Alastair Fitter teaching in lecture theatre B006 in 2011.
Teaching: Undergraduate and Masters' courses

Mark Williamson

Introduction

The department has always tried for excellence in both teaching and research. That is emphasised in almost all the Head of Department accounts. Chapters 1, 2, 5 & 6 emphasise undergraduate teaching, chapters 1 & 4 graduate teaching. There is an additional incentive in that the departmental income depends to an important extent on student numbers (chapters 2 & 6). There is a detailed description of the teaching day in chapter 2 but beyond that we have not tried to describe details of the course nor the continual changes that have taken place. With such a broad course, we felt most of the detail would be of little interest to most readers, unlike the research unit accounts which are easily skipped if the area is not that of the reader.

So this chapter is essentially an account of the courses offered, both undergraduate and graduate, the dates we offered them and the numbers on the courses.

<table>
<thead>
<tr>
<th>TABLE 8-1: Dates and details</th>
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<tr>
<td><strong>BIOLOGY</strong></td>
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<tr>
<td>JOINT COURSES (all ⅔:⅓ except where noted):</td>
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<tr>
<td><strong>Biochemistry (with the Department of Chemistry) called Biology with Chemistry in its first four years</strong></td>
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<tr>
<td><strong>Biology with Education (with the Department of Education)</strong></td>
</tr>
<tr>
<td><strong>Biology with Computer Science (with the Department of Computer Science)</strong></td>
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<tr>
<td><strong>Biophysics (with the Department of Physics)</strong></td>
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<tr>
<td><strong>Environmental Biology and Environmental Management (with EEM [later called the Environment Department])</strong></td>
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<tr>
<td><strong>BIOLOGY SPECIALISATIONS:</strong></td>
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<tr>
<td><strong>Cell Biology and Biochemistry renamed Molecular and Cell Biology</strong></td>
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<tr>
<td><strong>Genetics</strong></td>
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<tr>
<td><strong>Biotechnology and Microbiology</strong></td>
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<tr>
<td><strong>FOUR YEAR COURSES:</strong></td>
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<tr>
<td><strong>Sandwich [year in industry]</strong></td>
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<tr>
<td>with a year in Germany changed to with a year in Europe Both can be combined with either a Biology single subject or with Biochemistry</td>
</tr>
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</table>
Undergraduate courses

The university has always had a mixture of single subject courses, based on a single department and joint courses, run by two departments, usually $\frac{2}{3}$ to $\frac{1}{3}$ but sometimes $\frac{1}{2}$ each.

Single subject course

Our main single subject course has always been called Biology, starting with courses common to all students in the first terms, and allowing specialisation in later years. We formalised that in 1979 when undergraduates could choose specialised names for their degrees, subject to meeting appropriate criteria. We started with four such courses, added one more in 1981 and still have four, three of them direct successors. Details of the dates and name changes are given in Table 8-1 below, and of numbers in Figs 8-1 and 8-2. Undergraduates have always been allowed to change freely between Biology and the specialist single subject degrees provided they have met the criteria for the specialist degrees, so I haven’t attempted to graph them separately, just as a single collective category. From the ’90s, we have offered variants to both the Biology degrees and Biochemistry of a sandwich course, which involves a year in industry, or courses with an extra year abroad.

Joint Degrees

For joint degrees, one with Education was important early on, dwindled to almost nothing and has now been abandoned. [We ran an MSc course with them in the ’70s [see below, Masters courses]]. A joint degree with Chemistry, the Biochemistry degree, on the contrary has grown more important over the years and with the single subject degree now constitutes all our intake, though both come in variants. With the encouragement of the UGC Biological Sciences Sub-committee, we started a joint course with Computer Science in 1973. That and the related masters course are described below, in the Masters courses section. In the ’60s, we offered or considered joint courses with History, Language and Sociology and, although there were occasional undergraduates who tried them, they all came to nothing. After a false start, we ran a successful Biophysics course, joint with Physics, for some years. After EEEM (later the Environment Department) was established in 1991 (first students in 1992) we ran a joint course with them for just four intakes, 1996-99, having started the successful and continuing MRes EEM course in 1995 [see below].
Eileen Gowthorpe, Bryan Norman and James Merryweather setting up the Teaching Laboratories for a practical class in the Autumn Term 1979.
The Structure of the Degree Course

Box 8-1 shows the entry for the 1965 prospectus, written in 1964 while staff were still being appointed, so essentially all my own work. The course was divided into a Part I of two terms followed by seven terms for Part II.

**Box 8-1**

The course consists of two terms’ work for Part I, followed by an examination, and seven terms for Part II. Those offering Biology as a single subject will take all four courses of Part II for three terms, and thereafter any two of them. Those offering Biology with a subsidiary subject will take two Part II courses for three terms and one of these two for the remaining four terms.

**Part I**

1. Genetics
2. The diversity of living organisms
3. Ancillary chemistry

**Part II**

1. Biochemistry (including that of cells), Microbiology, Biochemical Genetics.

In 1978 the Board of Studies set up a committee to revise our teaching pattern. The result was Part I became 5 terms long with five courses and so with Part II starting in term 6. There was no Part I exam, only continuous assessment. From 1989, there was a choice of courses in terms 4 & 5. In place of the 1965 structure of Part II shown in Box 8-1, the lecture courses were a set of Options, typically each member of academic staff offering one nine-lecture option, with students taking ten of these. The Board of Studies, which had responsibility for organising the degree courses, had five course committees corresponding to the specialist degrees within biology listed in Table 8-1. These course committees were responsible for arranging the details of the options, a few of which were shared between two courses. For example, the Options offered in 1988-89 are shown in Box 8-2.

**Box 8-2**

OPTIONS AVAILABLE IN PART II 1989–90
Each option is a nine lecture course, except where marked

<table>
<thead>
<tr>
<th>Term</th>
<th>Options</th>
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<tbody>
<tr>
<td>6</td>
<td>Metabolic Regulation, Plant Cell Biology, Microbial Growth and Fermentation Technology, Structure of Biological Membranes, Movement and Locomotion, Plant Physiology, Molecular Evolution, Recombinant DNA Technology, Eukaryotic Genome Structure, Behavioural Ecology/Socio-biology, Marine Ecosystems, Human Nutrition, Degradation of Natural Materials</td>
</tr>
<tr>
<td>7</td>
<td>Transport across Biological Membranes, Exo/Endocytosis and Membrane Biogenesis, Genetic Manipulation of Plants, Muscle Contraction, Neurophysiology, Animal Intelligence, Human Genetics, Population Genetics, Genetics of Bacteria and Bacteriophage, Eukaryotic DNA Technology, Invasions and Islands, Ecotoxicology, Biological Potential for Food Production, Pure and Applied Aspects of Evolutionary Ecology, Tissue Metabolism and Disease</td>
</tr>
<tr>
<td>8</td>
<td>Energy Transduction in Cells/Organelles, Protein/Nucleic Acid Interactions, Eukaryotic Gene Expression, Immunology (18–lecture course), Reproductive Physiology, Parasitism, Disease and Immunity, Environmental Physiology, DNA Replication and Cancer, Developmental Genetics, Soils, Plants and Man, Biological Conservation, Environmental Technology, Pesticides – Action and Use</td>
</tr>
</tbody>
</table>
Almost all the lecture courses in Part I had an associated practical class. These were normally laboratory-based, but a number of the ecological practicals were field based, and tended to be held in the summer term.

In 1995 the whole course became modular, no Part I or Part II, with many of the old courses being ‘units’ in 1995 and 1996, but modules ever since.

Field courses

Each year, many students attend a ten-day general field course in marine biology at the Marine Station at Millport on the Isle of Cumbrae in the Clyde. This was started by Martin Lewis in 1969 and continues to this day. It became a formal module only in 2011. Organisers since 1971 have been Chris Rees, Peter Hogarth, Calvin Dytham and Julia Ferrari, but many other members of staff have been involved.

An ecology field course at the end of the second year of the course was a regular feature from 1967, the first summer in which we had a second year. It became a substantial undertaking, involving 3 or 4 members of staff and 30 or more students; the courses lasted 2 weeks. Initially it was held at Malham Tarn Field Centre in the West Riding; from 1970 until the 1990s at the University College of North Wales, Bangor. The most adventurous course was created by Duncan Reavey, jointly with the University of Yaounde in Cameroon, with £10,000 a year funding from the Pilkington Trust and run in 1995 & 1996 by Calvin Dytham and Jon Graves and with Chris Rees in 1996. The third year in Cameroon had to be foregone for health reasons. The course was then at Blakeney Point, Norfolk for two years before becoming the North York Moors Field Course, which was a residential course first based on Scarborough, but run from York since 2011 when field work was incorporated in the Environmental Field Skills module.

Figure 8.3

Students studying the rocky shore on the Millport Field Course. Photograph courtesy of James Merryweather.
The first year is based around core modules (see box ‘First year modules’), taught primarily through a combination of lectures and practical classes. These provide an introduction to the main areas of modern biology, and lay the foundations for more specialised second and final year modules. An additional module, including regular tutorials, develops more general scientific and transferable skills. At the end of the first year, many students attend a highly popular field course in marine biology, held at Millport off the west coast of Scotland.

In the second year you begin to focus on areas of special interest, extending your knowledge and deepening your understanding through your choice of modules (see box ‘Second year modules’) and tutorials.

In your final year, a free choice of modules (see box ‘Final year modules’) allows you to concentrate on your special interests, and the two-term research project is your opportunity to interact with one of our many research groups and to produce an original scientific report.

**Specialist degree programmes** In the first year you follow the core Biology programme. In the second and final years, your selection of modules must contain a core set in the area of your specialisation (see box ‘Second year modules’ and ‘Final year modules’), and the topic for your research project must also lie within your area of specialisation.

### First year modules

In the first year, all modules are compulsory for all students and provide a foundation in all the main strands of the subject.

- **Molecular Biology and Biochemistry of the Cell** explores the relationship between structure and function at the molecular and cellular levels. It examines how chemical reactions provide energy and building blocks, and how enzymes provide catalysis and control.

- **Genes, Genomes and Evolution** considers how DNA is organized into chromosomes and genomes in a variety of organisms, from bacteriophage to humans, and examines gene expression through the processes of transcription and translation. Gene mutations and chromosome aberrations are considered in the context of human genetics and disease, and in terms of their significance in evolution.

- **Microbiology, Cell Biology and Development** reveals how knowledge of the biology of various microorganisms, including bacteria and viruses, has led to the development of genetic engineering and the control of infectious diseases. It also examines how fundamental processes within cells are organized and regulated, how cells communicate with one another, and how unicellular and multicellular organisms divide and reproduce.

- **Physiology and Adaptation** explores how the diversity of both animal and plant species, and their anatomical and physiological adaptations, have been shaped by evolutionary processes.

- **Ecology** highlights interactions between organisms and their environment, at the level of individual organisms and ecosystems through to biomes. It includes an introduction to animal behaviour, and a consideration of how an understanding of ecological concepts is crucial to conservation.

In addition, a module covering essential scientific and transferable skills, including tutorials, runs throughout the first year.

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**BOX 8-3: The Course in 2013**

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In addition, a module covering essential scientific and transferable skills, including tutorials, runs throughout the first year.
## Second year modules

Students select modules from the provisional list below. For students registered for specialist degree programmes, a number of core modules in each term will be compulsory.

- Cell Biology
- Immunology
- Human Genetics
- Molecular Biotechnology
- Environmental Interactions
- Animal and Plant Ecology
- Millport Field Course

- Behavioural Ecology
- Developmental Biology
- Neuroscience
- Biomedicine
- Evolutionary and Population Genetics
- Environmental Ecology
- From Gene to Function

In addition, a scientific and transferable skills module runs throughout the second year. This includes tutorials, group projects and other sessions aimed at developing experimental design and research skills. You also choose two from a list of specialist experimental and transferable skills areas, which is likely to include:

- Protein Interactions
- PCR
- Cell Biology and Cytometry
- Environmental Field Skills
- Genomics

- Evolutionary Trees
- Bioenterprise
- Communicating Science
- Systems Biology
- Molecular Imaging

### Final year modules

Biology students have a choice of modules from the list below, while specialist degree students select a set of core modules in their area of interest. The topics cover areas of current scientific importance, and may change from year to year. The following provisional list gives a selection of those currently planned for the 2013 student intake.

- Molecular Machines
- Protein to Protein Recognition
- Advanced Topics in Developmental Genetics
- Cancer and the Cell Cycle
- Learning and Memory
- Evolutionary Ecology
- Global Change Ecology
- Biorenewables
- The Dynamic Genome
- Epigenetics in Development and Disease
- Molecular Microbiology
- Molecular Virology
- Plant Biotechnology

- Biocatalysis
- Glycobiology
- Advanced Topics in Developmental Biology
- Advanced Topics in Immunology
- Bioremediation
- The Brain in Health and Disease
- Cell and Tissue Engineering
- Conservation Ecology and Biodiversity
- Ecological Genetics
- Nutrient Acquisition and Cycling
- Molecular and Cellular Parasitology
- Protein Nucleic Acid Interactions
- Systems and Synthetic Biology

In addition, students take a research skills module that deals with topics of particular relevance to the final year research project and finals examinations, including information retrieval, scientific writing skills and problem solving.
When the Human and Environmental Biology degree was set up, Mike Chadwick arranged a joint field course with the University of Bayreuth, which was held alternate years in York and Bayreuth for some years. Later there was a York-based AEB course on the River Foss which ceased with the course in 2000.

The course in 2013

To complete the course descriptions given above, the prospectus entry for 1965 in Box 8-1 and the list of Options for 1989 in Box 8-2, above is the prospectus entry for 2013. It shows the development of the structure with the changing nature both of the subject and the staff, but no revolutionary change.

Finally, I would just re-iterate a couple of points discussed in the Head of Department accounts. All students at York have a supervisor (see chapters one and four) who is normally also their tutor in their first term. York has always held tutorials in various forms. The place of tutorials in Biology is mentioned variously in chapters one and two but particularly in the discussion between Simon Hardy and Barry Thomas of the differences between Biology and Chemistry in this (pp. 24-25).

Masters Courses

As I said in chapter one, from early on the department wanted, as far as possible, that all research students would attend and be assessed on formal courses. We thought, as American universities had thought for a long time, that a first degree was seldom, of itself, sufficient preparation for three years of research work for a doctorate. One difficulty was a lack of sufficient suitable courses, so the development of one year taught graduate courses, initially called BPhil but quite soon MSc, was a natural one for us. However, it was difficult to get funding. The first one was the MSc in Computation in the Life Sciences, later Biological Computation, described below, which ran from 1970 to 1999. As graduates from other universities had often had weak numerical training, it served too for some DPhil [now PhD] students. We also tried an MSc in Biochemistry which ran from 1977 to 1981 but never had more than a handful of students.

More successful was our MSc in Biology with Biological Education, described below, which also started in 1977 and ran for ten years. It was for school teachers on secondment and usually had about ten of them a year. Before discussing the MRes courses that came in the ’90s, here are descriptions of the Computation in the Life Science course and one of its successors, the MILE MRes course, and of the Biology with Education course.

Michael Usher, with help from Terry Crawford, writes:

In the early days, around 1970, there was an unusual mixture of interests, for the time, amongst the academic staff. Two of the members of the Computer Science Department (David Burnett-Hall and John Wilmot) had research interests in problems related to biology, especially classification. Two members of the Biology Department (Mark Williamson and Michael Usher) were interested in modelling and statistical analyses and had experience of using computers. The UGC Biological Sciences Sub-committee, at their visit on 13 February 1970, encouraged us to develop courses based on our quantitative interests. This was the beginning of a synergy between the two departments that continues to this day.

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Subsequently, the course started to gain more interest and momentum. With the change of degree titles in York, it became an MSc course, with the title being changed to 'Biological Computation'. During the 1970s the climate of opinion in many areas of biology became less descriptive and more quantitative. Recruitment of academic staff in the Department of Biology resulted in considerably more expertise in mathematics, computing, statistics and modelling; similar recruitment in the Computer Science Department led to more staff with an interest in applying their expertise in the biological sciences. Demand for the course increased, with more than 100 applicants in some years in the 1980s and with more than 20 students on the course each year. The greatest intakes, 27 in each year, were in the academic years 1985/86 1986/87 and 1987/88, with the number of students falling off rather irregularly after this peak (Figure 8-4).

Support from the Research Councils increased, with 2 grants per year initially from the Natural Environment Research Council and eventually 9 grants per year from the Science Research Council, later the Biotechnology and Biological Sciences Research Council. Very few students failed to complete the course satisfactorily and the career prospects of graduates were generally excellent. Until he left the University in 1991, Michael Usher had been the course organiser – he handed this task over to Chris Elliott for the next decade. A small advisory committee whose members were all external to the University, initially chaired by Michael Dadd of BIOSYS, helped the University staff in keeping the course relevant to the employment prospects of the graduates. A cash prize for the best student in each year was offered for several years by British Sugar, a company that the students visited on their January ‘Field Course’ exploring the use of computers in research, business and industry.

Looking back it is hard to realise that computers had not completely dominated people’s lives even a quarter of a century ago. The change was becoming noticeable towards the end of the 1980s, when far more graduates with a biology degree had been exposed to computers, either during their degree course, or at school, or indeed at home for their own interest. Demand for the course therefore started to decline until the University decided to discontinue the course towards the end of the 20th Century.

Although the one-year taught postgraduate degree was the main focus of the synergy between the two departments, there were other areas of cooperation. One was the joint BSc degree between Biology and Computer Science which began in 1973 initially, as noted above, ⅔:⅓ but ½:½ from 1981–86. The Computer Science Department at first only offered joint undergraduate degrees with other departments and hence this degree was a welcome addition to their portfolio. Later in the 1970s, the Computer Science Department started its own single-subject undergraduate programme and in the 1980s its MSc in Information Technology. The joint undergraduate degree was never a particularly popular course, with a maximum of 10 students beginning it in any one year (at which time there were three variants – Biology, Ecology or Genetics with Computer Science). The courses reached their peak in 1979/80 with 24 students in all three years of study;
however, the number of students in the two preceding years as well as in the two following years was hardly less. With the increasing use of computers in everyday life during the late 1970s, these joint undergraduate courses attracted some extremely bright undergraduates.

Another area of cooperation was the one-term course linking the University of York and the Fisheries Laboratory at Lowestoft from 1975, an initiative by the deputy director, David Cushing. Later we had scientists from other places on that course including from the NERC Institute of Terrestrial Ecology. Staff from these institutes were seconded to the University for the autumn term, attending the taught sessions of the MSc course and often undertaking small projects related to their work. Indeed one of them, Colin Bannister of Lowestoft, was so content with his time in the department that, for several years, he personally funded a prize for the best 3rd year quantitative field biology project.

This collaboration between the Biology Department and the Computer Science Department was virtually unique in British Universities during the 1960s to 1980s. Several of the graduates of both the MSc and BSc courses have gone on to careers that reflect very well on the teaching and project activities in the University of York.

The MSc ended in 1998-9 and was replaced by an MRes in Bioinformatics and, from 2001 by MILE, which is now described by Richard Law.

MRes Mathematics in the Living Environment

This motivated a new masters course intended primarily for students with a background in mathematics, interested in a career using applied mathematical skills in the living environment. The course was funded by NERC from 2001 until 2011 when funding and the course ended.

The course got strong support from the Mathematics and Biology Departments, and helped to build links between the departments that are still developing. The key personnel were the course organiser, Jon Pitchford, who was given a joint appointment in Maths and Biology, Maurice Dodson of Maths, who championed the course at an early stage, and me. We felt it was important to run the course with minimal extra work for staff in the two departments, but nonetheless received strong support from a number of colleagues. Throughout the time, an Advisory Group of senior people from the environmental sector kept track of the course development. They represented potential employers of students graduating from the course, and gave us a lot of advice and encouragement; the course benefited greatly from their involvement.

The cornerstones of the course were dynamical systems, modern statistical methods, and computation, all in the context of the living environment. Students needed to come out from the course knowing enough about the culture of ecology to be able to work effectively with people involved in the living environment, so they were also given some background modules involving ecology. Research projects were a key part of the curriculum, starting with a group project, and moving on to an external placement during the summer. The latter was especially important as this is not an obvious career path for maths graduates, and the students needed to get a sense of what it would be like working in research institutes in the environmental sector. As time went on, the students became much in demand around UK
for the special skills they could bring when on their summer placements.

The number of students enrolling each year was not large, as we were looking for people with skills in maths, and if possible an interest in the environment. My sense is that the demand for graduates was greater than the supply: there was, and still is, a national shortage of people with these skills. However, we have been able to bring into the system quite a number of young mathematicians over the years, and expect this to make a material difference to environmental research in UK in the future.

Thirdly, here is an account of the MSc in Biology and Biological Education:

**Alastair Fitter**

For 10 years from 1977 Biology joined with Chemistry and Physics and the Education department to run a series of MSc courses for secondary school teachers. The teachers came to the department full-time on secondment from their schools for two terms and took a range of modules that were mostly specific to the course and were intended to acquaint them with current understanding in their subjects and in educational theory and practice, and then returned to their school and did five more terms on a research project, usually using school facilities, sometimes enhanced by equipment loaned from the department. The students were enthusiastic and committed - some of the best groups to teach we have experienced - and some of the research projects were highly successful: several led to significant publications, one of which is cited by John Lawton in his account of the work that led up to his FRS (see p.87). We set aside a small room as a common room for the students and decorated it with a set of Paul Nash drawings previously loaned to the department; their unrecorded location caused consternation some years later when the Registrar was trying to discover what had happened to the University art collection. The course eventually died when the government changed the rules on funding for teacher in-service training, and what had been a ring-fenced pot that could only be used for courses of this ilk vanished, leaving LEAs free to use the cash to support their own budgets and the course with no students.

**Masters in Research (MRes)**

There was a sea change when, as described by David White in chapter four, the research councils invented the MRes degree. As he describes there, we took up the opportunity with alacrity and had two MRes courses from 1995, a biochemical one with Chemistry called Biomolecular Science and an environmental one with the Environment Department called Ecology and Environmental Management. Both are still going strong (Table 8-2), the latter with the same name, the former first Functional Genomics and now Post-Genomic Biology.

In the latter years of the MSc in Biological Computation there were usually two sets of students, those interested in quantitative molecular biology and those interested in environmental problems. With the end of that course in 1999, the former were catered for by a new MRes in Bioinformatics under Sandy Baldauf (see chapter five), the latter, after a short pause, by the MRes Mathematics in the Living Environment, described above by Richard Law. Apart from a couple of short-lived other courses (see Table 8-2) the other development is the MSc in Bioscience Technology which started in 2006 which is run by our Technology Facility and so is a most unusual course, unique and unrivalled as the brochures says.
Table 8.2
No. of students on Master's courses from the introduction of MRes in 1995.

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Key

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<th>Taught by:</th>
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<td>EEM</td>
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<td>⅓ Biology, ⅓ Environment, ⅓ Scarborough University College</td>
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<tr>
<td>PB</td>
<td>MRes in Plant Biology</td>
<td>Biology</td>
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<td>BS</td>
<td>MRes in Biomolecular Science, replaced by ½ Biology, ½ Chemistry</td>
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<td>MRes in Functional Genetics, replaced by ½ Biology, ½ Chemistry</td>
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<tr>
<td>PGB</td>
<td>MRes in Post-Genomic Biology</td>
<td>run by Biology with some input from Chemistry</td>
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<td>MILE</td>
<td>MRes in Mathematics in the Living Environment</td>
<td>½ Biology, ½ Mathematics</td>
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Biology D wing in winter [2005].
The Department has a research environment that is diverse in technology and subject area. (A) Colin Beale training interpretive wildlife guides in the Maasai Steppe of Tanzania, holding a juvenile Rock Python, (B) Simon Baker of the Jack Birch Unit at work (C) John Sparrow studying Drosophila melanogaster, (D) research on plant breeding in one of the Departmental glasshouses and (E) output from a scanning electron microscope in the Technology Facility’s Imaging Laboratory.