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Attitudes to the Uses of Animals in Higher Education: Has Anything Changed?

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Abstract

Bioscience staff and students at Glasgow University in session 2005–06 were questioned on their attitudes to animal uses in higher education, as follow-up to a similar survey 20 years before. Disapproval by students of animal use was generally reduced compared to 20 years ago, but students remained in a 'moral bind', recognising the interest and educational value of animal uses such as dissection, while disapproving of killing animals for this purpose. Staff strongly rejected the proposition that animal use such as dissection de-sensitises students: students also rejected this, but less strongly. Both staff and students recognised that students did become more willing to use animals as they progressed, but attributed this not to desensitisation but to a better understanding of the values of animal experimentation. Final year students were more aware than first years concerning the ethical standards required of experiments on humans, and generally, final year students showed development/ progression in ethical sensitivity, compared to first years. Staff and students agreed on the value of ethics coverage in bioscience degree programmes, similar to findings 20 years before.

Keywords: Dissection, animal uses, bioethics, desensitisation, alternatives to animals, human experimentation

Introduction

Soon after the enactment of the UK's Animals (Scientific Procedures) Act of 1986, which made some changes to the ways in which animals can be used in education, Downie and Alexander (1989) reported on attitudes of students and staff in Scottish Universities to a wide range of animal uses in higher education (HE). Part of the context at that time was an active campaign on 'Violence-Free Science' being promoted throughout UK HE (NAVS, 1986). A key finding of the study was that both staff and students recognised the ethical nature of decisions on animal use and that it was desirable that bioethics should be integrated into bioscience degree programmes. The importance of discussing the ethical issues relating to animal use in HE had been recognised in a joint statement by the Association for Science Education, Institute of Biology and the Universities Federation for Animal Welfare (ASE/IOB/UFAW, 1986), but Downie and Alexander (1989) and, later Downie (1993), noted that there was little evidence of much attention being paid to this need.

Much has changed since the late 1980s in this context. The UK's Quality Assurance Agency's Biosciences Benchmark (QAA, 2002) contains several statements on the need for undergraduate programmes to include discussion of the ethical issues relating to advances in the biosciences. The Higher Education Academy's Centre for Bioscience established a working group on bioethics which has organised several workshops/conferences and produced

a range of briefing papers (Centre for Bioscience, 2007). Textbooks aimed at answering the needs of both students and staff in the field of bioethics have appeared, notably Bryant *et al* (2005) and Mepham (2005). Partly as a result of all these developments, there is evidence that a majority of bioscience academics now approve of the inclusion of bioethics in degree programmes (Bryant and Morgan, 2007), and that many such programmes do now include bioethics to varying extents and using various approaches (Willmott *et al*, 2004; Downie and Clarkeburn, 2005).

Amongst the many issues covered by the term 'bioethics', the use of animals in experimental science remains a hot topic. However, it is our impression that 'animal rights' campaigning in UK universities has reduced since the 1980s and there has recently arisen a student-led campaign in favour of animal experimentation (Hopkin, 2006).

Given these contextual changes, we felt that it would be valuable to carry out a repeat survey of staff and students, using some of the same questions as Downie and Alexander (1989), but also tackling some new issues. The main issues we report on here are:

- To what extent do students approve of different kinds of animal use in their education?
- How highly do staff and students rate the educational value of animal use in practical biology, and their alternatives?
- Is there any evidence that animal use in bioscience classes 'desensitises' students to the sentient nature of animals?
- In comparison to experiments on non-human animals, how do staff and students regard the ethical issues relating to experiments on people?
- How highly do staff and students rate the value of ethics teaching in bioscience degree programmes?

Our survey was carried out on staff and students in the Institute of Biomedical and Life Sciences at the University of Glasgow. Bioscience courses at Glasgow normally last four years, starting with a general foundation course in Biology, which includes some teaching of bioethics. After two years of general coverage, students choose from a wide range of subjects (Anatomy to Zoology) for the final two years of their Honours programme.

Methods

Three questionnaires were drafted for staff (12 questions), first year (20 questions) and final year (24 questions) students. Some of the questions were common to each questionnaire, others unique to the target group. Only answers to some of the questions are reported here. Each questionnaire was approved by the Faculty Research Ethics Committee.

Questions were of three types:

a) Likert scale questions: respondents were asked to rate the extent of their agreement with a statement using a five point scale (1 = low to 5 = high). In analysing responses, 1 and 2 were combined as low, 3 was neutral and 4 and 5 combined as high.
b) Respondents were asked to state which of a set of related statements they agreed with. An open box was available to write in their own view if it differed from all the given statements.
c) Respondents were asked to answer yes or no to a question.

Questionnaires were completed anonymously, but respondents were asked for some personal details (age, gender, dietary restrictions, religious affiliation, bioscience subject area). The only personal detail used in the analysis reported here is bioscience subject area. On some personal details, samples sizes of particular categories were too small for meaningful analysis; this was

not true of gender, but inclusion of gender differences here would have added significantly to the length of this paper. Each questionnaire form had a cover sheet explaining the purpose of the investigation and seeking the consent of respondents to use their answers and comments in this research. The text of each question reported on here is given in the Appendix.

First year students completed the questionnaire during a laboratory session in April 2005, towards the end of their foundation Biology course. This timing ensured that the students had experienced a wide range of animal-based practicals as well as a brief introduction to bioethics. Having questionnaires completed in a class reduced the likelihood of bias in the sample. 213 completed forms were collected.

Final year students are dispersed over a wide range of optional courses. Seven different options were visited in November 2005 and questionnaires completed in class, with 138 forms returned.

The staff questionnaire was distributed as hard copy via internal mail (reckoned to be more likely to succeed than an electronic survey). From about 100 members of teaching staff, 47 forms were returned in time for analysis.

Only a proportion of the analysis carried out on the data collected is presented below, since the complete analysis is very lengthy. We tested differences between groups using □2, but have excluded these results in the interest of brevity. Results are presented as percentages rounded to whole numbers.

Results

Responses to questions on related themes are grouped under main sub-headings. Question numbers refer to the full texts of questions, as shown in the Appendix.

To what extent do students approve of different aspects of animal use in education and research?

Students in first and final year were asked to give an approval rating for four animal practicals in first year biology (Q1). Since these practicals were also in use in the 1980s we can provide a direct comparison of levels of approval over a 20-year interval (Table 1).

Table 1 *Student approval ratings (A = approve, N = neutral, D = disapprove) for the use of freshly killed and live animal material (results given as percentages of those responding). Results for 1985–86 from Downie and Alexander (1989): n=250–5; for 2005 first year, n=142; final year, n=132*

	First year 1985–06			First year 2005			Final year 2005		
Practical	**A**	**N**	**D**	**A**	**N**	**D**	**A**	**N**	**D**
Rat dissection: rats bred for laboratory use	38	25	37	44	27	29	46	27	27
Sheep's heart & lungs dissection: slaughter-house material	73	21	6	87	7	6	83	14	3
Immunology: sera produced by antigen injection into laboratory animals	34	42	24	61	25	14	58	30	11
Behavioural observations on living blowfly maggots	58	33	9	79	16	5	83	11	7

The pattern of results is similar across the three groups. Students recognise the ethical distinction between observing live animals (maggots), dissecting abattoir by-products (sheep

heart and lungs) and dissecting animals bred and killed specially for student use (rats). The highest uncertainty level is shown over the immunology practical, where animals are not killed, but they are subjected to invasive laboratory procedures.

However, there is an interesting shift across the years. Approval ratings for these practicals are very similar for our two 2005 groups, but distinctly higher in all cases then in 1985–6.

In the 1980s, students worked in pairs to dissect a rat. A few years later, to deal with the minority of students who strongly objected to killing animals especially for dissection, we introduced an opt-out scheme where students could choose to work on a model instead (Downie and Meadows, 1995). Later, driven by the escalating cost of rats, we moved to small group dissections and then to demonstration dissections. Clearly, shifts in attitude towards dissection may be influenced by the nature of the dissection experience. We therefore asked for an approval rating for the rat dissection under three conditions (Q2, Table 2).

Table 2 *Student approval ratings for rat dissection under three conditions. Results given as percentages of those responding: first years n=136; final years n=134*

	Approval levels					
	First years			**Final years**		
Condition	**Low**	**Intermediate**	**High**	**Low**	**Intermediate**	**High**
One animal per class	43	22	35	37	21	42
One animal per small group	6	28	66	10	19	72
One animal per student	50	23	27	57	20	23

The results from first and final years are fairly consistent and indicate an interesting mix of ethical and educational motivations. One animal per class would sacrifice the smallest number of animals, but does not get the highest approval rating, probably because students recognise the poor level of the educational experience. One animal per student maximises the experience but also the killing and has the highest disapproval rating – so one animal per group is most approved. These data differ significantly from the findings of Downie and Meadows (1995) where students who chose not to opt out of dissection strongly preferred working in pairs over any other option.

Next, we asked about factors important in the design of animal-based practical work, as a means to test student appreciation of the issues involved (Q3). Results are shown in Table 3, again with a comparison from the late 1980s. Interestingly, in all the factors relating to the animals, staff gave the highest ratings, final year students next, then first year students lower, except that all groups agreed at similar high levels on the importance of humane killing. First year students in 1987–8 gave higher ratings than 2005 first years. Dealing with student distress was not given a high rating by any group.

Although the main focus of this study is on animal use in education, students are well aware of the debate on the uses of animals in research. This debate often focuses on seemingly trivial experiments. We assessed student (and staff) attitudes to a range of animal-based research purposes (Q4).

Table 3 *Staff and student rating of ethical factors in the design of animal-based practical work (results given as percentages of those responding 'high' only). Staff, n=42; First year, n=140; Final year, n=128; First year 1987–8, n=273 (data from Downie and Alexander, 1989)*

Factor	Staff 2005	Final year 2005	First year 2005	First year 1987–88
Minimising the number of animals used	86	77	56	64
The fate of the animals after the practical	71	55	44	50
Conservation status of the animals	80	72	68	90
Humane procedure to kill animals/avoidance of animal distress	90	95	91	95
Dealing with student distress	49	44	34	50

These questions were not posed by Downie & Alexander (1989). Results are shown in Table 4.

Table 4 *Staff and students giving different purposes of animal experimentation high approval ratings (results as percentages of those responding). Staff, n=46; Final year, n=127; First year, n=120*

Category	Staff	Final year	First year
Testing of new compounds likely to help treat serious human diseases like malaria and cancer	91	93	74
Testing of compounds used in everyday life, such as detergents to ensure they are safe for people to use	39	21	9
Testing of compounds intended for use in cosmetics	14	4	3
Fundamental research intended to improve our understanding of how living organisms work	91	58	40
Testing of new compounds likely to help treat diseases of animals like cats and dogs	65	52	42

Not unexpectedly, staff gave high approval ratings for all categories of research, except cosmetics testing (which some pointed out is now illegal in the European Union).

Interestingly, as in Table 3, final year students were closer in their attitudes to staff than to first years, indicating their deeper appreciation of what research can achieve and possibly their realisation of how much there still is to find out. The differential ranking of the five research purposes essentially follows what would be expected from a utilitarian approach i.e. research likely to bring important benefits, such as saving human lives, is more easily justified than research for lesser purposes.

How valuable is animal-based practical work in educational terms, and how highly are 'alternatives' rated?

First, we asked staff what educational value dissection has, as an example of animal-based practical work (Q5). Their acceptance levels of five value statements are shown in Table 5. Top rating was given to hands-on experience of real animal material, and several staff amplified this in their 'other' responses e.g. 'only dissection can demonstrate the intricacy of tissues and organs'. Skills of observation and instrument use were also important, as was the back-up

to teaching functional anatomy by other means. Despite minor differences in methodology, Downie and Alexander (1989) in asking Glasgow staff about the educational objectives of first year practical work obtained a similarly high ranking for observational skills and the impact of direct experience with biological material.

Table 5 *Staff ratings of educational aims of animal dissection. Results as percentages of those responding (n=45). Total responses add to more than 100% since staff were free to make more than one choice*

Statement of aim	Response
Dissection gives students hands-on experience with fresh material	76
Students learn to co-operate as part of a group	18
Dissection helps students learn observational skills	69
Dissection gives students confidence with instrument use	58
Dissection aids teaching	64
Other	20

We also asked students about their reactions to dissection in two ways: interest level (Q6) and value of skills attained (Table 6). The skills question was "Do you believe dissection is a valuable skill that will be required by you in the future?" (Q7). Students clearly found the First Year dissection practicals fascinating, and many would have liked to do more, though this desire had waned by final year. First years regarded dissection as an important skill. With more knowledge and experience, final years were less sure that dissection as a skill would be useful to them. The ability of mammal dissection to fascinate students was also noted by Downie and Meadows (1995). While a high proportion of students (33–37%; Downie and Alexander, 1989) disapproved of killing rats for dissection, the rat dissection obtained the highest rating for interest (82%: Downie and Meadows, 1995) from five different practicals.

Table 6 *Student reactions to dissection a) interest, b) skills learned. Results are percentages of those responding to sets of statements. For first years, n=163; for final years n=138. Total responses add to more than 100% since students were free to make more than one choice*

	Statements	Response (year)	
		Final	First
a)	Dissection is boring and has put me off studying biology	0	1
	Dissection is boring. I would rather do different practical work	1	2
	Dissection is interesting but less time should be spent on it	7	4
	Dissection is an interesting part of the course and has the right amount in the course	41	36
	I find dissection very interesting and would like to do more	41	56
	Other	12	4
b)	No, I don't believe any more research using dissection is required	4	3
	No, I don't want a job that involves animal research	12	11
	No, I won't require dissection in the subject I've chosen	16	6
	Yes, dissection is an important skill in any biological field	32	47
	I don't know if I will require it in the future	32	34
	Other	8	3

The survey also considered students' views on alternatives to dissection of fresh animal tissue (Q8,Table 7). They show a very strong affirmation of the value of real dissection. Our question asked students their views on alternatives as substitutes, but it is clear that they did recognise the value some kinds of 'alternatives' (e.g. computer simulations) in allowing multiple viewing and revision. This recognition increased in the more experienced final year students. As a follow-up, we asked for an evaluation of alternatives in terms of medium of delivery (Q9).

Results are shown in Table 8. Modern media such as video and CD-ROM obtained much higher ratings, especially among students, than traditional media such as textbooks.

Table 7 *Student reactions to alternatives to dissection. Results as percentages of those responding to a set of statements. For first years, n=148; final years, n=135. Total responses add to more than 100% since students were free to make more than one choice*

Statements	Response	
	Final year	First year
I would rather use a substitute over fresh material	9	7
I have used substitutes in the past and they were as educational as fresh material	14	8
Alternatives allow repeated investigations that cannot be done with fresh material	39	26
Dissection allows the student to feel and explore real animals, which is an experience that cannot be substituted	43	52
You cannot investigate the subject like you can on a fresh specimen	24	24
Other	9	2

Table 8 *Staff and student evaluation of different media in providing alternatives to dissection. Results are percentages rating each medium as high. For staff, n=42; final years, n=127; first years, n=129*

Medium	Staff	Final year	First year
Video recording	23	51	46
Interactive CD-ROM	33	35	41
Plastic models	12	25	26
Preserved specimens	28	50	37
Textbooks	9	15	12

Does dissection desensitise students?

Critics of animal experimentation often claim that one of the purposes of animal use in bioscience education is to desensitise students to the plight of the animals concerned, so that students can later become effective experimenters, regarding animals simply as experimental subjects, not as sentient beings (e.g. Rollin, 2006). How do our staff and students react to such claims? We asked for levels of agreement with two propositions: “dissection desensitises students to animal cruelty” (Q10) and “dissection and animal experimentation in education and research encourage people to regard animals as ‘things’ rather than as sensitive living creatures” (Q11). Results are shown in Table 9.

Responses to the two statements were very similar. Staff strongly rejected the claims about desensitisation and treating animals as things. Rejection was firm, but not quite so strong among students, with final years closer to the staff response than first years.

Another way to tackle this issue is to find out whether student attitudes change during their time in HE. Table 10 shows the responses of final year students to a question on how they feel their attitudes have changed (Q12). A high proportion of finalists (44%) felt their attitudes had not changed. Of these, most students (40% of the total) claimed always to have accepted animal experimentation. 60% reported a change in their own attitudes, but only a small number (3%) had moved towards opposing against experimentation. Most shifts were associated with accepting the need for and purposes of experimentation in learning their speciality. In terms of desensitisation, only a small number (5%) claimed that they now enjoyed experiments. This was a question where a large number of students (11%) felt the need to clarify their position with some additional comment.

Table 9 *Staff and student agreement levels with statements that a) dissection de-sensitises students, b) experimentation encourages people to regard animals as 'things'. Results are percentages of those giving low, intermediate or high agreement. For staff, n=45; final years, n=135; first years, n=141*

		Agreement level		
	Group	**Low**	**Intermediate**	**High**
a)	Staff	96	2	2
	Final year	79	15	7
	First year	68	20	12
b)	Staff	89	9	2
	Final year	71	17	12
	First year	60	27	13

Table 10 *Final year student (n=133) evaluation of their own changes in attitude towards animal experimentation. Results as percentages of those responding to a set of statements. Total responses add to more than 100% since students were free to make more than one choice*

Statement	**Response**
I now realize that experiments on animals are an essential part of learning for my course	29
I now enjoy conducting such experiments	5
I now feel that the use of animals is more important at my level	23
I no longer believe such experiments are acceptable	3
No change: I have remained totally against animal experiments	4
No change: I have always thought animal experimentation is acceptable	40
Other	11

We also asked staff about their perception of changes in student attitudes to animal experimentation during their years as undergraduates (Q13, Table 11). A majority of respondents felt that students became more willing to take part in animal experiments. This corresponds well with the students' self-perceptions recorded in Table 10. However, this was a question that a high proportion of staff did not answer (11 of our sample of 47) and many of those that did respond chose the 'other' box – with answers mainly stating that they did not really feel able judge on this question.

Table 11 *Staff perceptions (n=36) of changes in student attitudes to animal experimentation. Results as percentages of staff agreeing with a set of statements. Total responses add to more than 100% since staff were free to make more than one choice*

Statement	**Response**
Most students become more willing to conduct animal experiments	53
Most students become more reluctant to complete animal experiments	3
No change: most students remain interested in animal experiments	19
No change: most students remain unwilling	8
Other	17

Ethical issues relating to the use of humans in practical classes

Although this study has concentrated on educational and ethical issues relating to animal use, we felt that it would be valuable to assess attitudes of staff and students to experiments on people, as a comparison. Respondents were asked to indicate their agreement with a set of statements (Q14, Table 12) concerning a practical on human energy metabolism carried out in the first year course. As with earlier questions, final year students were closer in their attitudes to staff than to first years. Staff and final year students showed considerable understanding of the ethical issues associated with human experiments.

Table 12 *Staff and student agreement levels with statements relating to a diet experiment on students. Results are percentages of those agreeing with particular statements. Total responses add to more than 100% since staff and students were free to make more than one choice. For staff, n=46; final years, n=133; first years, n=138*

Statement	Response		
	Staff	Final year	First year
I don't think that there are any ethical issues relating to students making observations on their own diets	26	35	44
It is important that students who have personal reasons for not revealing information about their diet should be able to opt out of the practical	70	67	43
When collecting data on individual students' diets, it is important that the information is kept anonymous	87	44	38
When collecting student data for analysis, it is important that the students have the opportunity to give or with-hold consent	80	65	39
It is up to the co-ordinators of the course to decide which data students should be required to collect	15	6	4

The importance of bioethics coverage in bioscience education

To broaden the context of the questionnaire we asked a small number of questions on the role of bioethics. Table 13 shows results for two questions: a) describe the importance of teaching and discussing the ethical issues involved before using animals in practical classes (Q15); b) if bioethics has been covered in your course, assess the impact this has had on your views towards animal use in education (asked only of final year students, Q16). Both student groups gave a high rating to the importance of ethical discussions on animal use, but with a shift amongst final years to rate this more highly. A significant proportion of final years did not respond to the second question, implying their perception that their course did not cover bioethics: opinions were widely spread on the impact any coverage had had on their views.

Table 13 *Student importance ratings a) of discussing ethical issues in advance of animal practicals, b) impact of bioethics coverage on views towards animal use. Results as percentage of students rating low, intermediate or high. In a) first years, n=141; final years, n=137. In b) final years only, n=104*

Group	Low	Intermediate	High
a) First year	11	28	62
Final year	4	19	77
b) Final year	29	40	31

Next, we asked staff to evaluate the role of bioethics in undergraduate biology courses (Q17, Table 14). The highest agreement was on the statement concerning bioethics mode of delivery via lectures and discussion; very few took the opportunity to state that bioethics is unimportant. The data are very similar to the staff evaluation at Glasgow in Downie and Alexander (1989). The difference is that in 1989, very little bioethics coverage was being delivered. Now, there is an extensive and developing programme from first to final year (Downie and Clarkeburn, 2005).

Table 14 *Staff responses (n=47) to statements on the role of bioethics in undergraduate bioscience courses. Results as percentages of those responding. Total responses add to more than 100% since staff were free to make more than one choice*

Statement	Response
Bioethics should be taught in lectures	34
Bioethics should be taught in lectures and discussed in tutorials/discussion groups	72
Bioethics is not important in the course I teach in	6
Bioethics is as important as the skills developed by animal experimentation and should be discussed in greater detail	34
Bioethics is covered at a sufficient level	23
Other	6

Finally, we wondered how aware staff and students were of our ethical policies (Q18). All our course documents now include policy statements on science ethics and animal and human experimentation. 87% of staff and 72% of final year students (we did not ask first years) claimed to be aware that we had a policy on the use of animals in teaching, but, of these, 68% of staff and only 20% of students knew where to find it!

Subject area differences

We were able to categorise both first and final year students into four groups by subject area a) zoology, b) human biology, c) cell and molecular biology, d) sports science, in order to test whether attitudes to animal use were associated with subject. A few clear differences emerged: for example, zoology students were more concerned over the conservation status of animals than the other groups. However, in general, differences were not statistically significant due in part to relatively small sample sizes.

Discussion

Since Downie and Alexander's (1989) staff and first year student survey, there have been several studies of the attitudes of different groups to aspects of animal use in education, for example King *et al*'s (2004) survey of 5000 American school biology teachers, Lock and Alderman's (1996) report on English science school teachers and Stanisstreet *et al*'s (1993) university first year undergraduate survey. However, as far as we are aware, our study is the first to attempt an analysis of attitude change in this field over a two decade period, and the first to compare staff attitudes with students at the start and end of their undergraduate degrees.

Animal use in education: approval and interest

The present survey has considered animal use in education in general, ranging from simple observational experiments to more invasive exercises such as dissection. Emphasis has, however, been more heavily on dissection of mammals since this is an important part of our first year course and because dissection remains a controversial topic (Balcombe, 2000). We were able to compare 'approval ratings' for four first year practicals across the period 1985–6 to 2005 (Table 1). The ratings are strikingly different: both first and final year students in 2005 gave all four practicals higher approval than first year students in 1985–6. 'Approval' can be for different reasons and it may be that some students disapprove of handling blowfly maggots for aesthetic reasons. Nevertheless, the student ratings in 2005 correlate well with the degrees of invasiveness involved: rat dissection and immunology practical, high disapproval; sheep's heart/lungs and maggots, low. Following the finding of high disapproval levels for the rat dissection, in the late 1980s, a limited opt-out system was developed. Downie and Meadows (1995) reported on 6 years experience with the opt-out: numbers opting-out peaked at 15% of the class in 1990–91 but declined thereafter to 9 in 1993–94. When dissecting in pairs was replaced by a class demonstration, the opt-out was abandoned. The decline in students

opting-out may reflect the beginning of the shift we have now detected towards reduced disapproval of animal use.

This shift also appears in responses to our questions about the design of animal-based practical work (Table 3: animal numbers, fate, conservation status and killing procedure). Other than the need for humane killing, first year students in 2005 showed less concern for the factors surveyed than in 1987–88. However, final year students and staff showed high levels of concern.

When we looked at the educational value of dissection as perceived by students (Tables 6 and 1), we found a similar picture to Downie and Alexander (1989) and Downie and Meadows (1995): while many students disapproved of killing rats for educational purposes, the rat dissection scored very highly in terms of interest. Students are therefore in a moral bind over dissection, fascinated by what they learn, but disapproving of the means, and this is reflected in their views on how many rats should be killed (Table 2): one rat per class would sacrifice the fewest, but would provide the poorest educational experience and gets a lower approval rating than one rat per group.

Educational aims: animals and alternatives

There is an extensive literature on the uses of alternatives to animals in higher education (e.g. Balcombe, 2000; van der Valk *et al*, 1999; Smith and Smith, 2004), but, as is often pointed out, it is important to decide what the learning objectives of practical work are, before considering whether alternatives are appropriate. Our staff in 2005 rated direct experience as top aim (Table 5), followed by the development of observational skills, back-up to other teaching and confidence in instrument use. Results in Downie and Alexander (1989) were similar, except for a lower rating for instrument use, probably related to the question being broader. These aims relate well to the strengths of using real animals and are mirrored by student reactions (Table 6): first years felt they were learning important skills and found dissection practicals gave them a valued opportunity to explore real animals and their tissues. Final year students rated the value of dissection skills lower, probably reflecting the fact that these students had now entered more specialised fields and realised that dissection had little use in some of these.

Our questions on alternatives stuck to dissection, rather than broader issues of animal use (Tables 7 and 8). Students did not in general rate alternatives highly, though final years, perhaps reflecting their greater experience of studying, appreciated the value of repeated viewing of a specimen or investigation.

Does invasive animal use desensitise students?

It is a persistent claim of the animal rights movement that rather than teaching respect for life, the use of animals in education converts biology into a “science of death” (NAVS, 2004). Cumulative experience with animals, such as dissection, is said to make students more willing to take part in invasive experimental work and eventually to become animal researchers themselves (Rollin, 2006). Downie and Alexander (1989) called for a serious investigation of this claim. Our current study is not that investigation, since a rather complex well-controlled study would be required. Some comments can, however, be made on our findings. Staff firmly disagreed with the desensitisation claim, but more students, especially first years, accepted it (Table 9). A significant proportion of final years agreed that their attitudes had changed during their course (Table 10) and that they had come to realise the importance of animal experimentation. Is this desensitisation? Again, students are in a moral bind. They have come to realise the genuine benefits of animal-based research in discovering new treatments for diseases in animals and humans (final years appreciated these benefits substantially more than first years), but would not accept that this makes them insensitive to animal cruelty. In

other words, animal experimentation to biologists is a special case, justified by its benefits. There is no evidence that biologists behave in cruel ways towards their pets or to wildlife: indeed, conservationists and animal welfare researchers are mostly biological scientists by training.

Ethics in bioscience education

There has been considerable progress in developing the role of ethics teaching in bioscience education since early reports identifying an essentially unmet need (Downie and Alexander, 1989; Downie, 1993). In the UK, surveys by Wilmott *et al* (2004) and Bryant and Morgan (2007) demonstrate that bioethics has become a component of many, but by no means all bioscience degree programmes. At Glasgow University, bioethics is included at all levels in our programmes and course documents carry a policy statement on ethics, including reference to animal and human experimentation. We were interested in assessing staff and student reactions to these developments. In our question on ethical issues relating to human experiments, there was a clear progression in attitudes between first and final year students (Table 12). Not surprisingly, our experienced staff were well aware of the ethical issues associated with experiments on people. With respect to animal-based practicals, students showed a strong appreciation of putting these into an ethical context, especially final year students (Table 13). In line with national trends (Willmott *et al*, 2004) most staff agreed with the inclusion of ethics in bioscience courses (Table 14). These findings were similar to those in an earlier study by Downie and Alexander (1989). However, awareness of our policy statements on these issues was less than impressive, so there is work to do.

Progression in ethical sensitivity

A key result of this study is the finding, repeated over several sets of responses, that final year students show a higher level of appreciation of ethical issues than first years. Clarkeburn *et al* (2002, 2003) showed that young adults undergo a natural progression in their sensitivity to the complexity of ethical issues and that well-designed educational programmes can support this development by providing opportunities to grapple with complex ethical issues in an environment where they can see that other students may hold views quite different to their own. Bioscience degree programmes at Glasgow differ in the extent to which ethical issues are overtly covered, but the overall results from our study accord with the findings of Clarkeburn *et al* (2002, 2003).

Conclusion

The Biosciences Benchmark (QAA, 2002) has provided a helpful impetus for the inclusion of ethics teaching in biosciences courses. The revised version of the Benchmark (QAA, pending) will retain a strong emphasis on ethics but will also strengthen advice on the inclusion of practical work in degree programmes. As we have shown here, practical work involving animals gives considerable scope for students to grapple with ethical dilemmas that directly impact on their education and on their future careers.

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