Developments in Education Fund

A roundup of recent projects funded by the SGM

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

■ Kevin Kavanagh

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

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

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

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

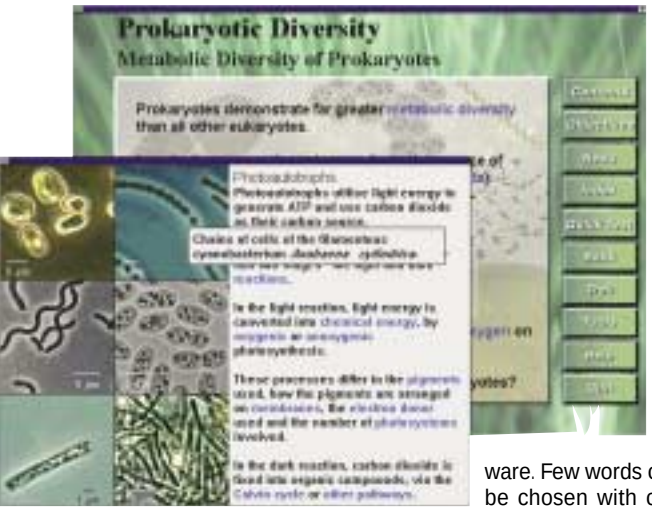
*Safe practice

These protocols were devised for use in schools in the Republic of Ireland. Different safety rules may apply in other countries. Please obtain advice and carry out a risk assessment before using the book. Safety information for England, Wales and Scotland is available on the SGM website (www.sgm.ac.uk) or email education@sgm.ac.uk

Prokaryotic Diversity: a multimedia courseware unit produced in collaboration with the Virtual School of Biodiversity

■ Linda Thomas

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



Multimedia courseware will only attract students if it is well designed, easy to use and enriched with appropriate media. Thus, my first objective was to obtain decent images of micro-organisms and so I contacted microbiologists worldwide requesting their help. The generous response from so many of them (who are credited on the unit), together with pictures I had taken, was critical to the success of the unit. There are many constraints when scripting this kind of courseware. Few words can be used – so these must be chosen with care. Images, diagrams and words are used to create imaginative links from one screen to another, encouraging the student to explore a subject in greater depth and at their own pace (see figures). When I had put the unit together, Dr Will Trewhella of the Virtual School of Biodiversity edited it to match the format of other units and finally the unit was independently refereed.

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

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

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

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

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

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

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

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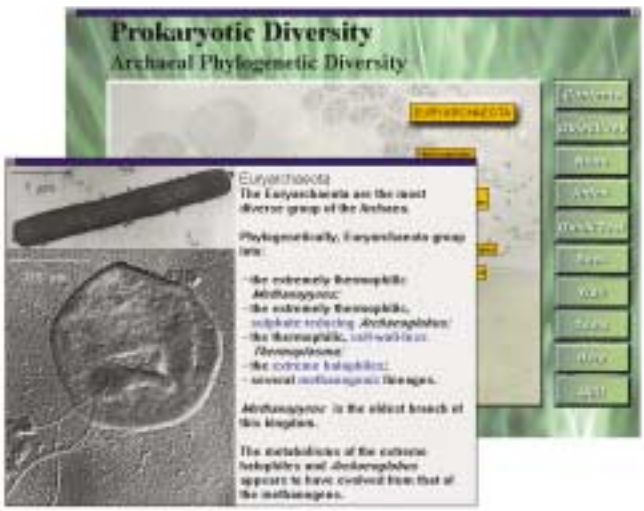

A microbial case-based CAL package (Simfection) for nursing students

■ Mike Tait & Yamni Nigam

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

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

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

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

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

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

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PowerPoint presentation of microbes in everyday life

■ Rob Cumming

The award paid for two second-year students from our BSc Biotechnology course to work for 2 weeks in the summer holiday. The aim of the project was to produce a PowerPoint presentation entitled *A day in the life of a student and his/her microbial encounters*. The presentation was designed for use in schools to aid recruitment to university microbiology courses. Thus the student was portrayed getting up in the morning (late) and rushing for his lectures/labs with meals in between (to introduce fermented foods and especially drinks!). The students wrote the script from a plan I had given them, but decided to introduce some romance in the story (to introduce some new diseases). The illustrations used came from the Internet with the web publisher's permission and acknowledgments are listed on the relevant pages of the story. A difficulty was how much to edit the story. I thought it would appeal to potential students if written by students; but the grammar and spelling had to be reasonable! A feature of the style was to have a picture on each page with accompanying text, to make it attractive to the audience. This meant, unfortunately, that the file size of

the presentation became very large, making distribution of the work difficult. Nowadays the writeable CD-ROM is available and would have neatly solved this problem. As an alternative, we converted it to simple HTML files (not via PowerPoint!). The project can thus be viewed from any school at http://www.sst.tees.ac.uk/external/U0000510/sgm/home.html

The HTML coding used was very basic, so don't expect any flashing microbes!

The students had great fun doing it; widening their microbiological knowledge in the process. I have since used it at a number of school presentations at my university.

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

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

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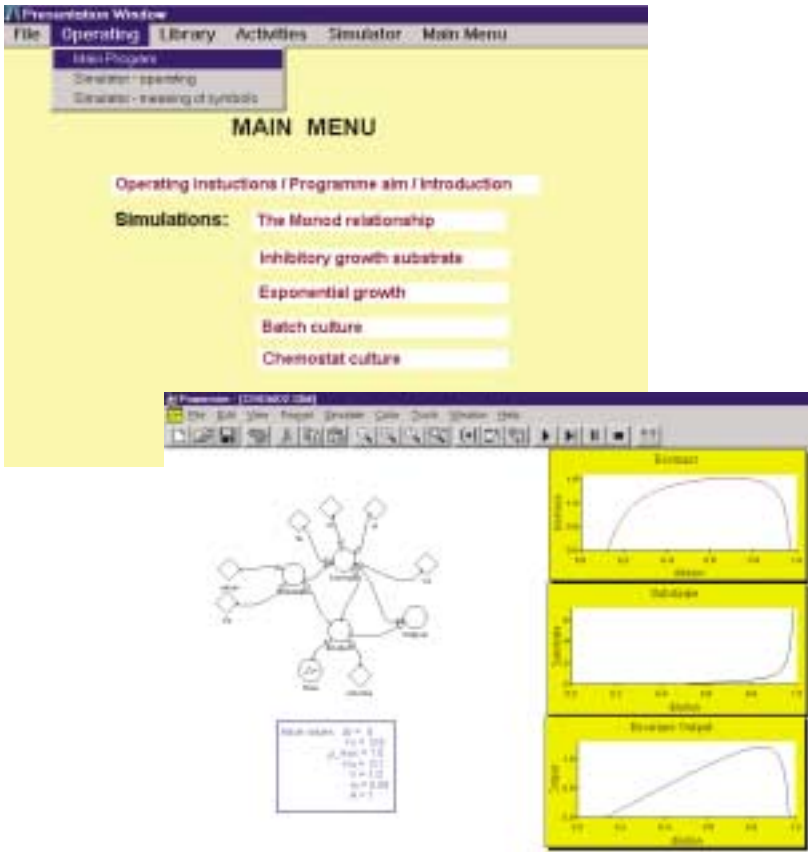

Computer simulation of the dynamics of microbial populations

■ R.O. Jenkins

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

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

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

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

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