LTSN BIOSCIENCE BULLETIN

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The Learning and Teaching Support Network (LTSN) Centre for Bioscience is one of 24 Subject Centres, funded by the four UK higher education funding bodies, to promote and support high quality learning, teaching and assessment in UK higher education

PRODIGIOUS PRODIGY?

WELCOME TO THIS NEW EDITION OF THE LTSN BIOSCIENCE *BULLETIN*. THE LTSN AS A WHOLE HAS been under the spotlight recently and the August 16th issue of the *Times Higher Education Supplement* featured a whole-page article on the LTSN entitled "Is the prodigy ready to prosper?" LTSN has been undergoing an evaluation by a team from Lancaster University, and their Report tries to gauge the academic community's awareness of what they call the 'LTSN Brand', and also whether there is evidence to show that the Network is making a difference to tertiary level teaching.

In terms of awareness, the report concluded that junior staff were more likely to have heard of the LTSN than older staff (readers, professors, deans) and that smaller departments were less likely to have heard of it than large departments. The really good news though is that 49 per cent of those interviewed said that the LTSN was already changing their teaching activities, and 67 per cent said that it had the *potential* to affect teaching and learning. Professional bodies/learned societies thought that the LTSN was complementing their work at the educational level. The survey team received responses from 219 institutions and each university's PVC for teaching and learning was interviewed. There is therefore evidence that we are having a significant effect – but no one pretends that there is not still a long way to go. This is particularly true of the group of staff who see research as their only priority and have little interest in improving their teaching. Therefore, not only do we have to keep banging the publicity drum by whatever means we can – by visits to departments, personal contacts, the web site, the *Bulletin*, etc – but also we need to continue to work hard at building the network in the bioscience community. Although the Centre for Bioscience is the hub of activities, the really important thing is to develop an enduring network in which people in bioscience departments talk to each other rather than through us (although of course we are keen to be active and stimulatory, and to harvest and disseminate good practice). Consequently, our Departmental Contacts, Discipline Consultants and Special Interest Group Co-ordinators are vitally important in sowing the seeds and forming nodes out in the community. We are constantly on the look out for individuals who can help and provide the lead in these sorts of ways.

Another consideration is just how long it takes to put some innovative teaching ideas into practice. You can only change the course once a year, and you need to plan in advance for next year's session as well as convincing one's colleagues that it is worthwhile to do something differently! Everyone knows that, but as mentioned in the *THES* article, our Teaching Development Fund (TDF) grants can help people to try out an idea or develop something which may help to improve teaching practice. Have you an idea that could be developed given a bit of seed-corn money? You can look on the web site for details of previous projects and also find the details of how to apply.

In addition to all of the above, we will focus on the Government's agenda to widen participation, improve retention of students, and enhance employability. One particular role of LTSN Bioscience will be to support and encourage improvements in the teaching of, and learning by, incoming students with a wider range of abilities and backgrounds. To this end we are holding a discussion Forum on 12/13 September to discuss what is already in place and how good practice might be spread. The report on the outcome of the meeting will appear on our web site in due course.

Professor Ed Wood *LTSN Centre for Bioscience*

http://bio.ltsn.ac.uk/

LTSN Centre for Bioscience, School of Biochemistry and Molecular Biology, University of Leeds, Leeds LS2 9JT. Telephone/Fax: +44(0)113 343 3001 email: ltsnbioscience@leeds.ac.uk

ltsn Learning and Teaching Support Network **Bioscience**

SUCCESSFUL FDTL4 PROJECTS

INTRODUCTION

The projects funded under phase 4 of the Fund for the Development of Teaching and Learning (FDTL) were announced recently. FDTL is to support projects with the aim of stimulating developments in teaching and learning that are disseminated across the higher education sector.

For the first time projects have the opportunity to work with LTSN Subject Centres in developing their dissemination strategies and draw on the expertise and networks we have built up over our first two years of operation.

Below are brief project outlines and contact details of a number of projects that will be working with LTSN Bioscience. More detailed articles about individual projects will follow in future issues.

PASS: PROJECT TO ASSIST STUDENT LEARNING

- Project designed to cater for varying backgrounds of cell biology knowledge for entrants into the biology programme
- The project is to provide less able students with self-study packs and supporting work-shops and seminars to allow them to obtain sufficient grounding in the subject matter, allowing them to study the cell biology module content with maximum benefit
- The incidental benefit of these study packs will enhance the students' ability for independent learning ■

Dr Janet Clegg
St Mary's College
University of Surrey
cleggjm@smuc.ac.uk

IMPROVING THE COST-EFFECTIVENESS OF FORMATIVE ASSESSMENT IN SCIENCE

The project aims to improve the cost effectiveness of formative assessment to improve student progression and retention in science courses, including Biosciences, by evaluating the impact of existing formative practices on student learning behaviour, progression and retention in courses from the Open University and Sheffield Hallam University; developing, implementing and evaluating the impact on students of new approaches to providing students with feedback, and establishing a set of principles for the effective operation of formative assessment. ■

Dr Evelyn Brown
The Open University, J.E.Brown@open.ac.uk

PROFILE: A FLEXIBLE, GENERIC SYSTEM TO SUPPORT THE ASSESSMENT FOR ACADEMIC CREDIT OF WORK-BASED LEARNING WITHIN NON-VOCATIONAL BIOSCIENCE SANDWICH DEGREES

A generic, web-based system called PROFILE defines work-based learning in a way that forms a foundation for assessing placements for academic credit. The system will monitor, support and assess student placement experience on-line. Initially it will be developed for Bioscience placements but by the end of the project it will be available for all HE Institutions. We would also like to involve end-users in the development of PROFILE. ■

Dr Stephen Gomez
Faculty of Applied Sciences, University of the West of England
Stephen.Gomez@uwe.ac.uk

JISC-FUNDED LIFESIGN PROJECT HAS MADE A MAJOR BREAKTHROUGH WITH THE BBC

Two major series, *The Private Life of Plants,* presented by Sir David Attenborough and *The Human Body,* presented by Robert Winston are now available on-line. Other programmes from the BBC are *Horizon's* "Is GM Safe?" and the fascinating "Professor Bonner and the Slime Moulds". The programmes are available in their entirety but the viewer also has the option to select a specific segment they wish to view.

All programmes are available free to UK higher and further education institutions. (see *http://www.lifesign.ac.uk*).

SUPPORTING AND ASSESSING STUDENTS' PROGRESS AND ACQUISITION OF WORK-RELATED SKILLS IN THE PLACEMENT ENVIRONMENT USING A WEB-BASED INTERFACE

This project will develop and disseminate good practice in supporting and assessing students' acquisition of work-related skills in a placement environment, using the Food and Human Nutrition BSc degree programme as a model. We will be developing a web-based interface using the Blackboard Managed Learning Environment (MLE), to provide appropriate support at all stages of the placement process; through seeking and obtaining placements, maintaining contact during the placement year itself, and in collation and preparation of assessment materials for City & Guilds qualifications. ■

Dr Chris Seal
School of Medical Sciences, University of Newcastle-upon-Tyne
Chris.Seal@ncl.ac.uk

EFFECTIVE FEED-BACK, ENHANCED LEARNING: THE EFEL PROJECT

The project aims to develop and enhance assessment procedures. Good practice within the partnership and associated institutions will be audited. Generic grade criteria and task-specific criteria will be developed to ensure more consistent marking. Time-effective strategies will be developed that give students prompt, clearly structured feedback related to those criteria. Students will be helped to interpret criteria and feedback more effectively so that they may set targets for, and enhance, their learning. ■

Dr Colin Hughes
Department of Life Sciences
Nottingham Trent University
Colin.Hughes@ntu.ac.uk

DISSEMINATION OF FORMATIVE CONFIDENCE-BASED EXERCISES

The aim is to reward students for reliable confidence judgements about their answers to questions. This assists reflective study and formative assessment and (in a recent trial) has been shown to improve the reliability of summative assessment (with potential savings in exam effort). The project will disseminate the UCL scheme for biomedical subjects and numeracy (elsewhere and to new disciplines), and establish pooled Computer-Aided Assessment (CAA) resources. ■

Prof Tony Gardner-Medwin
Department of Physiology
University College London
ucgbarg@ucl.ac.uk
www.ucl.ac.uk/~cusplap

OLAAF: ON-LINE ASSESSMENT AND FEEDBACK

The OLAAF project will develop and disseminate a set of generic criteria and practices for embedding effective computer-based assessment and feedback within a range of pedagogical approaches. We will establish an OLAAF Interest Group to involve the wider HE community in the project. ■

Dr Richard Rayne
School of Biological and Chemical Sciences, Birkbeck College
r.rayne@bbk.ac.uk

PRACTICALS FOR THE BIOSCIENCES – COMING SOON TO A WEB SITE NEAR YOU!

The Centre is developing an on-line resource of tried and tested bioscience practical exercises and associated learning resources (student handouts, etc.) contributed from UK Higher Education.

This *Practical Work Compendium* (to be made available in autumn 2002) will span the broad range of bioscience disciplines and will provide a mechanism for sharing expertise and identifying and developing good practice with bioscience colleagues around the UK. It will also act as a useful reference point for new staff and those developing new practicals or modules.

Contributions welcome; please consider sharing one or more of your practicals. Your input will help make this a useful resource for the bioscience HE community. Details of practicals may be completed and accompanying electronic documents can be easily uploaded using our on-line form: *http://bio.ltsn.ac.uk/imagebankuploads/compendium/insertpage.asp*.

Practicals submitted will be clearly attributed to their originator(s) who will retain copyright, but agree to their use for educational purposes.

Latest details can be found on the project homepage: *http://bio.ltsn.ac.uk/resources/bioscience/compendium/* and any questions may be directed to *compendium@ltsnbio.leeds.ac.uk.*

THE BASIC TENETS OF TEACHING ETHICS TO BIOSCIENCE STUDENTS

THE FIRST TENET: ETHICS MATTER IN THE BIOSCIENCES

WE NEED TO TEACH BIOSCIENCE students ethics because of the issues facing society. Genetic and fertility developments, xenotransplantation, new forms of contraception and questions of euthanasia and assisted suicide (helping people to die) put Bioscience and ethics in the frontline. At the same time in university and in the practice of the biosciences, high ethical reflection and standards are required. The scandal and aftermath of Alderhey and the crucial issues of consent, funding and ownership of research make it vital that bioscience students have a clear grasp of the ethical perspectives and concerns.

The first tenet in teaching ethics to bioscience students is that ethics matter whether we like it or not and is necessary for a career in the biosciences.

THE SECOND TENET: LEARNING ETHICAL DECISION MAKING

What is less straightforward is how and what we are actually trying to teach. Bioscience students are not philosophers, but they can be taught to think and reflect ethically. This means helping them develop basic skills in ethical decision making. Students need to be able to distinguish between moralities based on principles from those based on consequences. They need to grasp that we live in a largely utilitarian and relativistic world, where maximising happiness and the denial of absolute values is common place. They need to realise that there is considerable unhappiness with these traditional approaches to morality, and instead an emphasis on growing and being virtuous people is widely appreciated. That means asking and answering what it means to be a good bioscientist doing good work. This is not just a matter of high professional skills and good quality research. It is also possessing the ability to act ethically and to be able to offer a moral justification for the work done and the way it is done.

Medicine and bioscience have stressed the importance of four fundamental principles. Bioscience students need to know and understand the principles of non-maleficence (do no harm), beneficence (do good), maximise autonomy (the freedom of the individual or community) and Justice (treating equal cases equally and unequal cases unequally).

The second tenet is to ensure that bioscience students have a clear grasp of the way that ethical debates are taking place and are able to reflect on their own values in light of the professional and communally accepted values.

When teaching ethics to bioscience students we must help them cope with the reality of living in a pluralist world where there is not one universally agreed and accepted answer. Morality is rarely black or white in the complexity of the issues produced by and facing bioscience. It may be helpful to suggest that they reflect on the extent to which there is some kind of natural law in the nature of things and people. Are there things that are universally good and things which are bad for all people? Interestingly, both a traditional Roman Catholic and an Evolutionary ethic point towards fundamental values in the natural realm. It is also important that students are helped to ask what it means to be human and what values we consider fundamental to humanity. This is not just important because of the debate over the use and status of animals but also because research involves people working often on people for the benefit of people. What then are the limits to such research and activity? We need to consider whether or not there is some common core of basic, 'rock-bottom' morality and what that means for bioscientific activity.

THE THIRD TENET: PREPARE FOR TOMORROW AS WELL AS TODAY

The danger is that we teach ethics as if Bioscience and ethics are static rather than developing. Students need to be aware not only of future developments in the biosciences but also that societal and professional changes will impact the practice of and demand for ethical bioscientific research. The law is becoming ever more intrusive in the regulation of the sciences. But is this ethical and how do we judge the validity of governmental control? The media constantly demand justification for action and clarification of the implications of research. Ethical justification is a crucial bulwark against the breakdown of public confidence and a retreat to law and expensive litigation.

As science advances, the moral bioscientist will recognise his or her responsibilities to society, conscience and the profession. Science does not happen in a vacuum and the international aspects of bioscientific research will require careful moral monitoring and assessment. So too will an understanding of the social implications of the biosciences. Modern movies picture a brave new world where biotechnology rules and intrudes on every aspect of human being. The students of today will be the leading bioscientists of tomorrow. They will shape not just the science, but the impact and application of the biosciences. Unless they have been well taught how to reflect and act ethically and how to think about brand new moral questions raised by new applications of bioscience, then the world will be a risky and dangerous place and science a new pariah. ■

Dr David Cook
Green College, Oxford
david.cook@green.oxford.ac.uk

THE STANFORD RESEARCH COMMUNICATION PROGRAMME: A CASE STUDY OF BETTER INTEGRATING RESEARCH IN THE TEACHING ENVIRONMENT

A common tension with university faculty is balancing a teaching load with a research agenda. What if these responsibilities were better integrated, or the tensions between them reduced? What if undergraduates were exposed to researchers speaking in an understandable language about their studies? What might the effect of this be in fostering cross-disciplinary communication between researchers, enhancing learning in the classroom, and informing the general public?

SPURRED BY THESE QUESTIONS, AN idea was born at Stanford University. In 1999, a pilot group of thirteen PhD students would attempt to write brief, clear, and compelling statements about their research to share in introductory undergraduate classes. Three years later, the Stanford Research Communication Programme has developed and refined a process and curriculum that builds upon this experiment.

The programme's primary offering is I-RITE, where participants from all disciplines create 750-word statements that describe their research and why it is important in a larger context. The statements must be clear and compelling to 17 year-old students (generally US high school senior/university freshmen), which, in turn, can reach a broader audience.

The core I-RITE programme is a six-week experience conducted mostly online, with supplemental face-to-face meetings. Participants create and revise their work many times over the course of the workshop with help from peers in different disciplines and external reviewers: communication researchers affiliated with the National Communication Association, and undergraduate students. The undergraduates are of particular interest, as they review I-RITE statements in mandatory first-year writing courses at Stanford. By bringing draft research statements to the classroom, students learn the basics of critical reviewing, and begin to understand what constitutes research in a wide variety of disciplines at the PhD level and beyond.

I-RITE is continuing to build on its core programme with modules that integrate oral components codenamed I-SPEAK, and the ability to include figures or diagrams with the written statement.

I-RITE's success is evidenced by participation from over 200 undergraduates, PhD students, postdoctoral researchers, and faculty from institutions in the United States and Sweden. I-RITE also receives financial support from a broad range of disciplines within Stanford: the Schools of Earth Sciences, Engineering, and Humanities & Sciences; the Graduate Fellowships Programme; the Center for Teaching and Learning; and the Center for Innovations in Learning. The Wallenberg Global Learning Network has also provided initial support for participation in Swedish universities.

Another pilot project of the Research Communication Programme was *Odyssey*, a magazine created by undergraduates that featured completed I-RITE statements, combined with in-depth interviews of programme participants and other researchers. During the Spring of 2002, *Odyssey* secured sufficient advertising to produce 1,500 copies distributed across the Stanford campus, and to major US research universities. One can imagine similar projects could be undertaken in undergraduate journalism or communication courses.

Participants not only use statements in the classroom for teaching purposes, but also as a basis for job talks, grant proposals, and other instances where communicating work to the general public is useful.

For the future, the Research Communication Programme plans to create an organisation that will allow institutions in the US to implement versions of I-RITE. Proposed plans include creating a package of participant and instructor materials for use in workshops, provide instructor training programmes and certification, and showcase best practices from participating institutions. The programme also hopes to expand to countries in Europe; if any institution in the UK is interested in piloting a trial version of I-RITE or using some of the teaching applications in the classroom, do not hesitate to contact the author. ■

Carolyn Gale
Stanford University, USA
cgale@stanford.edu

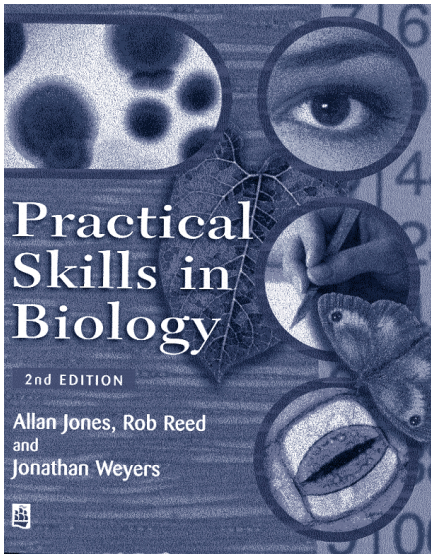
SPECIAL INTEREST GROUP – PRACTICAL WORK IN THE BIOSCIENCES

The LTSN Centre for Bioscience has set up a Special Interest Group (SIG) looking into Practical Work in the Biosciences. The Co-ordinator is Allan Jones from the University of Dundee.

MY INVOLVEMENT AS CO-ORDINATOR of the LTSN Bioscience Special Interest Group (SIG) on Practical Work in Biosciences is a consequence of many years of interest and involvement in practical work ranging from laboratory work to field courses, and from protocol-dominated activities to independent project work. These activities stimulated the development and co-authoring of the *Practical Skills* series of textbooks published by Pearson. This now includes separate titles on Biology, Biomolecular Sciences, Environmental Science (which includes ecology) and Chemistry. Through my work with this SIG, I wish to facilitate and develop discussion and debate about the many problems facing practical work in the Biosciences and to help promote the dissemination of good practice and thoughtful implementation and assessment of practical work.

We are all faced with increasingly difficult situations with regards to decreasing curriculum time and available resources for practical work. In particular, fieldwork activities have become increasingly difficult to sustain in the face of a diminishing unit of resource and the increasingly common requirement for students to pursue paid employment. At the same time, the cost of practicals and project-work in many areas of the modern curriculum has become almost prohibitively expensive. We have also to cope with increasingly large class sizes, with the inevitably increased costs, and an increased diversity of the student population in terms of both pre-university experience and modular backgrounds. The nature of secondary-level (high school) practical work has changed, and continues to change, in both character and quantity, e.g. there has been a general reduction in the use of animal materials in most curricula. This significantly affects the assumptions that we can make, and our expectations, when designing a tertiary-level practical curriculum but, in my experience, these changes have not been sufficiently recognised and allowed for when developing practical work in the biosciences.

The SENDA (2001) [Special Educational Needs and Disability Act (2001) DDA part IV] legislation will also require new thinking about the accessibility and validity of our practical activities. This would seem, therefore, to be a particularly good time for the LTSN Centre for Bioscience Centre to be setting up this SIG as



we are facing considerable challenges that will require both new thinking and new approaches to the roles and functions of practical work in the biosciences.

Bioscience is a term incorporating a disparate collection of sub-disciplines, each with their own perspective on the place and value of practical work within the curriculum. This will provide a significant part of the challenge for this SIG where the aim is to represent all aspects of the subject area. Whilst not wishing to fragment the activities of the SIG and lose the benefits of cross-subject interactions, it is our intention to organise resources such as the *Compendium of Bioscience Practicals,* supervised by Jackie Wilson (Project Officer), according to either the sub-discipline and/or the pedagogical topic wherever this will assist the reader: cross referencing will be used wherever possible to maintain the integration of the site. The *Compendium* is an important resource associated with this SIG and its specific aim is to encourage and enable the sharing of ideas, experience and good practice in bioscience practical classes. For the latest news on that project, or to contribute material to it, please visit our web site at *http://bio.ltsn.ac.uk/resources/bioscience/compendium/index.htm.* I would ask that you seriously consider contributing to this particular resource.

The current aims and objectives for this SIG are summarised below. They are to…

- collect and disseminate good practice through the *Compendium of Bioscience Practicals* and through the organisation of appropriate symposia, the first of which *Personal Transferable Skills and Practical Work – Problems and Strategies* is being planned for 7 November at the University of Leeds;
- encourage and promote the development of cost-effective practical activities – have you designed any practicals that are effective and yet have a relatively small cost requirement? We need you!
- identify interested persons and their areas of expertise / interest. We are compiling a list of those who have expressed particular interest in this field and it is hoped that they will receive email updates, notification of events, activities, etc on a regular, but not excessive, basis;
- facilitate discussion of the functions of practicals (experimental, observational,

fieldwork, procedural, manipulative, virtual, C&IT, etc). It is hoped that synchronous and/or asynchronous discussions will be facilitated on key topics.

- identify and disseminate information on what works and what does not!
- commission discussion papers on key topics for publication on the web site – but if you have a particular interest in a 'hot' topic and would be prepared to write a discussion paper for our web site, please let the team know.
- encourage debate about strategic approaches to practical work (preparation, group-work, assessment, curriculum development, etc)
- facilitate informed discussion on important and often sensitive aspects of practical work such as the use of dissection and the ethics of experimentation;
- discuss and disseminate good practice with regard to disability and practicals / fieldwork;
- discuss the incorporation and integration of Personal Transferable Skills (PTS) into the practical curriculum;
- facilitate discussion of the problems of assessing practical work within the concept of constructive alignment of the curriculum; and
- discussing the particular question of the role of peer and self-assessment in practical work.

These activities will be developed mainly through:

- the web site pages;
- meetings to be held at sites in both the north and south of the UK;
- development of discussion areas within an asynchronous or synchronous chat room context;
- commissioned 'expert' discussion documents to stimulate debate on particular topics; and
- the *Compendium* collection of practical work *(http://bio.ltsn.ac.uk/resources/bioscience/compendium/index.htm).*

I am very keen to develop interactions with other interested persons so if you have any comments or suggestions, please contact me or the LTSN Bioscience team. ■

Dr Allan Jones
Life Sciences Teaching Unit
University of Dundee
a.m.jones@dundee.ac.uk

ECOLOGICAL PROJECT COMPENDIUM

The British Ecological Society is developing an innovative on-line resource for lecturers and others teaching ecology in Higher Education. The project is currently accepting contributions of successful practical exercises in ecology ranging from examples of student-centred learning and project case studies to more lecturer-directed activities and effective strategies for dealing with large student groups. If you would like to submit work for publication, instructions for authors and more details about the project are available on-line (at *www.britishecological society.org*). The Compendium is also seeking suitably qualified individuals to referee submitted work for the quality of the science and the pedagogic approach. You do not need to be a member of the British Ecological Society to contribute to this new resource as an author or as a referee. If you would like to find out more please contact the Managing Editor, Jac Potter, at j.potter@chester.ac.uk

GUIDANCE FOR STUDENT PROJECTS

When conducting final year research projects, the level of guidance and assistance that students receive can vary considerably. Guidance for Student Projects (GSP) is an online learning resource to assist students with the planning, execution and presentation of research projects (*http://bio.ltsn.ac.uk/hosted/gsp/introduction.html).* This resource is targeted at undergraduate students in the biological sciences who are expected to undertake final year research projects. However, the content should be more widely applicable to MSc and PhD students, and to other disciplines.

One of the strengths of GSP is its breadth of coverage of issues that arise during student projects, from the selection of a research topic, the assessment criteria used for dissertations, advice on experimental design and data presentation to the formatting of research reports. The major topic headings in GSP are: dissertation assessment; project management; literature review; experimental design; data presentation; and compiling the report.

Within each of these topic headings a number of relevant issues are presented. So, for example, the section 'Project Management' contains suggestions and advice on how student and supervisor should interact, how to plan and schedule a project (including a detailed case study), and highlights important transferable skills (e.g. time management, computing and information management).

Throughout the website, we provide advice and guidance from our own experience as project supervisors and researchers e.g. see the list of common problems in 'project management', 'data presentation' and 'compiling the report'. We provide numerous hyperlinks to websites and references to literature that provide quality learning resources for student researchers.

Funding for GSP was provided by an LTSN Bioscience Teaching Development Fund grant.

Dr John Finn
Teagasc, Republic of Ireland
jfinn@johnstown.teagasc.ie

Dr Julian Park
University of Reading
j.r.park@rdg.ac.uk

feature

NUMERACY SKILLS DEFICIT AMONG BIOSCIENCE ENTRANTS

THERE IS GROWING concern that many entrants onto bioscience degree programmes lack the skills that, according to the Government, define a 'numerate individual'. This, despite the fact that most, if not all, possess at least grade C in GCSE Mathematics, and many possess a higher mathematics qualification (e.g. AS- or A2-level Mathematics).

In contrast to the Government's definition of a 'numerate individual', many bioscience entrants:

- fail to recognise why numbers are important and have a limited sense of the sizes of numbers and where they fit in the number system;
- lack confidence in their ability to deal with basic mathematical concepts, arithmetic and algebra;
- are unable to calculate accurately and efficiently without the aid of a calculator;
- do not possess strategies to check whether their answers are reasonable; and
- are unable to manipulate numbers and equations, to convert between units of measurement, and to explain and make predictions from data presented in graphs, charts and tables.

Reasons proposed for the perceived decline in numeracy skills include:

- changes to GCSE and A-level Mathematics curricula in the 1980s and 90s;
- an over-reliance on the use of calculators and computers for simple calculations; and
- students' lack of confidence in, and irrational fear of, anything numerical.

The Government's National Numeracy Strategy is attempting to address some of the above through proposed changes to the teaching of mathematics in schools and via initiatives aimed at creating a climate of greater support and encouragement for parents and children at home, as well as within the wider community. However, higher education is unlikely to reap the rewards, if any, of such policies for another five to ten years. Nevertheless, in an initiative that may yield more rapid returns, teachers and academics have united to provide a single voice in advising the Government on mathematics curricula, assessment and the training and supply of mathematics teachers. The Advisory Committee on Mathematics Education (ACME) is an independent committee, chaired by Sir Christopher Llewellyn Smith and based at the Royal Society.

In the shorter term we will continue to be confronted with the problem that we can no longer assume that our entrants possess the necessary base level of numeracy skills upon which tertiary bioscience programmes of study aim to build.

So, what are our options? Raising our entrance requirements to include AS- or A2-level Mathematics is simply not feasible and may prove futile given growing concerns about assessment policies and declining standards at GCSE, AS- and A-level. Adopting strategies aimed at improving entrants' numeracy skills is one option that includes:

- offering summer courses prior to or following entry to undergraduate programmes, or one-year foundation modules that cover specifically the mathematics required by the biosciences;
- using the results of diagnostic tests (paper- or computer-based) to organise revision classes or tutorials;
- encouraging the application of mental calculation and the more appropriate and effective use of calculators;
- providing drop-in 'surgery' facilities where staff can help with students' acute problems of understanding;
- organising tutorial support, either within or outside subject-specific modules; and
- providing access to self-help and independent learning resources (e.g. self-instructional texts, computer-based learning packages, and web sites).

Whatever strategy(ies) you adopt, be prepared for a challenge! Many students do not appreciate the limitations that numeracy skill deficits place on learning in the biosciences and often resent any time spent explicitly on basic numeracy skills. And do not forget those high achievers who may feel disenfranchised by your attempts to cater for the low achievers. ■

Dr Vicki Tariq
School of Biology and Biochemistry
Queen's University Belfast
v.tariq@qub.ac.uk

RESOURCE STARTER PACK

We have put together an introductory resource pack, including a quick guide to LTSN Bioscience, an annotated list of useful online sites for bioscience educators, a bioscience learning and teaching bibliography and a list of bioscience education journals. Copies have been sent to Staff and Educational Development departments in the summer; those that requested copies for distribution should have received them in early September (copies can still be ordered from: ltsnbioscience@leeds.ac.uk). The pack can also be found on our web site *http://bio.ltsn.ac.uk/resources/bioscience/publications/index.htm.*

WIDENING PARTICIPATION

IF YOU HAD NOT ALREADY noticed from the volume of coverage in the media and from wider debate about the role of Higher Education widening participation is now the key policy priority facing us all.

It is an issue which impacts on all levels of HE; the sectoral, the institutional, departmental and discipline, the individual – staff and students. It is an issue which generates considerable debate, some of it misinformed and prejudicial (such as the contrasting myths that 'more means worse' and 'universities are elitist'). It is also an issue which is essentially non-negotiable – clearly HE should be more socially inclusive and in a world where public funding is now driven by the 'something for something' credo, additional funds will only be forthcoming if HE does become more socially inclusive.

Our sector now has clear targets for both increasing the level of participation to 50 per cent of 18–30 year olds by 2010 and for widening the social profile of students while maintaining our traditionally high rates of student success (student retention) and standards of educational provision. These are challenging targets and universities and colleges will be faced with delivering specific targets in these areas over the next year or so. Therefore, departments, subject communities, course teams and individual academics will all be involved in some way in helping to deliver this key dimension of higher education.

Where does one start? Clearly, it will depend on factors such as where you sit in the institution, your institution's and/or department's mission, your institution's student profile, your geographic location, the trend in student recruitment and entry qualifications. The factors are numerous and vary widely and there is no single and comprehensive approach to addressing this issue. However, useful models are emerging which allow appropriate interventions and strategies at the departmental and subject level. One such model is to consider widening participation strategies in terms of the student lifecycle.

ASPIRATION RAISING

What can you do to raise the aspirations of future students currently in schools and colleges, particularly those in disadvantaged areas? The future supply of students from disadvantaged backgrounds can be driven by greater involvement of HE staff and undergraduate students working more closely with schools to improve the levels of attainment and raise aspiration levels of many who otherwise would not consider a future at university.

PRE-ENTRY AND ADMISSION

Schemes such as summer schools and preparatory programmes can boost many students' ability to acquire the appropriate entry requirements for many courses. Similarly, taking a broader view on the nature of qualifications and experience of prospective students may be required.

FOCUS ON YEAR 1/ FIRST SEMESTER

This is the time when most students drop-out. Look closely at the design of the course and how it is delivered, and the academic and pastoral support that is provided

ON COURSE PROGRESSION

Are non-traditional students provided with sufficient and appropriate support throughout their progression? Are appropriate assessment approaches being developed and utilised? Is the pedagogy, the course design and the learning styles encouraged suitable for a diverse student population?

These are just some aspects of the student life-cycle which could be used to make the widening participation agenda manageable, meaningful and workable. Your focus could be at one stage or several.

There is also an abundance of assistance available to provide you with ideas, good practice, means of sharing experience and how to secure the changes necessary to make your widening participation strategy work – LTSN Bioscience is a gateway to some of this. ■

Cliff Allan
LTSN Programme Director
Cliff.Allan@ltsn.ac.uk

ESCAPE...

... attend one of our forthcoming Professional Development Programme events for opportunities to discuss particular aspects of bioscience learning and teaching, share problems, experiences and develop ideas and solutions with like-minded colleagues.

23 October
University of Birmingham
Diversifying Assessment for Effective Student Learning

7 November
University of Leeds
Personal Transferable Skills and Practical Work – Problems and Strategies

28 November
University of Newcastle
Exploring Tools for On-line Assessment – a whistle-stop tour for busy bioscientists

Registration for these events is free and you can now register on-line at: *http://bio.ltsn.ac.uk/events/*

IMAGEBANK NOW OPEN

The LTSN Bioscience Imagebank is now online at *http://bio.ltsn.ac.uk/imagebankuploads* and is looking for images to populate its database. Users are able to search for images based on keywords or browse within a wide range of bioscience subject areas. Images are then 'downloadable' along with a descriptive text provided by the contributor. If you wish to contribute images, please contact us at imagebank@ltsnbio.leeds.ac.uk

TLRPs FOR TEACHING

FOR HARD-PRESSED LECTURERS, MAKING software available for direct student access via a distributed network seems an easy way to provide a teaching resource. However, if this is all that is done few students use the material and those that do are usually the better students rather than those who need the help. One piece of software provided in this way was used by only 12 per cent of the students on a module. Increased utilisation results if software is properly integrated into the course and the way this is done can greatly influence the student's perceived value of the software. For example, software was provided together with a workbook completion of which was a required and assessed part of the course; student approval = 90 per cent. The same software provided with MCQs which had to be completed in pairs and a joint submission made and marked; student approval = 78 per cent. When the software was just shown in a lecture and provided on the intranet; student approval = 59 per cent and when simply made available on the intranet, student approval = 46 per cent. The data are indicative that 'it is not what you have got – its how you use it' that matters. To draw and analogy with a laboratory, we do not say to students, *"There's a laboratory, go and do something in it."* A practical class is linked to concurrent lectures, is assessed, requires a write-up and contributes to the final mark awarded. Similarly, software should be properly integrated into a module.

However, the production of the ideas and materials to achieve integration is very time consuming and to overcome this difficulty TLTP project 83 (Implementing technology-based teaching and learning in Pharmacology) has developed Teaching and Learning Resource Packs (TLRPs) which enable specific pieces of software to be implemented in courses with only minor time commitment from staff.

THE TLRPs

Since it is the development of supporting material to integrate technology-based teaching into courses that takes time, expertise and innovation from teachers, it is this material which forms a TLRP. The material in a TLRP may require students to:

- produce a glossary;
- design a poster or produce a web page;
- complete a crossword;
- provide a drug or disease profile; and
- complete a work-book;
- set or complete a number of MCQ or EMQ;
- label a diagram;
- fill in missing words in text;
- deal with problem based learning exercises;
- or track through event scenarios.

The TLRP may contain student schedules and answers/explanations and marking schedules at different levels and for different types of student. The material is provided for teachers to use selectively as appropriate with their students. It is provided without copyright restriction and can therefore be freely changed and adapted to meet local needs. TLRPs supply to teachers a choice of editable wrap-arounds to integrate a software package into a module.

Staff developing TLRPs commented that they enjoyed collaboration with colleagues and enjoyed the intellectual challenge. Each TLRP took on average 70h to put together though the development time is shortened with experience. Staff using TLRPs did so because they needed to use new teaching methods and materials to cope with the pressures on teaching and had limited skills or time available. They were very positive about the resulting teaching sessions and were convinced that using a TLRP produced a big reduction in time needed to prepare the required student support materials. For example, preparing material to enable students to use a simulation package was estimated to take 8-10 hours but took only 2 hours using a TLRP. Similarly, a problem based learning scenario would have taken 30 hours to develop but was completed in 3 hours; a case study estimated to take 60 hours took 2 hours and a work book estimated to take 32 hours took 0.5 hours.

Some 19 TLRPs are available from the British Pharmacological Society (*www.bps.ac.uk*). These contain pharmacological material though some may have generic applicability (e.g. on production of posters or on writing good dissertations).

FUNDING OFFER

The LTSN Centre for Bioscience will consider bids for funding from groups of teachers who would like to develop TLRPs appropriate to our discipline community. If you have ideas on how to integrate software or new teaching methods into courses come and talk to us - you could produce a TLRP. ■

Professor Ian Hughes
Co-Director LTSN Centre for Bioscience
i.e.hughes@leeds.ac.uk

LTSN BIOSCIENCE WEB SITE

The LTSN web site has been significantly re-organised recently. Users should find the new site easy to use and navigate. The content is divided into easy to remember sections e.g. *http://bio.ltsn.ac.uk/resources* or *http://bio.ltsn.ac.uk/events*. You can also find information about our special interest groups (http://bio.ltsn.ac.uk/network/sigs), funding opportunities (*http://bio.ltsn.ac.uk/opportunities*) A site-wide search is included in each section. We hope you like the changes and look forward to your next visit.

GRADUATES IN INDUSTRY – HIGH PERFORMANCE TEAMWORK

Today's bioscience graduates form a major cornerstone of the pharmaceutical and biotechnology industry and will become tomorrow's pioneers of major scientific breakthroughs and exciting new medicines. To achieve this goal, bioscience graduates need to be able to contribute sound biological knowledge, problem solving, and creativity, within a team structure, to drive the discovery and development of new products and services. The person should be flexible, have a willingness to learn new techniques and be a good communicator.

THE BIOSCIENCE GRADUATE IN industry today, enters an unparalleled and rapidly evolving world of exciting challenge and opportunity. In the pharmaceutical industry for example, drug discovery is a long and complex process, which often takes more than 10 years from initial concept to the delivery of a safe and effective new medicine to the market. For the last 20 years, the process has followed a flow scheme of medicinal chemists synthesising new molecules that are then tested in primary (binding, etc), secondary (usually a functional test) and finally tertiary behaviour or disease models. However, in the last 5 years the technologies associated with genomics, genetics, automation and imaging are generating increasing quantities of experimental information from human and animal cells and tissues. This complex and interrelated information is contributing to the understanding of disease and the discovery and development of new medicines for major world problems such as cancer, heart disease, diabetes, and infectious diseases.

Unlike cystic fibrosis which is caused by a single gene defect, most disease processes are multi-factorial. For example, analysis of normal and diseased human tissue samples indicates that a malfunction of more than 100 genes leads to the initiation of heart failure. Consequently, we need to utilise all our skills in biochemistry, cell biology, pharmacology and physiology and to integrate this with genomic and genetic information to understand the 'big picture' relating to health and disease.

Once a target is identified, it is common to clone and express the receptor in a cell and to develop a high-throughput screening assay to test large numbers (500,000+) of compounds. Rapid parallel chemical synthesis is often employed so that the number of compounds made and tested for each project is much higher than a decade ago.

In common with many employers, we in the pharmaceutical industry are looking for graduates who not only have a good quality scientific training but can also apply this knowledge in the workplace. Scientific understanding must be combined with practical skills in the generation and analysis of data. An ability to make rational decisions based on the available information is key – as is the ability to effectively communicate these views to colleagues in other disciplines.

The importance of the ability to carry out and interpret experiments in complex biological systems cannot be underestimated. The rationally designed, carefully controlled relevant experiment, using appropriate and meaningful technology and analysed using state-of-the-art IT tools, is the cornerstone of the decision making process required to select drug targets and potential drug molecules. At the same time, good skills in written and verbal communication are important. Colleagues inside and outside the immediate team need to be able to use the data and new concepts developed, either to move projects forwards or to terminate them. In many ways these 'transferable skills' are as important as the scientific ability of the candidate.

An employer will want to see all of these skills demonstrated at interview. For this reason, group exercises and psychometric tests are frequently used to supplement technical interviews. Employers want to recruit scientists who will have the confidence to question assumptions and challenge accepted dogma in order to build new insights. In addition, the bioscientist of today needs strong determination and tenacity to explore new avenues, to develop new ideas and to understand and apply new information, concepts and strategies.

One of the best opportunities for students to develop these desired skills during an academic course is through participation in project work, ideally in relatively complex biological systems. This creates an opportunity to generate and analyse data and develop ideas and concepts. Project work also allows the student to gain a deep understanding of a particular aspect of biology, read and summarise the literature, and put their new data in the context of earlier work. It is important to be able to integrate taught information with experimental observations and to demonstrate, with real examples, key skills in thinking and understanding that can be evaluated at interview. Initiatives like sandwich courses, student placements and employer links are important in providing an awareness of the issues facing industry. These activities also expose the student to the use of new technologies and to working in the context of relevant health and safety working practices.

In conclusion bioscience graduates need the opportunity during their courses to apply their theoretical knowledge in a practical setting, thus gaining an insight into the complexity of biological organisms. Only by doing this can they hope to develop those vital skills that will allow them to become effective contributors to high performance teams. ■

Martin Todd
AstraZeneca Pharmaceuticals
Macclesfield, UK
Martin.Todd@astrazeneca.com

COMPUTER-BASED FORMATIVE ASSESSMENT WITH WEBOL LITE

FORMATIVE ASSESSMENTS ARE designed to aid learning primarily through encouraging participation, guiding efforts, enabling progress to be checked and practising for summative tests. This can be achieved through traditional means but some of the pedagogic advantages of formative assessment by Computer-Based Assessment (CBA) are:

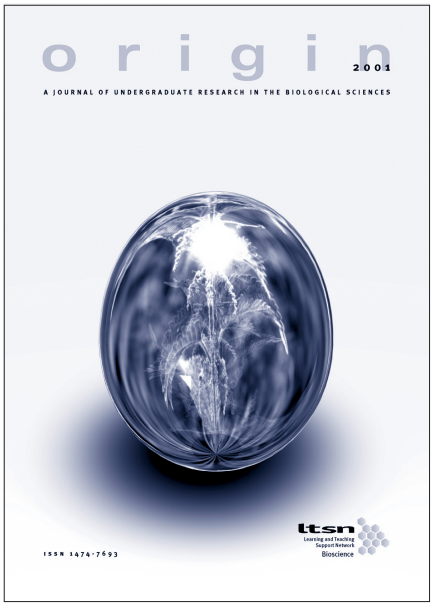
- repeatability
- immediate feedback
- consistent marking
- increased diversity of assessment styles
- flexibility of timing & access to assessments
- increased range of design options for questions

Three factors that can limit the introduction of formative CBA are (i) time to construct the assessments and support materials; (ii) the availability of easy to use software tools, and (iii) support by the institution.

WebOL Lite was produced using a LTSN Bioscience Teaching Development Fund grant and is designed to address these issues. Students using the software do not have a steep learning curve. At a workshop at the Association of Science Education (ASE) 2001 participants with no previous experience of WebOL were able to construct an assessment in under an hour. Questions and web pages within an assessment can easily be utilised in other assessments. The software is free and can be easily obtained (*http://bio.ltsn.ac.uk/resources/bioscience/projects/tdf*) and installed by an individual user or by an institution. WebOL has built in help so that it does not require any formal support from an institution. An exception is when projects are to be delivered over the Internet or a local area network (LAN) when the project files need to be put on an internet or LAN server respectively. However, WebOL simplifies this task through maintaining all of the files for a project in one directory ready for distribution.

WebOL is a flexible tool for creating assessments and courseware that can be distributed through a variety of media – Internet, LAN, CD-ROM, floppy disc, etc.

Ray Harper
Department of Sport, Exercise & Biomedical Sciences
University of Luton
ray.harper@luton.ac.uk



ORIGIN

ORIGIN IS AN IN-HOUSE JOURNAL developed in 2001 to publish representative examples of undergraduate research by Biological Science undergraduates at Chester College. The potential for excellent undergraduate research to be published in professional journals and reach an academic audience already exists for a very few students however, there is much of value in the work that is not of this calibre. For example, other students may benefit by being able to see examples of achievable best practice and may be able to build on earlier work published in *Origin*. External organisations that support student research by allowing access to their land or facilities can be openly acknowledged. For contributing students there are the benefits of completing the full research cycle from the initial inception of an idea through to publication. At Chester 14 per cent of Biological Sciences students go onto further discipline-specific study and this extended research opportunity to contributors was a major driver in developing *Origin*. This view seems vindicated. One of last year's authors was informed at an interview for a place on a competitive, vocational Masters programme, that her achievement in *Origin* contributed to her acceptance on the course.

In addition to the informal feedback from students and staff, a major part of developing *Origin* was to evaluate both the product and the process. Among both the staff and students there has been overwhelming support for the initiative. Student authors have praised the support and structure for publication and in almost all cases have identified an increased interest in undertaking further research and science writing. Students reading the work have commented on the value of seeing work they could realistically achieve. The positive nature of the feedback has been reflected in the increased number of manuscripts submitted to the journal in 2002. The staff have also been enthusiastic: a crucial element to the success of the initiative given that the project sits outside the curriculum. The development of *Origin* has made some staff more careful in developing and supporting potential research ideas for students as they now need to consider the feasibility and originality of the work for publication in *Origin*.

You can find out more about *Origin* and look at work by student authors at the website: www.chester.ac.uk/origin or by sending an email to biology.origin@chester.ac.uk

Dr Jac Potter
Department of Biological Sciences
Chester College of Higher Education
j.potter@chester.ac.uk