uk).

Partnership Grants: Linking schools with scientists and engineers



The Royal Society, with Exxon Mobil and the Mercers Company, has set up a grant scheme to support partnerships between practising scientists and UK teachers. The students involved must be aged 5–16. Applications must be made in conjunction with the partner, but grants (£250–2,500) are paid to the school. For full details and an application form see **www.royalsoc.ac.uk/education**

Nuffield Science Bursaries

Instead of scientists going into schools, this scheme gets post-16 school students out into labs to experience science in the real world. Students take part in science-based projects in university, industry, hospitals or research institutions during the summer holidays. Students can find their own placement or apply for project placements organized by Nuffield Regional Co-ordinators. 600 bursaries are awarded each year. Project providers are urgently needed. Can your lab help? See **www.nuffieldfoundation.org/grants/scibsc**

SGM Public Understanding of Science Grants

Grants of up to £1,000 are available to SGM members for science promotion activities. Past awards have supported microbiology workshops and training courses for school students which members have run in their university labs. The SGM will supply packs of teaching resources and has plenty of suggestions for suitable investigations to carry out. Application forms are available on the SGM website.

Post-16 Microbiology Summer School

Following the success of the event held in 2002, SGM will be running a residential summer school for post-16 biology teachers at the University of Leeds from 12 to 16 July this year. The programme has been carefully planned to reflect the microbiology content of the current post-16 examining body specifications, including the new pilot specification from Salters/Nuffield. The microbiological issues studied throughout the week will be set in the context of real life applications, making the content both relevant and stimulating. The latest research findings in each topic will also be addressed.

There will be a mixture of talks by experts who are also proven communicators, workshops, practical sessions and a visit to the Thackray Museum.

The Summer School will begin with an introduction to microbiology, followed by a session on science communication, led by a professional science writer. On Tuesday and Thursday mornings four microbiological themes (medically important diseases, molecular microbiology, environmental microbiology and biotechnology) will be explored by in-depth talks.

Practical sessions will take place on Monday, Tuesday and Thursday afternoons, including an investigation into the antibacterial properties of Tea Tree oil, DNA finger-printing, PCR, data logging and the use of microscopes. All practicals will adhere strictly to current schools safety guidelines. On Wednesday there will be a half-day visit to the Thackray Museum, which through its collections, galleries and interactive displays brings to life the history of health and disease, treatments and cures and medical discoveries. The afternoon will be spent in the university library, working in groups, to produce a scientific poster that will be presented later that evening to a panel of science communication experts. The Summer School will conclude with a questions session and an overview of *Science in the 21st Century.*

Exciting social events will provide light relief after an intensive day's study, including an evening cruise down the River Ouse with supper and a Gala dinner at University House.

The Summer School costs £100 for SGM members and £130 for non-members, to include all course materials, lunch, refreshments, accommodation, visits and social events. Due to the limited number of places available only one teacher per school will be eligible to attend and priority booking will be given to SGM members.

Contact Dariel Burdass (d.burdass@sgm.ac.uk) for information.