Development of a Bioinformatics PBL Scenario Resource Centre

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

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The Postgraduate Student as Teacher

For many years, the delivery of undergraduate teaching in the biosciences has been supported by the employment of graduate teaching assistants (GTAs), typically doctoral students, who are undertaking the work to get some money to stretch their stipends and build up some experience of teaching for their CVs. In the biosciences the most common usage of GTAs is as demonstrators in practical classes, but they may also be involved in a range of activities, including facilitating group work, tutorials, seminars, and even in delivering lectures in some instances. In many departments GTAs may also undertake some marking, for example of first year practical exercises.

There are clear benefits resulting from the involvement of GTAs in teaching. For many departments, for example, their large first year practical classes could not be run without the support from demonstrators. With the moves to increased provision of small-group teaching, support from GTAs as facilitators is, again, often essential to provide sufficient cover for large numbers of students. Feedback from first year students shows that they often find the GTAs, who are clearly very close to them in age, more approachable and less intimidating than the academic staff and so they are more prepared to ask questions.

There are also downsides, though: most of us can still remember as undergraduate students that some of the demonstrators were really good, whereas others clearly did not have a clue about how to set up the practical or interpret the results. Surely, things must have changed for the better? Today, there is rightly an emphasis on training for the GTAs before they are allowed to assist with teaching. In most HEIs this training incorporates both generic aspects associated with the basic skills and approaches for good teaching as well as the specific training necessary for understanding and being able to run the experiment or discussing the group work. Often the generic training is provided centrally by a staff-development unit or equivalent, whereas the specific training, of necessity, is provided by the course lecturers. Despite this, feedback from undergraduate students indicates that they are often unhappy with the variability in the quality of the teaching support provided by GTAs.

In recent months there has been a flurry of publicity in the Press about the amount of staff-contact time students receive and issues of value for money. Most of this debate has been focussed on the arts and social sciences, where overall contact hours are normally far lower than in the biosciences. An undercurrent in the debate, however, has related to a perception that, as the unit of resource has failed to keep pace with the increases in undergraduate numbers, there has been a progressive increase in the amount of teaching being delivered by GTAs rather than academic staff. Although there is some evidence from across the sector to support this (for example from the National Postgraduate Committee), it is apparent that much of the evidence being used externally is anecdotal and subjective. Particularly at the level of individual subjects, there is actually very little hard data regarding the amount and nature of the teaching delivered by GTAs, the levels at which they teach and also how much marking they undertake.

Is it your experience that your department is relying more on demonstrators? If so, is this a matter of concern or is it actually a positive feature of teaching delivery? If bioscience as a subject area is going to be able to engage effectively in this debate, it is important that we have a good overview of the picture. It would also be valuable to be able to develop information about aspects of good practice, for example in terms of training and supervision, which could be disseminated through the Centre for Bioscience. To develop the initial overview of the extent of teaching delivered by GTAs in the biosciences, and the types of training and supervision they are given, the Centre has launched a short, online questionnaire which we hope you will be willing to complete *(https://www.heacademy.ac.uk/survey/rolegta/)*

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The Higher Education Academy
CENTRE FOR bioscience

2 Developing Students' Writing Skills: The Science Log

Students arriving at university are keen to learn and are motivated to carry out tasks even if unassessed. The first few weeks of the first year, therefore, are crucial for both students and staff. A study at the University of East Anglia, funded by the Centre for Bioscience, aimed to improve levels of literacy in undergraduates in the School of Biological Sciences. The study was incorporated into an existing year-long module, 'Skills for Biologists'. In addition to assignments and teaching on subjects such as essay writing, students were given a number of teaching sessions on writing skills and different writing tasks, of which the Science Log was the first.

In their first week, undergraduates were set a writing task to complete a Science Log. This was a booklet comprising a page of instruction and fourteen blank pages. Students were told to use one page per day to write for ten minutes on a scientific subject of their choice. In the first week they could use only full-stops, in the second week they could use any punctuation (Figure 1). The exercise of limiting punctuation has been used with previous cohorts of students at UEA and was first suggested by an adult basic skills consultant (Prudence Jones). The aim behind limiting the punctuation was to get students to write in short, focused sentences; one of the biggest problems in students' writing being long rambling sentences.

Many students improved their writing over the two weeks (Table 1). What was fascinating was that this came from the students themselves, they were not directly instructed on writing skills while they carried out the exercise. A couple of examples of feedback from students about the exercise:

"I found the science log really useful in developing my writing skills"

"I thought the science log exercise was extremely useful. It really showed how to structure sentences and paragraphs."

The Science Log had additional and unexpected benefits. Many students reported on articles they had read from publications such as New Scientist (Figure 1). This assisted constructive reading skills and self-directed learning. Most students do not understand what self-directed learning is, and this exercise could potentially be used to demonstrate this. The Log also provided students with the opportunity to write freely about the subject they had chosen to specialise in. Many students showed a deep interest in biological issues, and clearly enjoyed writing about subjects they read about or discussed with their peers. Some students wrote about facing ethical issues they had deep concerns about, some wrote about life-long passions about ecological issues, and their concerns about climate change. Perhaps this is only to be expected from students who have chosen to study this subject, but nevertheless, it was encouraging to see such motivation and depth of thought.

The Science Log proved to be extremely popular with our first years. It could only have been done in the first couple of weeks when students were happy to carry out unassessed assignments. It was by far the most effective piece of work within the module, and had many added benefits for both students and staff. It will now become a permanent fixture for biology undergraduates at UEA.

Table 1. Improvements in students' writing over two weeks as observed in their Science Logs

Type of improvement	% students showing this improvement
Fluidity of writing	24.1
Handwriting	26.5
Grammar, incl. punctuation, paragraphs, sentence structure	18.1

Day 7

An article on brain electrodes raises some interesting ethical points. The electrodes work by artificially stimulating the thalamus. The thalamus is a region of the brain associated with wakefullness and arousal. This technology has been used on coma patients to a level where he can speak & control his limbs.

This technique is known as deep brain stimulation and its applications are varied. DBS can help conditions such as Parkinsons and depression.

There are concerns over this treatment. There are patients who may not wish to prolong their life in a state of partial recovery and deciding when to intervene could be difficult.

Day 10

An article in the magazine 'New Scientist' delves into the story of Daniel Rolander, a budding scientist who worked for the emminent Carl Linnaeus. Rolander was one of 17 Swedish scientists who went on scientific expeditions for Linnaeus. The intrigue of the story centers around Rolanders obscurity in relation to the attention given to the other 16 'apostles', as they are commonly known.

For the 300th anniversary of Linnaeus's birth the IK foundation set about publishing all the apostles' journals in English. Most of these journals had already been published, apart from Rolander's. However, his manuscript was recovered from the Natural History Museum in Copenhagen and after two years translating it from Latin to English his story was finally revealed.

Figure 1. An example from Student X's Science Log, showing transcribed entries from day 7 and day 10.

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News from the Centre

A round-up of some of the recent news and activities

Staff Changes

A big "thank you", and goodbye and good luck to Anne-Margaret Campbell, our Manager for the last three years who has recently returned home to her native New Zealand. The Centre has grown and developed in many positive ways under her guidance, and she will be sadly missed. Jackie Wilson (one of our Academic Advisors) takes over as Centre Manager.

New Learning Guide

Student Research Projects: Guidance on Practice in the Biosciences written by Martin Luck (University of Nottingham) is the third practice guide in our Teaching Bioscience: Enhancing Learning series.

The book follows the series format of theory augmented with bioscience case studies. In the first three chapters Martin explores the value of student research in the biosciences, ways of implementing research projects for final year students, and project outcomes and assessment. The second section of the book features ten bioscience case studies which cover a range of formats of research project: conventional laboratory or field studies, group projects and a diversity of alternative forms involving data-mining and analysis, and commercial, communication and education-based investigations. Copies are available free of charge from the Centre.

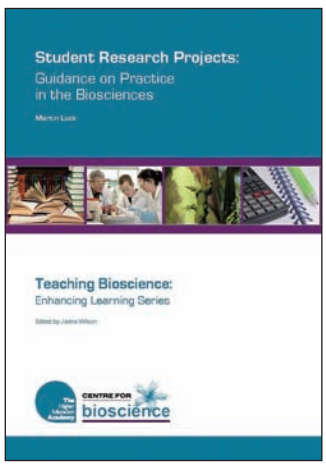

Figure 1. Learning Guide: Student Research Projects

E-Learning Report

As part of the Distributed e-Learning projects undertaken by the Centre we have published a report on the behind-the-scenes issues experienced by e-learning developers and users. The report contains key points for e-Learning projects in many situations, based on lessons that have been learned through experience, and suggests some approaches which have been found useful to avoid a few pitfalls. It includes some recommendations for the future, and details of how the Centre for Bioscience intends to keep finding and sharing your online ventures and successes. The report is not intended for the deep technical user; it is for your typical busy academic practitioner who wishes to discover if their experiences have synergy with other projects we have found to be significant in our community. To download a copy please visit *www.bioscience.heacademy.ac.uk/ftp/reports/Delreportv4.pdf*

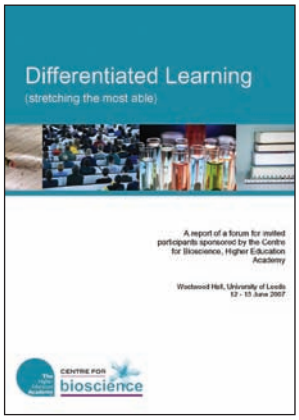

Figure 2. E-Learning Report

Subject Profiles

Published earlier this summer, the profiles present a detailed overview of the current state of higher education in Biochemistry and Microbiology, focusing particularly on the factors which have a direct impact on the students' learning experiences in undergraduate and taught postgraduate programmes. These profiles provide an extensive amount of information for the bioscience community. They should become a helpful source of data for teaching staff, administrators and students in biochemistry and microbiology and provide a baseline from which to track trends impacting on the teaching of biosciences. We would be very interested in your feedback on their content. Please contact the Centre if you would like copies.

Figure 3. Student profiles

Short Guides and 'How to' Sheets

Have you seen the latest addition to our very popular Short Guide series? *Postgraduate Demonstrators and Teachers* is intended for postgraduates who demonstrate and / or teach. The guide brings together hints and tips, mainly focused on demonstrating in practical sessions, but also briefly considers tutorials, lectures and field trips.

'How to' sheets

Our brief 'How to' sheets (A4, double-sided), give hints, tips and ideas on making your teaching more sustainable. They also have suggestions for introducing sustainability concepts to students, *www.bioscience.heacademy.ac.uk/resources/esd/howto.aspx*

We are looking to extend the scope of the How to sheets, to cover a variety of learning and teaching topics. Please get in touch with suggestions of topics or if you would be interested in authoring one for us.

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4 The Large Class Environment: The Impact on New Students

Entering the higher education system for the first time is a daunting process. It is a substantial change in lifestyle for anyone, particularly school leavers, who until this stage of their life would have been comfortable in small, contained social environments. I first experienced this change in lifestyle in the Faculty of Biological Sciences at the University of Glasgow, which has the largest first year biology class in Western Europe.

In my secondary school, classes varied between 15-25 pupils, depending on the subject. The social landscape was limited, with most students coming from the same background there was little variety in the people that I came across. Moving ahead to university and things changed dramatically. Biology lab classes were filled with up to 50 students and lecture halls were filled to capacity with approximately 290 students. Clubs and societies were ever present, encouraging involvement. Everything seemed bigger and better and generally more inclusive. So, how did entering this environment impact and shape me as a student?

Well, in the days and months before I came to university, my concerns were mostly academic. *"Will I be smart enough? Will I cope with the workload? Will I cope with all one hundred and forty-eight chapters of the essential textbook?!"* However, entering the university environment almost made the thought of worrying about grades trivial. When I got here the self doubts changed. *"How will I make friends amongst the masses? What kind of social life will I have? Will I end up one of those odd looking students who keep themselves to themselves?"*

Well, the set up of the large class environment helped remarkably with regards to shaping a shy, quiet young schoolboy into a confident outgoing student. The biology laboratory classes in particular deserve praise for making the school to university transition that bit easier. When entering the lab for the first time, each student was allocated a particular seat. This seat remained 'yours' for all the practicals in the entire academic year. This encouraged interaction and collaboration with those sitting around you, especially as particular tasks set require discussion, team work and support from one and other. The bonds made in the laboratory did not only form lasting friendships, but also equipped me with the skills necessary to converse confidently with people with whom I was unfamiliar. Comparatively, in my geography lab class where there were no particular seating arrangements and group activities I gained very little beyond the learning objectives for the session.

Another useful consistency was the demonstrator who was assigned to our bench was the same for the entire year. This was helpful as they became familiar and it felt more comfortable to ask for help and gain support and advice from them.

Problem based learning (PBL) was incorporated into the laboratory and I found it an engaging way to learn, when compared with how I learned in school. PBL allowed me to interact with more people from my lab class, both inside and outside the lab. It developed my sense of independence, organisation and planning skills, as well as nurturing my people skills. PBL was overall a positive experience.

The lecture hall was not a place to make new friends. As friendships and groups flourished in the laboratory, lab friends would sit together through lectures. With the lecture classes being so large they were not the ideal time to strike up conversation with new people, however they did provide the opportunity to maintain and develop the friendships I had made in the lab.

Although there is not a regular programme of tutorials in Biology, from my perspective those that did exist allowed me to become comfortable with speaking about academic matters to fellow students and staff. Having an intensive programme, I feel would have been too overwhelming and by having few, they proved more useful to me than the weekly tutorials I had in another subject.

Level one assessment was varied. Both coursework and final exams had a variety of assessment, ranging from multiple choice questions to small essays. This was another vital introduction to university. Having a variety in coursework allowed me to find my feet and find out what I was good at and what I needed to improve at. When it came to the final exam the variety was comforting, while I was nervous regarding the broad nature of the multiple choice questions, the exam didn't seem as terrifying, as I had other questions that I knew I could perform well in.

Overall my first year was an enjoyable experience and an appropriate introduction to the university environment and way of doing things.

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Get the Bulletin direct to your door

Did you receive this copy of the Bulletin through the post? If not, you may be one of our regular readers who rely on receiving a copy via our Bioscience Representative in your department. To reduce potential wastage we will be reducing the number of bulk copies of our newsletter we send out to departments from Spring 2009 (Bulletin 26) onwards. To be sure you continue to receive your copy please register your details with the Centre for Bioscience (free of charge) by going to *www.bioscience.heacademy.ac.uk/network/joinreg.aspx*

Existing contacts will continue to receive their copy as usual three times a year. In addition all of our Bioscience Reps will continue to receive half a dozen copies (or more upon request) so they can be made available on coffee tables and noticeboards in bioscience departments, and given to new members of staff.

Learning to Learn at a Higher Level

The transition from school to university can be a difficult path. Three University of East Anglia students from very different school backgrounds shared their experiences with lecturers attending *Transition Issues for Bioscientists/Scientists (www.bioscience.heacademy.ac.uk/events/norw130308.aspx)*, a Centre for Bioscience event held at UEA in March.

What have you all found to be the most difficult transition academically as you entered into university?

University education brings a new style of learning and a new style of coursework for students. The step up from GCSE to A-levels at secondary school was relatively smooth compared to the transition to a degree course. After experiencing coursework at university we felt our A-level coursework was immature. A-level practical write-ups require apparatus lists, very detailed methods and brief conclusions. Receiving our first lab report came as a shock. Before beginning our write up we were given advice as to what subtitles should be used and what information should be included in each section; our guidelines asked for a brief method, no apparatus list and a detailed scientific discussion.

You mention how lab reports differ between schools and university, have there been other differences in writing skills you have noticed?

Essay writing was also a challenge, mainly because we rarely wrote essays in A-level biology or for A-level exams. Essay writing skills have turned out to be essential given that the majority of first year exams are essay-based. We feel this was why writing skills seminars were introduced for first years at UEA, and we found them beneficial. (Further details of the writing skills course are contained in Harriet Jones' article on page 2.)

Currently, referencing is not required for any science A-level coursework, which makes understanding how and when to use the Harvard and Vancouver referencing systems tricky. Sourcing references can also be cumbersome when faced with row upon row of text books and journals. We didn't expect finding relevant, quality references to be so time consuming, and the skills required to tell the difference between a mediocre reference and an excellent one are definitely still developing!

You may each have come from schools where group learning was popular. How have you changed your learning approaches at university?

When faced with all these new tasks at university, we could ask for help from a friend, but we were unsure how much help counted as collusion. Friends could offer a deeper understanding in areas that hadn't been covered so much. When stuck for ways to start or structure work, they could be a valuable source of inspiration. However, if two pieces of work are too similar, and it is clear that the producers have worked together, then neither may receive a mark; this puts a lot of people off sharing their work and ideas.

One obvious difference between school and university is in class vs. lecture sizes. What other differences have you experienced?

The size of lecture classes and laboratory groups were daunting when your A-level classes had comprised fewer than ten people. At A-level we had a text book to follow, so any information required for the syllabus was sitting in front of you. At university you have a whole library, and no 'everything you need to know' book. This meant we had to source for ourselves the information from lectures we missed — although a generous friend could pick up a handout and lend you their notes to copy up, or you could log into Blackboard and print out the handout.

How have you coped with the shift in learning that comes from preparing for university module exams rather than revising for A-level exams?

Required knowledge for coursework and exams isn't always covered in lectures. It is necessary for you to be motivated to research around lecture topics in depth, without prompting. Self-study is often hard to fit in around a full timetable and you're often left feeling a bit lost as to where to start. Seminars are useful because you can ask questions and voice opinions that you wouldn't in a lecture situation. However, if you need help you must seek it. Too many people leave it too late and panic but help is always available, you just have to ask. At first this wasn't easy, we felt like we should be able to do everything ourselves, but once we saw others seeking advice, the lecturers seemed much more approachable.

What do you think would help improve the first year experience for bioscience students?

We believe the key to making the transition to university smoother is to prepare A-level students well. Perhaps undergraduates could go back into schools and talk to A-level students about what it is really like at university and university staff could talk to school teachers about how to better prepare their students for university. Talking to our lecturers about their A-level experiences was eye-opening. They didn't have single text books to follow and parts of the syllabus were self taught. We feel that as A-level students we were spoon-fed and the exams were too similar to GCSEs. This creates a big leap to university in what should be a steady progression through education.

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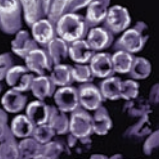

6 National Teaching Fellows

The Centre for Bioscience is committed to promoting the recognition of individuals for learning and teaching. Here we profile this year's two bioscience National Teaching Fellows and two individuals who have received University awards. They describe their learning and teaching interests and the activities which led to their awards. To celebrate others recognised for teaching, we have begun compiling a list of University (and National) Teaching Fellowship awardees under the Funding and Recognition section of our website *(www.bioscience.heacademy.ac.uk/funding/recognition/prof.aspx)*. Look out for further profiles in future issues.

Annette Cashmore

I am delighted to have been awarded a National Teaching Fellowship. I have always been passionate about the synergy between research, teaching and public engagement in science and it was really rewarding to have this philosophy recognised. I joined the Department of Genetics at the University of Leicester in 1987, continuing my work on pathogenic fungi and teaching both biological sciences and medical students. I have had varying roles within the University and the opportunity to contribute to key policies and strategies relating to research, and learning and teaching. As Head of the Department of Genetics, I was fortunate to work with people who shared the same passions as me, and during that time we were awarded the Queen's Anniversary Prize for our work in genetics research and the impact on society. A highlight was the award presentation at Buckingham Palace!

I am currently Professor of Genetics Education, Sub Dean of the Faculty of Medicine and Biological Sciences and Director of GENIE (Centre for Excellence in Teaching and Learning in Genetics). Projects involve not only the development of resources for teaching genetics and broader areas of biological sciences but also the investigation of areas generic to higher education. For example, the first year experience of students and the challenges of taught masters programmes. Raising public awareness of science is still high on the agenda and outreach to schools, colleges and the general public is also a major activity of GENIE.

Another key project is a collaboration with the Higher Education Academy to look at the reward and recognition for learning and teaching across the HE sector; vital if academic endeavours in this area are to be considered alongside subject specific research. The National Teaching Fellowships (NTFs) do play a role in this recognition. Fifty NTFs are awarded annually and this growing community provides a diverse network for meeting people, collaborating and discussing issues important for the sector; an exciting opportunity.

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Julian Park

"The path is made by walking" old African proverb.

My teaching 'path' started at the end of a long harvest day in 1986 when I was considering the future of my contracting business. I was discussing options with a friend who was a lecturer at one of the then County Agricultural Colleges. *"You've got a good knowledge of farming, you've been to university, have you considered college lecturing?"* was roughly how I recall the conversation. Two years later having completed a Certificate in Education at Wolverhampton Polytechnic I was off to Norfolk College of Arts and Technology to teach Agriculture to Youth Training Scheme students.

I have trodden many paths since then but still enjoy teaching, get a buzz out of encouraging and facilitating learning, tutoring and enthusing students, trying different techniques and tools, and meeting and working with colleagues at Reading, across the UK and further afield. These are the aspects on which I have built my lecturing career and it was demonstrating and evidencing these that formed the basis of my NTF.

My recent teaching areas have been in practical environmental science (including field courses), approaches to sustainable development, environmental management and simulation modelling. I have particular interests in the design and use of websites to support learning (i.e. *Engage in Research* [1] and *Environmental Challenges in Farm Management* [2]), considering ways in which we can improve the link between teaching and research (i.e. the Applied Undergraduate Research Skills CETL [3] and the Bioscience Horizons [4] journal) and in the general areas of assessment and feedback. I have just started a project entitled *Feedback in Time* which aims to provide a web resource for staff, collating existing information and tips on how to provide quality feedback to students in a time effective manner, and I will be using the NTFS award to continue my research related to feedback, particularly to review methods available to ensure students engage with the feedback they receive.

For 6 years as well as teaching at the University of Reading I have been a part time Academic Advisor with the Centre for Bioscience. Working with Centre staff, attending and speaking at events and meeting with colleagues from across the wider Bioscience community has provided a wealth of new ideas and experiences which have informed my own teaching. I am moving to new pastures at Reading, as the Life Sciences Faculty Director of Teaching and Learning, which ironically means I will be teaching less but perhaps have the opportunity to more widely enhance teaching quality. It is a new path which I am looking forward to walking!

1. *www.engageinresearch.ac.uk*
2. *www.ecifm.rdg.ac.uk/*
3. *www.reading.ac.uk/cetl-aurs/*
4. *http://biohorizons.oxfordjournals.org/*

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University Teaching Fellows

Jo Badge

For many students, plagiarism is not something they intend to do, but wander into accidentally. In a similar fashion, I seem to have wandered into the world of plagiarism detection by accident and having been awarded a university teaching fellowship on the work I have done in this area. I guess I have to admit that it is an area of teaching and learning that fascinates me. When I was appointed to my role in 2004, I conducted a brief audit of the learning technologies being used in the School. A common theme emerged while talking to people; concern about a potential increase in plagiarism due to the increased use of electronic resources. This led us to be the first to trial the JISC Plagiarism Detection System (Turnitin) in the University of Leicester. The results from my pilot studies led to its adoption for all coursework in the School of Biological Sciences and ultimately these data were influential in the commitment by the University to a paid subscription for Turnitin. I am now leading an internal project analysing departmental inconsistencies in plagiarism policies and studying staff and student attitudes to good academic practice. The way forward in this area has to be a long term sustainable solution where we can move towards instilling a culture of academic integrity amongst our students and staff.

Alongside my work on plagiarism, I am increasingly interested in how we can harness the social aspects of the web in our teaching and learning practices. Free services that connect students together socially, such as Facebook, could provide some powerful models for their support and self directed learning. I am currently working on several projects looking at using tools like RSS, social bookmarking and online video sites like seismic to create support networks and personal learning environments for students. I would love to hear from anyone else engaged or interested in similar projects!

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Dave Lewis

I was awarded a Teaching Fellowship by the University of Leeds in 2007, primarily in recognition of my work in developing ethics teaching within the Faculty of Biological Sciences. In collaboration with colleagues from the Leeds-based Interdisciplinary Ethics Applied Centre of Excellence in Teaching and Learning (IDEA CETL), I have successfully embedded ethics teaching and the critical thinking it engenders within all of the Faculty's undergraduate and postgraduate degree programmes, with topics including both generic issues which are applicable to all scientists (e.g. Scientific integrity) and discipline-specific issues (e.g. Use of animals in research). With the recent appointment by the University of a Research Ethics Training Officer, this programme is being expanded to provide training for Postdoctoral Research Assistants (PDRAs) and staff. Further details of this work and our teaching resources can be found on the IDEA CETL website: *www.idea.leeds.ac.uk/*

I am also the Final Year projects Module Manager within the Biomedical Sciences group of programmes. Given that many graduates in the Biological Sciences do not follow a science-based career on graduation, I intend to use the project money from this Fellowship to develop alternatives to wet laboratory-based final year projects for these students which will provide training more suited to their future careers.

There is considerable public interest in ethics; with the new *Twenty First Century Science* GCSE and AS/A2s in Science and Society and Critical Thinking, ethics is increasing within the national curriculum; it is also essential that scientists promote the public understanding of their work. The aim is to bring all of these together within ethics/public understanding of science final year projects. Students undertaking these projects will design and deliver teaching sessions on a current topical ethical issue of their choice, either at local schools or as part of the Leeds Festival of Science, evaluating and writing these up as their final year project. These projects should encourage students to be enterprising and innovative and enhance their future career opportunities and employability. By working with the local community and schools, not only will these students promote the public understanding of science, but also hopefully they will also encourage schoolchildren to follow them into science-based courses at Leeds.

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Teaching Awards shortlist

Our Teaching Awards provide an opportunity for bioscience academics to receive national recognition for their outstanding learning and teaching practices. The Centre is pleased to announce the short-listed individuals for our inaugural Award are:

Debra Bevitt, Newcastle University; *Momna Hejmadi*, University of Bath; *Mark Huxham*, Napier University; *Dave Lewis*, University of Leeds; *Katherine Linehan*, University of Sheffield; and *Jane Saffell*, Imperial College London.

The shortlisted applicants will be working with members of the Centre for Bioscience Team over the current academic year to develop a 2-page Case Study. All the Case Studies will then be published on our website and in print form. The overall winner will be selected and a presentation will be made at the Science Learning and Teaching Conference in June 2009.

Further details at *www.bioscience.heacademy.ac.uk/funding/recognition/award.aspx*

8 Making Metabolism Meaningful

I came to the Medical School at Leeds in 1946 having spent the war-years in industry as a chemist – responsible for the large-scale production of sulphonamides — the first antibacterial drugs. I was thus a participant at the beginning of the historic Age of Chemotherapy and this led to me joining the Department of Bacteriology as a Research Fellow in Chemotherapy. The Fellowship encouraged a limited amount of teaching — as I soon discovered. I had been there about a month when the Professor *'asked me'* if I would give a lecture to the medical students on Malaria — a subject on which I knew virtually nothing. I had no biological background but I had some sort of a degree, and therefore, in the philosophy of the time, I could teach! From the very beginning, therefore, I began to think deeply about the perils and opportunities of teaching, so that, three years later, when I had become a University Lecturer, a new and inelegant word had become my motivation and has remained there ever since — meaningfulness.

Metabolic Pathways Charts

With my chemical background I was inevitably directed into the teaching of Bacterial Metabolism — and what a wonderful and exciting time it was — to be both learning and teaching. Bacteria had become the major source of our enlightenment into the basic chemistry of life, and their huge numbers and rapid generation times also made them ideal organisms for revealing the biochemical nature of genetics.

Metabolism involved the elucidation of sequences of biochemical reactions which led to the building of the basic chemical requirements for life such as sugars, fats, and amino acids. Each sequence became a metabolic pathway and could involve from 2 to more than 20 individual reactions. In the 1950s several pathways were being unveiled every year and this created a severe challenge to a teacher. Some pathways were clearly related to each other but for a living organism it was necessary for them all to be integrated into a living concerto. The un-made jigsaw puzzle would only become meaningful when all the pieces were put together as a unified chart. My first Metabolic Pathways Chart was a crude prototype drawn with UNO stencils and it was not until 1960 that the first printed copy appeared. Fifty years, 22 editions and over a million copies later, I am still involved in their evolution.

Minimaps

In 1996, on my 80th birthday I bought my first computer and Minimaps evolved. Different aspects of metabolism, such as carbohydrates, amino acids, and lipids, were differentiated by colour. Each minimap was a specific pathway which included co-factors, compartmentation, regulation and other factors of significance within the cell. The timing of their introduction was unforeseen but hugely significant because of the simultaneous growth of the internet. The minimaps, and later the animaps, became the copyright of the International Union of Biochemistry and Molecular Biology and could be freely downloaded on the internet anywhere in the world *(www.iubmb-nicholson.org/)*.

Animaps

The response to minimaps was very satisfying but a basic drawback remained unresolved. Biochemistry was BIO-chemistry, and to make it more meaningful it had to be animated. Flash software made it possible to create animations to show the flow of reactant(s) into the cell and their exact alignment with active sites which initiate each chemical reaction. Such animations can show how a negative sign on an oxygen atom or a pair of electrons on a nitrogen atom can become bonds which enable molecules to grow. The most important animaps have been — Glycolysis, the TCA Cycle, the Respiratory Chain and ATP synthase. They are all independent but interrelated, so again, to become more meaningful, they are now being integrated (Figure 1).

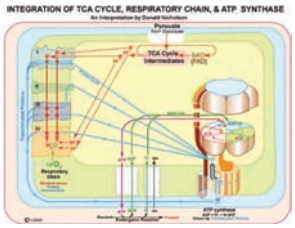

Figure 1. Visualizing integrated metabolic pathways. Image courtesy and copyright of IUBMB.

The internet has had a huge educational significance in making biochemical animations immediately available throughout the world and particularly in the more impoverished parts, where books are at a premium. Recent website statistics for *iubmb-nicholson* alone suggests nearly 1000 downloads each day and provide reassuring confirmation of their usefulness.

For nearly 50 years I have been encouraged by an aphorism which has become the basis of all I have been able to contribute to biochemical education: It is *"To make metabolism meaningful, wonderful — and fun"*

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Tagging for Bioscience

Most web users are familiar with the Amazon style reviews and ratings for books and goods and how these can help refine the users' choice. The Delicious.com, site allows you to share all your web favourites using 'tags'.

We have set up an account to aggregate favourites across the bioscience community. You can begin to see what you and your bioscience colleagues might find useful at *http://delicious.com/heabio* but we need you to use the **heabio** tag to help the Centre find more evaluated content. Once you find something useful in delicious.com you can follow others who found the same item interesting, and discover their other recommendations too.

To learn more about social bookmarking and how it can save you time finding teaching resources, see *www.youtube.com/watch?v=x66lV7GOcNU*

Capturing Curiosity — Mobile Learning and the *Internet of Things*

Engaging students in meaningful learning experiences requires significant effort and it can be disheartening when this is not reciprocated. Conversely, when students' curiosity is aroused, educators are often not able to respond immediately to their enquiry, or students decide that it will require too much effort to pursue it. As a result, many personal learning opportunities are lost. Recent developments in multimedia technology provide a myriad of ways to capture and present learning material. However, in a curiosity driven scenario, the content must be accessible without delay.

The *Internet of Things* (International Telecommunication Union, 2005) concept involves physical objects being tagged with URLs to websites giving access to information about them. As McAndrew (2008) highlighted in *Bulletin 24*, Quick Response (QR) codes are a common type of 2D barcode optimised for mobile phones with a built in camera (as an alternative means of data entry, on which the user can then initiate a desired action (Biever, 2006).

Having become aware of this technology, I considered how it might be used to facilitate learning. It became apparent that due to the relatively limited screen resolution of mobile phones (at that time), they would be better suited to presenting audio information and hence would have an application in promoting access to learning. I was successful in obtaining funding under the JISC TechDis HEAT (Higher Education Assistive Technology) Scheme to develop a prototype. The project was presented at *Ed Media 2008* and full details are available in the proceedings paper *(Thin, 2008)*.

The aim of the project was to test the use of 2D barcodes attached to objects that students interact with. Then through decoding of the URL contained in the QR code, a request is made from the Wi-Fi enabled mobile phone to a media server, to play the audio file pertaining to the object. The compact size of the phone means that they are readily portable and can be operated as a standalone wireless network without requiring any additional network infrastructure (Figure 1).

The setup was tested by a student with a visual impairment using a collection of models of human bones and joints labelled with 2D barcodes. They were very positive about the availability of information in audio format and its immediate availability on demand. They could see how such technology would enable them to become a more independent learner. It was also demonstrated to small groups of students who had taken the anatomy module the previous year. Not only were they very impressed with the setup, but they were enthused by the potential to enhance learning.

The project demonstrated a practical working solution of the original concept and the utility of the solution to be an enabling technology for students with visual impairment so that they can become more independent learners. Furthermore, the described approach significantly widens the scope for student-centred, enquiry based learning for all students in a wide range of learning environments.

Subsequent to the completion of this project, the wide range of technology now available including wireless portable media players, touch screen mobile phones and ultra-mobile PCs means that device limitations to the above approach have all but been eliminated.

References

Biever, C. (2006) See it, snap it, and let your phone find it on the web. *New Scientist* **2533**, 20-21

International Telecommunication Union (2005) ITU Internet Reports 2005: The Internet of Things. 7th edition

McAndrew, T (2008) m-Learning and Mobile 2.0 *Centre for Bioscience Bulletin* **24** (Summer 2008), 9. Available at *www.bioscience.heacademy.ac.uk/ftp/newsletters/bulletin24.pdf*

Thin, A. (2008) In-Class Utility of a Mobile Phone to Deliver Context Specific Audio Information to Students including those with Visual Impairment. In *Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications 2008*, 6214-6219. Available at *www.editlib.org/index.cfm?fuseaction=Reader.ViewAbstract&paper_id=29243*

Acknowledgements

This project was supported by the JISC TechDis Higher Education Assistive Technology Scheme. For further details see *www.bioscience.heacademy.ac.uk/resources/disability/heatprojects.aspx*

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Figure 1. Illustrating the process of using 2D barcodes attached to objects, linked to audio files.

10 Development of a Bioinformatics PBL Scenario Resource

At the University of Ulster we have been using problem-based learning (PBL) in the delivery of bioinformatics on Biomedical Science, Biotechnology and Biology undergraduate programmes. Whilst a wide range of academic disciplines have been delivered using PBL, we believe that it is particularly appropriate for bioinformatics given the extremely dynamic nature of this field. In addition PBL reinforces the need for, as well as the development of, life-long learning skills and the culture of personal development. The coupling of a team-based approach to problem solving means each student can bring their own experiences and knowledge to bear. The problem-based learning environment fosters peer learning and team building and provides students with a practice-based approach that necessitates integration of knowledge from diverse disciplines; valuable skills that will readily translate to the workplace.

"The starting point for learning should be a problem, a query, or a puzzle that the learner wishes to solve." (Boud, 1985).

The key to an effective PBL environment is therefore the provision of 'good problems', these should:

- Be realistic to encourage student engagement;
- Have no 'right answer', but be framed as open-ended questions which require discussion and thus challenge the students to make informed judgment;
- Challenge more able students as well as allowing all students to participate;
- Require a range of resources, including personal resources: skills, knowledge as well as external : e-resources, text, facilitators, other team members;
- Be multi-stage and require the students to work on the problem over a period of time; and
- Relate to module and course objectives, including both the content and the development of key intellectual, professional and transferable skills.

Two of the key challenges identified by Boud (1998) for the effective implementation of PBL were:

1) Research and development on the nature and type of problems to be used.
2) Investment in design, preparation and ongoing renewal of learning resources for the PBL curriculum.

We received funding from the Centre for Bioscience's Teaching Development Fund to address these challenges in the context of using PBL to deliver bioinformatics on a range of life science courses. The aim of the project has been to develop a database of problem scenarios that can be shared amongst the academic community. We have developed a website *(http://samsara.scic.ulst.ac.uk/~kay/cgi/pbl.cgi)* which provides access to tried and tested problems; archived according to level and subject. The website also includes links to required or suggested resources and supporting data. The problems are also annotated with the skills that students may develop during completion of the exercise. Key personal skills can be ranked on a scale of 1-5, whilst other skills, such as intellectual and professional, allow a free text response, so that the author can describe the intended learning outcomes of the problem in more detail. Table 1 provides an example of a scenario delivered to a cohort of final year Biomedical Sciences, studying a module on Human and Molecular Genetics; illustrating the type of information stored in the database.

Table 1: Example scenario delivered to a cohort of final year Biomedical Scientists

Title	**Subject**	**Level**
Genes and Disease	Biomedical Science	3
Problem	You are working in a Genetic Screening Laboratory which analyses DNA. You have been provided with a sample of foetal DNA. Please prepare for a meeting with the prospective parents.	
Key Words	Sequence analysis; Mutations; Probability	
Skill	**Level**	
IT	4	
Numeracy	3	
Communication	5	
Time management	3	
Finding Resources	3	
Team Work	4	
Content	Molecular biology; Mutations, Disease specific information	
Intellectual	Identify potential effect of mutations, Probability	
Professional	Team work, Communication	

The web site also includes questionnaires through which both staff and students can provide us with feedback and allow us to evaluate how effective the scenarios were at delivering the intended outcomes. We welcome input from the academic community, both in terms of evaluating the current scenarios and adding their own scenarios.

References

Boud, D. (1985) Problem-Based Learning in Perspective. In *PBL in Education for the Professions*, ed Boud, D.J., p. 13. Australia: HERDSA.

Boud, D. (1998) Changing Problem-Based Learning. Introduction to the second edition. In *The challenge of problem-based learning*. 2nd edition, eds Boud, D.J., and Feletti, G.I., p.5. London: Kogan Page.

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Bioscience Horizons Award

Bioscience Horizons, the National Undergraduate Research Journal *(http://biohorizons.oxfordjournals.org/)*, was awarded a highly commended certificate for publishing innovation in this year's Association of Learned and Professional Society Publishers (ALPSP). Oxford University Press is supporting volume 2, which has received another good crop of papers that are currently under review.

As part of our evaluation and aims to secure the journal's future, we are seeking views from both the academic and student communities on the utility of Bioscience Horizons. The BBSRC are supporting this evaluation to determine the impact of the journal on postgraduate training.

Bioscience Horizons will only achieve its potential if it works for both the academic community and students, so your views are essential for us to continue shaping the journal.

How can you help? Please encourage staff and students in your department to complete the relevant online surveys at:

For academic staff, see:

www.surveymonkey.com/s.aspx?sm=yCmdWwprCgaZ4cfFN22v_2fQ_3d_3d

For undergraduate students (we suggest limiting it to those students now doing their main research project) see:

www.surveymonkey.com/s.aspx?sm=h3QCKugjNf53lU9m_2fZuaDw_3d_3d

These surveys will be open until 19th December 2008, after which time, any further feedback is welcome by email.

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12 Resource Round-up

A look back at some of our key resources

The Centre web site is extensive and contains a wide variety of tools, resources and publications, including:

Audit Tools

The audit tools are intended to help teaching and support staff consider the content and design of a course or programme with respect to a particular issue, and identify where improvements could be made. A range of audits are available, including assessment, work related learning, ethics, and enterprise.

Bioethics Briefings

Developed by Chris Willmott (University of Leicester), the Bioethics Briefings bring together information and references on a number of ethical topics. Each gives the scientific background to the issue, an overview of the ethical arguments for and against, as well as a number of related case studies. Six are available: *Ethics and Bioethics; Genetically Modified Crops; Preimplantation Genetic Diagnosis (PGD); Xenotransplantation; Stem Cells;* and *Issues at the End of Life*.

Figure 1. Bioethics Briefings

Bioscience Education

Bioscience Education is a publication primarily for, and by, bioscientists and as such publishes articles that are relevant to those teaching tertiary-level bioscience. The journal aims to avoid unnecessary [educational] jargon and publish articles relevant to day-to-day teaching. As an open access journal *Bioscience Education* is freely available to anyone with internet access. Papers from Volumes 1-12 are available online.

Case studies of L&T

Written by bioscientists, the case studies provide examples of effective learning, teaching and assessment practice. Each case study outlines a practice which has been tried and found to work well with students. Topics include: Linking teaching and research; e-learning; assistive technologies; and enterprise. We pay £100 for accepted case studies.

Learning Guides

The first two guides in our *Teaching Bioscience: Enhancing Learning* series were on *Self- and Peer- Assessment,* and the *Effective use of IT*. The guides combine a mix of theory with warts an' all bioscience case studies.

Ped-R wiki

Set up following our first Ped-R event, the wiki brings together thoughts on why and how to conduct pedagogic research and how to go about publishing your work. With a wide variety of references and links the wiki contains information for both those new and experienced in Ped-R. The wiki format also means you can add to the resource.

Resource lists

The Centre produces resource lists to accompany the New Lecturers folder, to distribute at events and to bring together useful and recommended resources in a variety of areas. They could provide a starting point if you are new to a topic, or give you a few ideas or new resources on a familiar topic.

Survey and other reports

These evidence-based reports draw on surveys and our fora/workshops:

- Differentiated Learning
- Student view of 1st yr lab work
- 1st year practicals

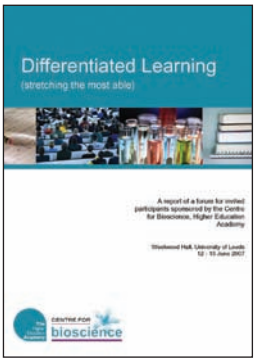

Figure 2. Differentiated Learning Report

Teaching Development Outputs

Since 2001 the Centre has funded over 50 teaching and learning projects on a variety of topics, from assessing practical skills, to investigating students understanding of plagiarism. Final reports and project outputs are available from our website.

Themed Bulletins

We have published two themed newsletters; one on e-learning, the other on feedback and feed-forward. Like regular *Bulletins* they bring together articles, project reports, Centre news and resource reviews, but in a specific area. The next themed edition will focus on practical and fieldwork.

These and a wealth of other paper-based and online resources are available to you through our website or from the Centre. Visit our **A-Z of resources** for further details *www.bioscience.heacademy.ac.uk/resources/az.aspx*

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