CENTRE FOR BIOSCIENCE
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Supporting teaching in higher education to improve student learning across the Biosciences

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# STUDENTS WITH ATTITUDE

Students are not clean slates when they arrive at university; all arrive with differing experiences which have formed their character and attitudes, both to life itself and to learning. Talk with a group of first year students and you will soon discover that student attitudes (mental attributes that may be informed by values and experience and can be expressed as behaviours) differ widely – some *'want to be top'*, others are at university because *'everything else looked like hard work and a dead end.'* Attitudes affect how a student approaches and perceives a set learning experience, as well as the learning itself. We have all given tutorials in which some students arrived well prepared, some did not, some participated well and others did not and some left with new perceptions while others had to be woken before departure! International students add to the diversity, compare attitudes of students from the UK and China.

Student attitudes may vary widely but they are not fixed. Compare the unquestioning 'don't mark a friend down' often seen in first year students with the greater willingness to make critical judgements about other students' work by year 3. Tutors who run an industrial year will be familiar with the wholly changed person who arrives back at university after a year of work experience with fundamentally different attitudes.

As university teachers we now recognise that subject knowledge (academic excellence in the discipline) and subject-specific skills (in the lab) are not the only deliverables from a course but that generic knowledge (e.g. ethics, sustainability, finance) and generic transferable skills (e.g. communication, time management, negotiation) are also important. However, if job adverts are anything to go by then graduate attitudes are also of great importance to employers.

*'... Interested, enthusiastic and flexible graduate...'* and *'...keen, motivated and ambitious individuals...'* are frequently encountered phrases and the words *'dedicated, passionate, self-starter, energetic, systematic, committed'* abound.

These largely represent, or at least derive from, attitudes and encompass such things as *'can-do'*, flexibility, confidence, self-belief, enthusiasm, ambition, integrity, never-say-die, professionalism, doggedness (though I understand I have to be careful with this last word!). These are the Cinderella aspects of employability which we have not addressed effectively, in part because they are in the *'too difficult box'*. For example are we clear:

- *What exactly is an 'attitude'?*
- *Whether there are 'good' and 'bad' attitudes?*
- *How important are they to learning, graduates and employers in bioscience?*
- *If we should be involved at all in forming or changing attitudes?*
- *If so, how do you measure/assess them?*
- *How do you teach/change them?*

This is a *'touchy-feely'* area and many bioscientists feel out of their depth dealing with the fundamental beliefs, cultural and racial differences which may influence attitudes. Yet the importance of attitudes has long been recognised in medical graduates and to quote from *"Tomorrow's doctors"*, *'attitudes and behaviours that are suitable for a doctor must be developed'*. While this is directed towards outcomes at graduation I would argue that early development of appropriate attitudes in bioscience students during a course will enhance their learning as well as better prepare them for the real professional world into which they will move.

As one graduate put it *"After 3 months I decided I was going to get no help so I'd better just get on with the job. With this change in mental attitude things moved rapidly..."* It is perhaps time we got on with the job, opened the *'too difficult box'* and started to think about what we can and should do about student attitudes.

**Ian Hughes**
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**CONTENTS**



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The Higher Education Academy

CENTRE FOR bioscience

# 2 | BIOSCIENCE HORIZONS:
## A NATIONAL JOURNAL FOR UNDERGRADUATE RESEARCH IN THE BIOSCIENCES

Undergraduate research is commonly carried out as part of final year research projects. Some of this research is published in peer-reviewed journals, however a considerable amount of high quality undergraduate research remains unpublished. There are good examples of institutional undergraduate journals in the Biosciences, such as Biolog-e (University of Leeds, *http://www.biolog-e.leeds.ac.uk/*), Origin (University of Chester, *http://www.chester.ac.uk/origin/*) and Burn (University of Nottingham, *http://www.nottingham.ac.uk/~sbzml/*). Following the success of these journals a working consortium met in 2005 to explore the possibility of launching a National Journal for Undergraduate Research in the Biosciences with the broad aim of strengthening teaching-research links within and across universities.

Following this meeting a survey of Bioscience teaching staff was undertaken in June 2006 to which 63 people responded. A large majority thought the journal was a good idea, although there were some very negative views. Some colleagues were concerned about the actual details of submission and the practicalities of getting the journal up and running. Examples of positive comments included:

*"This initiative is to be applauded. The opportunity for undergraduates to see their research in print should help to encourage the next generation of scientists, and raise the bar for existing projects.*

*I think such a journal would inspire UG students carrying out their projects and act as a benchmark of quality for UG projects nationwide."*

On the basis of the support received from the survey and with support from Oxford University Press (OUP) the first pilot on-line edition of the Bioscience Horizon journal (BHj) will be produced in the academic year 2007/08, the aim being to produce two on-line editions in the year with approximately 10 articles in each. The objectives of the journal are:

- To promote the link between teaching and research in Higher Education;
- To provide a repository of high quality undergraduate research which will be useful to other students and staff;
- To provide a forum for students, their supervisors and universities, to showcase high quality undergraduate research work; and
- To illustrate the student skill base to prospective employers.

The journal editorial board, comprising of representatives from a consortium of universities, is seeking contributions from Bioscience departments by 16th July 2007. We hope that Bioscience Departments will engage with BHj and submit papers reflecting high quality assessed student research for inclusion in the journal. Submissions must be approved by departments in which undergraduates are studying (have studied), and the journal will not accept submissions directly from students without written approval from their department. Detailed guidelines for authors are available at *http://biohorizons.oxfordjournals.org* It is envisaged that departments will effectively provide the first stage of the peer review process by submitting only high quality articles from assessed work. It is envisaged that submissions will be based on final year research projects, but that these will have been re-written by the student (with guidance from their supervisors) into concise research papers of no more than 5000 words. On receipt of submissions the journal editorial board will send suitable articles out for review prior to acceptance (or not) and publication.

The consortium recognise that there are still many issues to be resolved before the Journal becomes an established resource but this pilot project with OUP will provide clear guidance as to whether a National Journal for Undergraduate Research in Biosciences is a sustainable proposition. Colleagues requiring further information should contact the editorial team, *biohorizons@leeds.ac.uk* or visit the website at *http://biohorizons.oxfordjournals.org*

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### BIOSCIENCE EDUCATION E-JOURNAL VOLUME 9

The articles below are available on our website at *http://www.bioscience.heacademy.ac.uk/journal/vol9/*

- A Tool for Mapping Research Skills in Undergraduate Curricula
- Improving the Effectiveness and Efficiency of Teaching Large Classes: Development and Evaluation of a Novel e-Resource in Cancer Biology
- Attitudes to Teaching Ethics to Bioscience Students: An Interview-based Study Comparing British and American University Teachers
- Assigning Level in Data Mining Exercises
- 'You Have 45 Minutes, Starting From Now': Helping Students Develop Their Exam Essay Skills
- Educational Research: Biologists Finding Their Voice
- Perspectives on Self-Directed Learning — The Importance of Attitudes and Skills

We also invite submissions for volume 10, see the web site for further information, layout, and submissions guidelines. *http://www.bioscience.heacademy.ac.uk/journal/*

# DO SCHOOL CURRICULUM PRESSURES PREVENT INDEPENDENCE?



As an undergraduate, one of my overriding memories of university life was the enormity of the library. The change from our school library (which was a well stocked building in a good, all boys, grammar school) was very significant and what is more, the shelves were full of journals. As with many undergraduates, I entered university not knowing what a journal was, and I did not use or rely on journals until later in my university course. Of course, I studied for my BSc and PhD in the pre-Google (BG) and pre-Web of Science days, where inter-library loans were heavily relied upon if the library did not hold the journal I was looking for. Today, the Google generation undergraduates can type in a few key words and be presented with over 1.2 million hits, including a full electronic copy of the paper they are looking for. With the introduction of the *"dumbed down science GCSE,"* what literacy skills will future students enter university with?

As a biology school teacher, I would defend the recent statements regarding the lack of independent research skills and the lack of importance schools are placing on this aspect of science. However, from my experience I feel that the skills and the teaching of these skills within science is patchy. Whilst our brightest triple A students will always be independent in their approach to learning, we should be aware of the drive to involve more students at post 16 study and the larger spread of ability that this may bring. Additionally, the level of student support seems to be increasing which may include after school support lessons, more intense marking, more regular reporting to parents and/or extra revision sessions. Whilst all of this added assistance helps our students to reach their potential, are these extra support measures actually counter-productive?

A former teacher at our school, who sadly was rather incompetent and whose classroom management left a lot to be desired, actually achieved reasonable results with a class of GCSE students. Why? Because the students realized the need to take responsibility for their own learning and they sought to do the work in their own time. Of course this approach to teaching would be ill advised and far less successful with less able students, but it does demonstrate that the more support schools offer, the more help students accept and therefore the less independent they become.

The term *"independent"* means *"to think or act for one self"* (as defined by Google). In terms of learning, it is perhaps synonymous with the phrase *"I am self taught."* It is a goal that we have for our students and it will allow them, should they come to university, to fully assess their own understanding and seek to fill the gap in their knowledge through private study. However, with the wealth of information that the Internet now presents which is largely not peer reviewed and in cases it may be incorrect, even those students who attempt to find out for themselves may not do so correctly. Therefore the term Information Literacy (IL) is becoming the new buzz word in schools. It is defined, once again by Google, as *"the ability to locate, organize, manipulate, synthesize and evaluate information"*. Several key skills therefore, are needed within this one field. It is the latter skill that is perhaps the most important now that students have access to such wealth of information.

Development of information literacy skills comes from the reincarnation of the classic school projects, such as *"the Romans"* or *"the birds in my back garden"* etc. However, once a relevant topic has been chosen there is a focus on each of the key skills of locating, organising, manipulating, synthesizing and evaluating. It is becoming more common, however, to focus on one skill to ensure the students fully understand what is required of them. Given full independence, students may succeed in locating and organising the information, but completely fail to evaluate it. Therefore a project based on Global Warming could concentrate on the evaluation of five different websites and their competing viewpoints, rather than simply asking the students to research and write a report on global warming. Using this approach, students not only develop a skill e.g. evaluation, but also learn about the process of global warming at the same time.

Information Literacy skills are now more formally included in the new science GCSE course, particularly with regard to the more controversial scientific developments. However, it remains to be seen whether the assessment of these skills are more formally examined. Currently it seems that the assessment of scientific practical skills has improved and certainly student's knowledge of practically investigating a scientific question appears to be improving. However, whether new teaching approaches embrace information literacy skills or push these to one side in favour of more structured, short term grade improving lessons, remains to be seen.

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## CETL BOOKLET AND LEAFLET

Two new publications from the Centre aim to raise awareness of CETLs (Centres for Excellence in Teaching and Learning) within the bioscience learning and teaching community. The leaflet brings together brief descriptions of those CETLs with a bioscience focus and the booklet provides a more comprehensive introduction to both bioscience-related CETLs and CETLs of general interest to bioscience learning and teaching staff.

Both are available as paper copies (please contact the Centre) or electronically from: *http://www.bioscience.heacademy.ac.uk/issues/cetl/*



# 4 | EDUCATION FOR SUSTAINABLE DEVELOPMENT PROJECT

The Academy's Education for Sustainable Development (ESD) Project was initiated in January 2005. The first task was to examine the state of sustainable development related education in the HE curriculum. An audit of subject communities was carried out by a small research team working with 18 of the 24 Subject Centres, and this culminated in the 'Dawe Report' which was launched in November 2005. Entitled 'Sustainable Development in Higher Education', the report – available at *http://www.heacademy.ac.uk/esd* – provided a platform for taking the Project's work further.

In the period since the report, the Project has initiated a wide range of projects to develop resources, fund new curriculum initiatives, build capacity and strengthen networks. The Project's purpose is 'to help institutions and subject communities develop curricula and pedagogy that will give students the skills and knowledge to live and work sustainably.' This gives rise to three aims, to:

- research and support the development of ESD in the HE sector, particularly within subject communities;
- build capacity amongst individuals, subject communities and institutions to embed ESD in curricula and pedagogy; and
- assist the coordination and dissemination of policy, research and practice relating to ESD in institutions, the Higher Education Academy and the wider field.

A description of some of this work follows.

## SUBJECT CENTRES' ACTIVITY

Sixteen Subject Centres are currently actively working on ESD issues. In addition there are two funded ESD small grants in the area of Physical Sciences and Law. Examples of recent work by Centres include:

- Bioscience: survey of subject community on ESD issues, and ethics/ sustainability curriculum audit tool;
- Engineering: working with the Massachusetts Institute of Technology on the development of ESD resources;
- Education: developing a subject-specific pedagogical strategy for ESD; and
- Geography, Earth and Environmental Sciences: survey of employability skills for environmental scientists, and Skills for Sustainable Futures event.

## NETWORKING

To avoid duplication of effort and promote cooperation the project is convening informal link meetings between key institutions and agencies in the field. This culminates in a major conference for engaged Subject Centres planned for July 2007 – see details below.

- **Solo HEI Events**
  An experimental discussion day was facilitated at the University of East Anglia in 2006 [*http://www.heacademy.ac.uk/5189.htm*] to encourage a 'whole institution' discussion of the past, current and future presence of ESD within the institution, and to encourage consideration of the various manifestations and understandings of ESD. There are plans to hold more events at other selected institutions in the future.
- **Interdisciplinarity Seminar Series**
  Three meetings have been held examining the challenges posed by the coincidence of ESD and interdisciplinarity, at three different universities in the past 6 months [http://www.heacademy.ac.uk/5191.htm]. Some fifteen disciplines were represented. This approach will now be extended to other selected universities.
- **Small grant funding**
  Twelve projects from eight different HEIs and/or Subject Centres, representing 13 disciplines are being funded to develop innovation in the curriculum. The work ranges from 'Cultural Sounds and Conservation Texts: Soundscapes of a lost Montserrat (British West Indies)' to the 'Development of a Problem-Based Learning Tool to Design Micro-Generation Systems for an Eco-House'. Outcomes from the projects will be available in the summer of 2007. A small grant scheme has recently been initiated for similar projects in Scotland.
- **Resources**
  In addition, working with the Centre for Sustainable Futures at the University of Plymouth, the Project is developing generic curriculum and strategy / policy materials on ESD to encourage engagement by academics and senior management.

The Project now wishes to extend its influence, and involve and support more academics and HEIs in ESD work. To assist this end, the Project is developing its web presence and aims to become one of the principal sources of information for those in the HE sector wishing to embed ESD. The Project is very much a participative endeavour, led by a small management team to help direct and energise the Project from the centre in collaboration with Subject Centre support, advice and action.

In July, the Project is holding a national conference 'Sustainability and the Curriculum: Progress and potential' on 10–11 July 2007, at the University of Bradford. This will be an interactive event designed to explore and disseminate the work of the Project and its associated initiatives, Subject Centres and networks. All welcome – further information and booking form: *http://www.heacademy.ac.uk/events/List_5410.htm*

For further information, please go to our website: *http://www.heacademy.ac.uk/esd*, or e-mail the Project Coordinator, Heather Witham, at *sustainability@heacademy.ac.uk*

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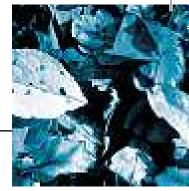



# ACCESSIBILITY RESOURCES

The number of students declaring a disability has increased from 2.6% of the student population in 1994/95 to 5.8% in 2004/05 (HESA). As higher education becomes more accessible so does the need for varied approaches to improve the learning and teaching experience for both specific groups of students and all students. As Simon Ball (2006) said; "Accessibility is a balance – an interactive media-rich resource which suits a dyslexic learner, a deaf learner and a learner with cognitive difficulties may be inaccessible to a blind student using a screen-reader." This article briefly highlights some of the resources available to help achieve that balance.

## EMBEDDING SUCCESS

Published by the Higher Education Academy, this book showcases the freely available resources produced by a range of HEFCE-funded projects. Examples include SignsOnline, a British Sign Language / English glossary for science and engineering and Premia, an online database of resources to support disabled postgraduate research students. Embedding Success can be ordered (free of charge) or downloaded from: *http://www.heacademy.ac.uk/disability.htm*

## ACCESSIBILITY ESSENTIALS GUIDES

Produced by TechDis (*http://www.techdis.ac.uk/*) these guides show how commonly used electronic documents can be made more accessible to all and demonstrate that small changes can increase accessibility. Making electronic documents more readable; Writing accessible electronic documents with Microsoft Word and Writing accessible documents with Adobe Acrobat Professional are now available, with the guide to Creating Accessible Presentations coming soon. See *http://www.techdis.ac.uk/index.php?p=3_20*

## DEVELOPING AN INCLUSIVE CURRICULUM

From the Geography Discipline Network and the Inclusive Curriculum Project, this series of nine guides is aimed at teaching staff. Guidance is given on designing a more inclusive curriculum for students with a variety of disabilities. Although intended primarily for geography teaching staff many issues are similar to those faced in the biosciences, for example making fieldwork and lab work more accessible. Similarly the information on group work, lectures and online learning is readily transferable to bioscience. The guides are available to download from: *http://www2.glos.ac.uk/gdn/icp/*. In June 2006,to demonstrate the increase in accessibility achievable with a small amount of technology provision, TechDis made funding available through the HEAT (Higher Education Assistive Technology) scheme. The following three bioscience bids were funded:

## ACCESS

(Audio Content Creation for Educational SuccesS)

Jon Scott, Alan Cann and Jo Badge, University of Leicester

Requested: Digital microphones

The School of Biology at the University of Leicester has successfully rolled out the Blackboard Virtual Learning Environment (VLE); this project aimed to increase accessibility to VLE materials through the use of audio media. The digital microphones enabled staff to record audio pieces to accompany the written materials on the VLE and to produce podcasts. There had been concern that the move to the VLE could disadvantage some students, for example those who are dyslexic; the combination of audio and written material could help to counter this and increase accessibility for all students.

## ADAPTATION OF NEUROSCIENCE AND BIOLOGY COURSE MATERIAL FOR VISUALLY IMPAIRED (VI) STUDENTS

Peter Chevins, Keele University

Requested: Tactile Talking Tablet (T3) (*http://www.rncb.ac.uk/t3/*)

The T3 technology was used to design and make bespoke practical class materials for blind and Visually Impaired (VI) students on Neuroscience and Biology degree programmes. The T3 tablet operates with A3 size, 3-dimensional, tactile diagrams which, when pressed at specific points, describe components of the diagram. For instance, a tactile diagram of a motor neurone will have spoken text associated with each of its major components enabling the student to form a mental image of the neurone using touch and hearing. The system can be applied to a wide variety of diagrams, for example illustrations of coastal zonation and representations of electrophoresis gels.

## EVALUATION OF SCREEN RULER SOFTWARE USE IN AN ON-LINE TUTORIAL

Rebecca McCready, Newcastle University

Requested: Claro Software ScreenRuler (*http://www.clarosoftware.com*)

The ScreenRuler enables users to magnify, highlight or increase the contrast between text and background in a horizontal band across a PC screen. Rebecca's project aimed to evaluate the benefit of screen ruler software for three groups of students; those with a minor visual impairment; those with dyslexia; and those with no disability (control).

Full case studies for all the HEAT projects can be downloaded from the TechDis website at: *http://www.techdis.ac.uk/getheatscheme*. Due to the success of the scheme a second round of funding, HEAT2, has subsequently been awarded and the project case studies are due for completion in November 2007.

## REFERENCES

HESA (Higher Education Statistics Agency) data available from: *http://www.hesa.ac.uk/holisdocs/pubinfo/stud.htm*

Ball, S (2006) Inclusive e-learning. *Centre for Bioscience Bulletin*, **19**, 7

**Katherine Clark and Stephen Maw**
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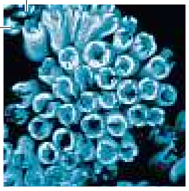




# MEET THE TEAM

The Centre for Bioscience has recently undergone a growth spurt going from a single office housing nine staff to a suite of three offices for twelve members of staff including the addition of two new Academic Advisors. Therefore we felt it was timely to introduce and re-introduce the team to you:

## ACADEMIC ADVISORS

Our six academic advisors are often your main point of contact with the Centre, primarily helping to foster engagement on issues around learning and teaching in the biosciences. Among other responsibilities, they initiate and disseminate the Centre's publications and resources, visit project holders and create and manage our professional development programme of events.

### Dr Katherine Clark

Katherine left the world of carnivorous plants in 2005 to join the Centre as Associate Academic Advisor. Katherine has contributed to all aspects of the Centre's work and is currently focusing on Education for Sustainable Development, WP and Disability issues.

Likes: Reading (especially sci-fi and fantasy novels), gardening and camping
Dislikes: Crowded trains and avocado

### Dr Steve Maw

Formerly a Teaching Fellow in the School of Biology at the University of Leeds, Steve joined the Centre five years ago and has contributed to the majority of the Centre's activities, particularly the Bulletin, Bioscience Education and first two books in the Teaching Bioscience – Enhancing Learning Series. Currently he is leading the Centre's work on the Case for Fieldwork and with Jackie is developing the Centre's support for pedagogic research.

Likes: Hillwalking
Dislikes: Being stuck in traffic

### Dr Sheryl Meskin

Sheryl worked in the United States as a science education specialist assisting local education authorities and science teachers with professional development sessions and as an Outreach Coordinator in HE. During her three days a week part of Sheryl's work will focus on the school to university transition and HE in FE issues.

Likes: Spending time with her 3-yr old son and husband hiking/walking, gardening, pottery, cooking and travelling; chocolate
Dislikes: Would like more time for the above; beetroot

### Dr Julian Park

When not working half a day per week for the Centre for Bioscience, Julian works at the University of Reading's School of Agriculture as a Senior Lecturer in Agri-environmental Systems and School Director of Teaching and Learning.

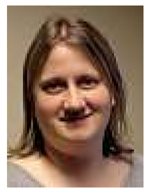
Likes: Living on the Thames and participating in watersports
Dislikes: People who still use mobile phones while driving!

### Dr Julie Peacock

Before joining the Centre in April 2007, Julie was a Research and Teaching Fellow in Tropical Forest Ecology at the University of Leeds. Initially she will be focusing on assessment, feedback and plagiarism, as well as supporting new academic staff.

Likes: Cooking, cycling and swimming
Dislikes: Trains that are late and large tropical ants that bite!

### Dr Jackie Wilson



Following several small biology teaching development projects at Northumbria University, Jackie joined the Centre in late 2001, initially as a project officer working on the Centre's resources database. As an Academic Advisor she has contributed to the majority of the Centre's activities, including development of our Bioscience Representatives network and liaison with Staff & Educational Development units, projects on the teaching of ethics and e-learning, the Centre's website, and the identification and dissemination of case studies and resources. Currently she is leading the Centre's work on Support for New Academic Staff and commissioning the Centre's third book in the Teaching Bioscience - Enhancing Learning Series and with Steve is developing the Centre's support for pedagogic research.

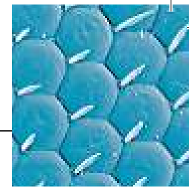
Likes: Making jewellery and growing vegetables for the first time
Dislikes: Slugs!

## CENTRE MANAGER

### Anne-Margaret Campbell

Arriving at the Centre via New Zealand, London and more recently managing a research Centre at the University of Edinburgh, Anne-Margaret supports the work of Centre staff through a range of activities including managing funding schemes, operational planning and Centre finance.

Likes: Hubbards Berry Berry Nice cereal; her nieces Lesina and Sofia (very much); most forms of sport; Friday afternoons!
Dislikes: Monday mornings; meetings for the sake of meetings; trying to come up with a list of dislikes





## ADMINISTRATIVE STAFF

### Jill Anderson-Clarke

Project Assistant
Jill assists in the organisation and administration of meetings and events and provides admin support for the Bioscience Education e-journal and the review of the student learning experience in biochemistry and in microbiology.

Likes: Swimming, playing tennis and modern art
Dislikes: Tacky seaside resorts

### Gill Sayers

Project Co-ordinator (0.8 FTE)
Gill provides day to day administrative support to the team as a whole.

Likes: Cooking, Wine and Crime Novels
Dislikes: TV Soaps, Diets and The Daily Mail

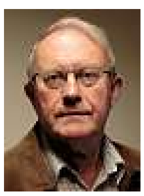
## DIRECTORS

### Professor Ian Hughes

Director (0.2 FTE)
Ian's research interests now focus on bioscience education at university level where he has contributed to the development and evaluation of innovative teaching methods, graduate employability, peer assessment and the use of audits to drive change in teaching. On the teaching side he lectures to medics, dentists and science students and runs projects which are mainly literature or fieldwork based. He contributes to the management team for the IDEAS CETL (interdisciplinary ethics teaching). Outside involvements include membership of the General Medical Council, the General Osteopathic Council and the Wellcome Trust/MRC Ethics and Governance Council for the UK Biobank Project.

Likes: Extra puddings
Dislikes: Not having enough puddings

### Professor Edward Wood



Co-Director (0.2 FTE)
Ed recently retired from his work as a Professor of Biochemistry, School of Biochemistry and Microbiology as well as an Associate Professor of Medicine, Faculty of Medicine all at the University of Leeds. As the Centre Co-Director, Ed serves on various boards.

Likes: Chips
Dislikes: Not having enough chips

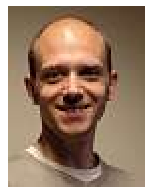
## IT SUPPORT

### Terry McAndrew

C&IT Manager
Terry has been working in IT since 8 1/2" floppy disks were seen as an advance back in the 70s. He is keen to get the best out of Information Technologies and discover any useful resources, and interesting ways to use them, which might help both staff and students enjoy their learning and teaching better. He monitors lots of communities for e-learning developments and produces the Bioscience Education e-journal for our website.

Likes: Cycling, Badminton, Music and 'good science' on TV
Dislikes: Bad science on TV, anything pompous

### Chris Birchall



IT and Web Officer
Before venturing into IT Chris did a degree in Biology at the University of Leeds. Chris is responsible for maintenance and development of our online resources and the infrastructure behind our databases and web pages. He contributes to various other projects such as our JISC funded DeL programmes.

Likes: Running
Dislikes: Motorists in general, Jeremy Clarkson in particular

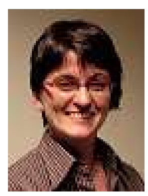
### Dr Sue Grahame

Imagebank Assistant
Sue, a botanist by training and an Information Librarian in her other job, works one day a week at the Centre managing ImageBank (our online collection of Bioscience images).

Likes: Gardening, spending time with my family
Dislikes: Not having enough hours in the day!

## SLED PROJECT

### Dagmar Biegon



Project Manager, Student Learning in the Disciplines (SLED) Biochemistry & Microbiology (0.6 FTE)
Dagmar works exclusively on the SLED review of the student learning experience in biochemistry and microbiology.

Likes: Walks, trying new foods
Dislikes: Muddy walking boots

# 8 | THE SCIENTIFIC METHOD:
## TEACHING THE HOW OF SCIENCE AND NOT JUST THE WHAT

The scientific method, in its pared down form, follows the approximate order: an observation is made of a phenomenon; information is gathered; a hypothesis is put forward; an experimental strategy is devised and carried out; results are collected and analysed; a conclusion is drawn about the validity of the hypotheses, or whether more experiments are needed to make a determination.

In university science classes however, much of the lab work is of a cookbook variety, where the students are told exactly what to do, how to do it and – much of the time – they are even told the results they should get and the conclusions they should draw. While this way of teaching science is valuable, showing students the importance of precision in following protocols and illustrating facts from lectures, such an approach should be complemented by laboratory classes where the students are provided with a more realistic experience of the scientific process. In a recent survey we carried out in a first year biology class (Shearer and Smith, in preparation) students showed a desire to understand the scientific process itself and for freedom to explore different avenues:

*"more explanation as to how the tutor came up with the given method for each experiment"*

*"more creative element would be great, to introduce a skill and then allow the students to go away and explore the use of the skill/technique in their own way/own experiment without the concern that if they make a mistake they will lose lots of marks"*

However, a free-for-all is not a good educational tool either. To make sure that students do not simply go wildly off on the wrong path (nor cause damage to themselves, or to the labs!), one method we have found works well in a first year class of biologists (based on White, 1999) is for the students to be shown a simple biological observation and asked the question, 'why?'. They are provided with a set of tools to approach the problem, and the class is split into small groups of 3 or 4 and left to develop hypotheses and experimental strategies. The class then reconvenes and the various hypotheses and strategies are shared and discussed, and in some cases, rejected. Each group then decides on their experiments, carries them out and observes the results. Another class discussion takes place (teaching the importance of interaction in the scientific arena), the students plan another round of experiments and so on. This approach more closely mirrors the process of science as carried out in research laboratories, underscores the dynamic nature of science (replete with all its contradictions and controversies) and creates a collaborative learning community, encouraging intellectual debate. But further, this strategy of active inquiry-based learning challenges and engages the students; two key factors necessary for effective learning.

Teaching the process of science – hypothesis formulation, problem solving, experimentation and data analysis (Handelsman, Houser and Kriegel, 2002) enhances the student experience on a number of levels and better trains future scientists. Providing such experience early in the first year allows students to bring the understanding of the scientific process to material they are taught throughout their degree. With such a perspective on the body of their scientific knowledge, they are well-prepared to continue into the realm of scientific research themselves. However, there is an additional and equally important benefit of such an approach.

Not all science undergraduates will eventually become research scientists, but will instead contribute to many other sectors of our society. Teaching the process of science in practical classes equips all students with the skills and understanding required to make them scientifically literate. And in today's society scientific literacy is essential. The media and popular press inundate us daily with headlines, breakthroughs, findings and statistics and if our students are not practised in the understanding and analytical skills essential for delineating fact from fiction (and are content rather to believe everything they hear or read without question) then we find ourselves in a precarious situation.

However, by experiencing first-hand the process of science – not just the what but the how – "students will see the allure of science and feel the thrill of discovery ... [T]he benefits will be an invigorated research enterprise fueled by a scientifically literate society." (Handelsman *et al.*, 2004).

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### STUDENT ESSAY WINNER

Congratulations to the winner of our third annual student essay competition, Aneeqa Meedin, a third year Biomedical Sciences student from the University of Sheffield, wins £250 for her essay *"What advice would you give to students starting your course?"*. Aneeqa's essay, the runners-up and shortlisted essays, are available through the Centre for Bioscience website at:

*http://www.bioscience.heacademy.ac.uk/publications/essay07.htm*



# CHALLENGING PERSPECTIVES ON ASSESSMENT:

## A COLLECTION OF SHORT PRESENTATIONS

Assessment is at the centre of the student experience. It provides a means of evaluating student progress and achievement, and it drives the activity of the student and therefore their learning. Over the last few years, those involved in developing assessment have generated some new perspectives which, as yet, have not been fully incorporated within mainstream practice. Challenging Perspectives on Assessment aims to work to close this gap by providing a collection of short Web presentations that are intended to provoke debate around assessment. This work has been supported by HEFCE via the Fund for the Development of Teaching and Learning and the CETL initiative. Each Web talk is intended to be contentious but well grounded. About ten minutes long, each introduces an idea that can be pursued using the references provided. The talks may be used by individuals or serve as catalysts for group discussions. Additionally, comments or questions can be submitted to each perspective.

The list includes:

1. Assessment is the most important thing we do for HE students - Sally Brown, Leeds Metropolitan University
2. Peer Assessment: What's it all about? - Ian Hughes, University of Leeds
3. Developing a more holistic approach to assessment policy and practice - Ranald Macdonald, Sheffield Hallam University
4. How feedback works for some of the people some of the time - Liz McDowell, Northumbria University
5. Understanding staff student interaction is central to engaging students with feedback - Jill Millar, Oxford Brookes University
6. I know a 2.1 when I see it - Margaret Price, Oxford Brookes University
7. Feedback can be a waste of time - Steve Swithenby, The Open University

The collection is a work in progress, and comments are welcome. To view the presentations visit: *http://stadium.open.ac.uk/perspectives/assessment/*

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# THE STUDENT LEARNING EXPERIENCE

The Centre for Bioscience is currently undertaking two reviews of the Student Learning Experience in the Disciplines (SLED). The reviews will present a detailed overview of the current state of higher education in Biochemistry and Microbiology and focus particularly on the factors which have a direct impact on the student learning experience.

Biochemistry and microbiology were targeted since the disciplines have some characteristics in common: they are quite well-defined; associated with strong learned societies and make a significant contribution to the national economy. Biochemistry as one of the larger disciplines in bioscience enrols 6.4% of all bioscience students and has an additional large service teaching contribution to other disciplines. Microbiology, on the other hand, has strong links with the NHS and enrols about 3% of all bioscience students. Both disciplines have undergone substantial changes because of recent advances in molecular biology, genetics, medical research and teaching methods.

The SLED reviews are being steered by two panels. The representative panels have provided us with very productive discussions and a basis on which to capture the breadth and variety of the student learning experience in biochemistry and in microbiology.

Three approaches have been used to gather data:

- Global databases (HESA, UCAS);
- Departmental contacts questionnaire; and
- Short student survey.

All information will be grouped in a neutral and impartial way – no universities will be identified individually.

The Centre's SLED reviews will help to:

- Improve the cohesiveness within each bioscience discipline;
- Improve relations and co-operation between different stakeholders;
- Develop a process which will inform future reviews; and
- Provide a comprehensive collection of discipline-related data to inform the discipline, lecturers, administrators, students and others about trends and to set a baseline for future information.

The project will run until December 2007. More information can be found on the website: *http://www.bioscience.heacademy.ac.uk/projects/sled/*. Similar reviews are being undertaken by the Centres for Materials and for Arts, Design and Media.

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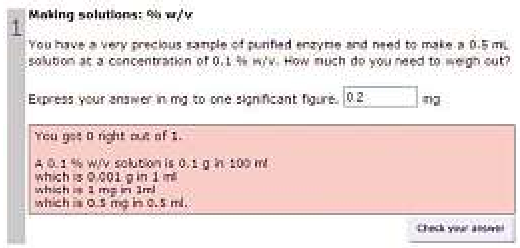
# IT'S NOT ROCKET SCIENCE

Possibly the biggest barrier to the adoption of new technology and new approaches to teaching is the perception that it is going to be difficult and time consuming. A good teacher, who thinks carefully about what students need and want, can produce good e–learning materials easily with relatively inexpensive and easy–to–learn–and–use software.

I am going to use a few examples to illustrate what I mean. These will cover 'just–in–time' formative assessment, short Flash animations derived from PowerPoint presentations and electronic flashcards. These are all used in or alongside tutorials in the context of a standard undergraduate face–to–face course and they are delivered through a Virtual Learning Environment [VLE]. I should point out that I do not have any shares in the companies that make the software and there will, no doubt, be other ways of doing very similar things.

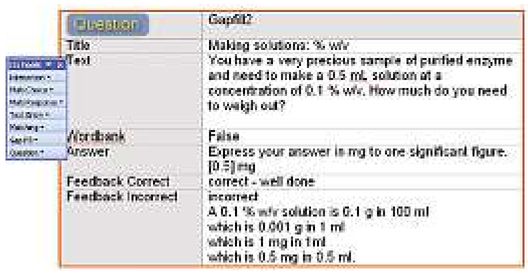
## FORMATIVE ASSESSMENT USING COURSEGENIE

Coursegenie *(http://www.wimba.com/products/coursegenie/)* is an add–in for Microsoft Word. It allows the conversion of Word documents into web pages quickly and easily using some additional formats from the toolbar. However, I think its most useful function is the creation of formative assessment. Multiple choice, gap–fill, matching or free text questions can be easily created with the help of a wizard where a question can be edited much like editing a Word document. There are some variations for each question–type and feedback can be incorporated: encouragement for a correct answer and the correct working for an incorrect answer. If the questions and answers already exist in a Word document, it is just a matter of cutting and pasting the document into the right format using the Coursegenie template. By clicking on 'generate course' button web pages and associated files are created *[Figure 1]*.





*Screen grab of resulting web page*





*Screen grab of Word document*

*Figure 1. An example of generated web pages and files with Coursegenie.*

I generally use this sort of method to produce simple formative assessments that allow students to identify any difficulties and revise things that they might be rusty on. By doing this the tutorial time can be used to review the questions that really puzzled them and allow them time to build up confidence when they get correct answers. It is also important that students get the answers then and there. The questions can be designed so that they get progressively more difficult and because students get immediate feedback to each question they can move on to harder questions with confidence. It is also possible to tackle much more complex questions by linking several shorter questions together.

## ELECTRONIC FLASHCARDS

This is simple. Using the Coursegenie add–in to Word, a table with two columns, one for each side of the 'card', can be created by first clicking on 'interaction' followed by 'flashcards'. Next the information can be copied and pasted into the table. Click on 'generate course' and upload files to a VLE to complete the cards.

## FLASH ANIMATIONS FROM POWERPOINT SLIDES

Whatever can be done with PowerPoint to make simple animations can also be captured as a Flash animation with voice narration. I use Camtasia *(http://www.techsmith.com/camtasia)* to do this, but I have heard of others who use Captivate (www.adobe.com/products/captivate/). Indeed these programs can be used to capture anything on the screen so it is really useful tool in demonstrating how to use other software.

I have used this approach to illustrate how to rearrange equations (eg the Michaelis–Menten Equation) because the elements of the equation can easily move about on the screen alongside a narration talking it through at the same time. It is easy to go from a blank screen and gradually build up the equations shown while keeping it so there is not too much on the screen at once (which could be intimidating). There is a slider bar at the bottom of the animation so students can go backwards and forwards, or pause and restart; they can take it at their own pace.

There is now a new term coined for this sort of approach – it is called 'Low Threshold Activities' – see *http://www.tltgroup.org/ltas.htm* If anyone else has any handy hints or found some useful software, please let me know.

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# THE WONDERFUL WORLD OF WIKIS



As one of the most popular websites on the internet, and appearing top of Google and Yahoo searches on most subjects, Wikipedia needs no introduction. The numbers of articles and contributors has grown at a phenomenal rate. It is challenging to find a subject that is not on Wikipedia, and topics range from Argentine Airlines to zZz (a Dutch band consisting of an organ and a drum kit, very interesting really, and whose discography contains "Bikini Inferno").

Whilst some academic institutions have banned the use of Wikipedia in student reference lists, the education secretary in April 2007 suggested that the website was a good educational tool for children. As the debate over Wikipedia continues, there is no doubt that increasing numbers of students entering university regularly use it and cite it.

## STUDENT USE OF WIKIPEDIA

I analysed first year Biomedical Science student essays on cell biology. Wikipedia was cited as a resource by 29% of students, with 4 students citing it more than once. There appeared a link between Wikipedia citation and poorer academic practice. As identified by Turnitin, 67% of students who plagiarised highly (Turnitin report >50% similar to other sources) cited Wikipedia, whereas 47% of moderate cases (25-49% similarity report) and only 20% of low cases (<24% similarity report) cited Wikipedia respectively. Wikipedia was not the only wiki software cited, with Wiki FAQ *(http://www.wikifaq.com)* also referenced.

Along with other open-source community software, Wikipedia is clearly part of student culture; a few students cited information contained in blogs and discussion forums. It was evident that many students did not understand what constituted scientific evidence or how to evaluate the quality of their resources effectively.

## LEARNING FROM WIKIPEDIA

I used Wikipedia as a tool for discussing what was meant by scientific evidence, and how to evaluate it. I held tutorials in the computer laboratory where students had to critically appraise information presented on Wikipedia on the topic of "flatulence". (If you go to the history page and scroll to the 15th January, you can find the version of the subject that we used). Students were asked to consider whether the information presented was accurate, reliable and current, by comparing it to evidence on Medline.

Students were on the whole astonished how poor the resource actually was. There were gross scientific inaccuracies suggesting that flatulence may occur "particularly if yeast were involved", with no mention of the importance of colonic bacteria. The most recent technical reference was from 2004 so not reflecting current research. Information regarding potential remedies for flatulence was grossly misleading, listing many functional foods without any supporting scientific evidence.

We discussed the results, and agreed not to use Wikipedia as a scientific resource in the future, at least without critically evaluating it first. I still felt that open-source software was strongly part of the culture with most students saying it was the first place they looked for information, so I doubted whether they ultimately would stop using it. It was apparent that we needed guidelines as to how it could be used. After another discussion, we all agreed that Wikipedia was a useful source of ideas, and good for identifying search terms and subheadings for a subject.

## CONCLUSION

I could simply banish the use of Wikipedia, but valuable lessons were learnt from demonstrating and discussing its foibles. We should harness student enthusiasm to use new technology, but without compromising academic and scientific standards. We can do this by discussing the philosophy behind open-source websites (blogs, forums, wikis) which provide anecdotal evidence and possibly some expert opinion. Whilst excellent as ideas generators and with links to further information, these sites do not contain scientific evidence substantiated by research, and therefore should not be cited as such.

## BARKING SPIDERS

If I was not so much of a Wikiphobe I would have got the class to update the article on flatulence. (Wikiphobe is one of the few subjects not covered by Wikipedia). Thankfully the flatulence pages have been updated to include "yeast and bacteria" and many of the wildly miraculous dietary remedies have had "citation needed" inserted next to them. I like to think that one of our more Wikiphilic students might have made the changes. I hope though that they were not the ones who vandalised the flatulence pages with insertions of one paragraph on Barbara Streisand and another on barking spiders.

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## YOUR COMMENTS

We always welcome comments on our activities and here is your opportunity to comment on the Bulletin.

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Please send any thoughts, comments or suggestions to Sheryl Meskin *(s.a.meskin@leeds.ac.uk)*. She would love to hear from you.

*http://www.bioscience.heacademy.ac.uk/publications/bulletin.htm*





# CHANGES TO A-LEVEL BIOLOGY (PART 2)

In the Spring 2007 Bulletin *[ftp://www.bioscience.heacademy.ac.uk/newsletters/bulletin20.pdf]*, I recently established the rationale behind changes to A-level Biology. The Awarding Bodies [ABs] submitted draft specifications for validation by the Qualifications and Curriculum Authority [QCA] in late March; they are due into schools by September, allowing teachers a year of planning and support before implementation. Hot-on-the heels of GCSE changes, and alongside changes to Key Stage 3, this is a squeeze . . .

Here, I explore what biologists in HE will be able to take for granted about any future A-level biologist: what the new specifications will have in common. In a final article, I will compare and contrast their distinguishing features.

## THE STRUCTURE OF THE SPECIFICATIONS

Much remains substantially the same, particularly the intention to maintain academic standards. Indeed QCA have made much about increasing the level of stretch and challenge for the most able, though there is no reference to this in the criteria.

One major difference is that specifications must include a range of contemporary contexts, at both AS (year 12, lower 6th) and A2 (year 13, upper 6th) levels. It is up to the ABs how their assessment schemes will help them discharge this responsibility.

Another significant change is the inclusion of the aim to develop and demonstrate students' deeper skills, knowledge and understanding of How Science Works (HSW). This builds on similar changes to GCSE and is the same across all science A-levels.

Most A-level subjects are being reduced from six assessment units to four. However, the sciences (except psychology) remain at six, in order to include internally-assessed practical work in two. At both AS and A2 levels, internal assessments must count for at least 20%. Given the need to address the perception that science A-levels are comparatively too demanding, retaining six units poses an interesting problem.

There are now three overall Assessment Objectives, each of which must be addressed in all of the six units. They are:

- AO1 Knowledge and understanding of Biology and of HSW;
- AO2 Application of the above; and
- AO3 How Science Works.

The largest is AO2, which carries up to 45% of the marks. It covers application, analysis and evaluation of information, knowledge and methods in unfamiliar situations, including socio-ethical issues.

The mathematical content is unchanged, including the requirement to apply a simple statistical test. There must be some extended prose answers.

## HOW SCIENCE WORKS

This must be integrated into the Biology content, and is the most significant change. However, much is not in fact new to A-level: the change is largely one of emphasis and assessment, requiring new teaching strategies.

Whereas students have always been expected to develop effective practical skills (and still will be), HSW extends this to deeper understanding of aspects such as:

- Use of theories, models and ideas; scientific questioning and argument;
- Resolving conflicting evidence; "the tentative nature of scientific knowledge" (sic); the role of the scientific community in its validation and in ensuring integrity;
- Correlations and causal relationships; and
- Ethics and the benefits and risks of scientific applications; how society uses science to inform decision-making.

This is a "bigger picture" of HSW than has been the case recently. HSW recognises that not all experimental work is investigative, and values qualitative as well as quantitative methods. This may address perceived skews in the current A-levels.

The assessment of HSW in AO3 focuses on practical skills and evaluation; some assessment will be via external exams. Softer skills, and newer aspects, will be assessed via AO1 and AO2.

## THE BIOLOGY CONTENT

The criteria define 60% of the Biology at both AS and A2, leaving space for ABs to include further biological ideas, applications and implications. A2 must build on AS.

Core topics are organised as in the table. There must be:

- Appropriate balance between plants, animals, microbes; and
- Emphasis on sustainability

| | AS | A2 |
|---|---|---|
| Population | Biodiversity | Ecosystems, including human influence |
| Organism | Exchange and Transport | Control systems |
| Cell | Cell structure; cell cycle | Cellular control |
| Molecular | Biological molecules; enzymes | Photosynthesis & respiration |

"Biodiversity" includes a beefed-up look at classification, and evolution. "Control systems" means homeostasis, and chemical and electrical coordination of paths from stimuli to responses. "Cellular control" is molecular genetics, protein synthesis, sequencing projects, gene technology and (oddly here) speciation.

It is reassuring: no major topics have gone missing; everything looks familiar. It remains to be seen how the ABs will deliver fresh and distinctive approaches, incorporating HSW. I feel a third article coming on . . .

The new Science A-level Criteria: *http://www.qca.org.uk/downloads/qca-06-2864_science.pdf*

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