

# Animal Welfare, Ethics and the 3Rs

## Training materials and resources

Dave Lewis



## PREFACE

This resource arose out of a project funded by the National Centre for the Replacement, Refinement and Reduction of Animals in Research (NC3Rs) and Laboratory Animal Science Association (LASA) to evaluate provision of training in animal welfare, ethics and law within UK Higher Education and to gather and disseminate good practice and teaching materials.



National Centre for the Replacement, Refinement  
and Reduction of Animals in Research

The financial support of the NC3Rs and LASA is gratefully acknowledged. I would also like to thank all my colleagues who have provided advice throughout this project, the survey respondents and, in particular, colleagues who have generously contributed their teaching materials and other information to this resource.

The ultimate aim of this project was to compile teaching materials and links to other resources which provide training in animal welfare, ethics and the 3Rs which colleagues could then use in their own teaching provision. Please feel free you use any of these resources or modify them to suit your own requirements. However, I would be grateful, if you use materials from this resource, that you acknowledge the source. If you require any further information on individual materials, contact me at [3Rs@leeds.ac.uk](mailto:3Rs@leeds.ac.uk) and I will forward your request to the author of those materials.

My intention is for this to be a living resource and therefore, in addition to the printed version, there will also be an electronic version which will be up-dated, as and when colleagues send me new materials for inclusion. This electronic version contains colour images, both of images printed in black and white in this resource and supplementary images. If you have any comments or feedback on the current materials, have modified any materials or have new materials or resources that you would like to contribute, please could you send them to me at [3Rs@leeds.ac.uk](mailto:3Rs@leeds.ac.uk)

Dave Lewis

Institute of Membrane & Systems Biology  
University of Leeds, UK  
&

Interdisciplinary Ethics Applied Centre of Excellence in Learning and Learning (IDEA CETL)  
University of Leeds, UK

Printed version: October 2009

E-version last updated: December 2009

Latest e-version can be obtained by emailing: [3Rs@leeds.ac.uk](mailto:3Rs@leeds.ac.uk)

The images on this cover were kindly provided by Understanding Animal Research

<b>CONTENTS</b>	<b>PAGE</b>
<b>Preface</b>	2
<b>Can the use of animals in scientific research be justified?</b> Discussion seminar for teaching animal ethics/law to students who use isolated tissues in their studies	5
<b>Science and Society: Can the use of animals in research be justified?</b> A debate for use in the teaching of the arguments for and against the use of animals in scientific research.	10
<b>Use and abuse of animals in scientific research</b> Materials for use in the discussion of acceptable boundaries with respect to the use of animals in research	13
<b>Ethical dilemmas</b> Interactive e-learning website which enables individuals to consider their own and others views on animal welfare issues	14
<b>Animals in research</b> Interactive on-line survey and supplementary questions for teaching animal welfare issues and the ethics of animal experimentation	15
<b>Are we abusing animals?</b> Group debate (and suggested topics) of animal welfare issues	18
<b>Behavioural ecology and animal welfare</b> Essay for use in the teaching of laboratory animal welfare	19
<b>Animal ethics and welfare</b> Student presentations on animal ethics and welfare issues	20
<b>Animal welfare: Who is right?</b> Evaluating and discussing video clips of animal welfare issues	21
<b>Animal welfare: What would you do?</b> Case study of an animal welfare issue	22
<b>Xenopus husbandry in practice</b> PowerPoint slides for Xenopus husbandry training course	25
<b>Poultry husbandry</b> PowerPoint slides for poultry husbandry (modules 2 & 3) training course	28
<b>A question of ethics</b> Compilation of ethical questions and issues for debate	31
<b>Ethical review &amp; the 3Rs</b> Case studies and class discussions to provide training for PIL holders/Schedule 1 Users in animal welfare, ethical review processes and the application of the 3Rs in their own studies/research	36
<b>Ergodynia- Hope at last!</b> Workshop for the teaching of experimental design and Ethical Review Processes	42
<b>Designing in-vivo experiments</b> Workshop to teach experimental design and application of the 3Rs	47
<b>Alternatives to animal experimentation</b> PowerPoint presentation of the alternatives to animal experimentation	49

<b>Strategic planning for research programmes</b>	52
Planning chart for reducing animal use in Biomedical Science	
<b>Applying the 3Rs in project design</b>	54
Discussion of strategies by which the 3Rs can be applied before and during a project	
<b>Direct ethical implications and wider social impact of a programme of research</b>	57
Applying training in ethical thinking to consider the ethical issues and social impact of a programme of research	
<b>Animal experiments: Cruel or necessary?</b>	59
Ethics-based “Science and Society” activities; an alternative non-laboratory base final year research project	
<b>Science &amp; Society activities in Schools</b>	61
Materials and ideas for schools presentations	
<b>Links to training material and other resources</b>	62

# CAN THE USE OF ANIMALS IN SCIENTIFIC RESEARCH BE JUSTIFIED?

*Discussion seminar for teaching animal ethics/law to students who use isolated tissues in their studies*

## Abstract

Undergraduate students in the Biological Sciences are highly likely to use tissue derived from animals in the course of their studies. The majority of these students do not receive Home Office modular training and therefore they have limited knowledge and/or serious misconceptions about the law governing the use of animals in scientific research, they also have limited awareness of the ethical issues. This seminar is designed to explore the case both for and against the use of animals in scientific research, to increase student awareness of the ethical issues involved and to provide knowledge of current UK and EU legislative requirements.

## Teaching Format

Two hour seminar (incorporates presentations and class discussions)

## Practicalities

Undergraduate students who have had no formal training in the ethical or legislative issues surrounding animal experiments but who may use animal tissues in the course of their studies.

## Relevant topics and issues

- Animal welfare
- 3Rs
- Animal (Scientific Procedures) Act, 1986
- Public communication of science
- Anti-vivisection movement

## Student Handout

### CAN THE USE OF ANIMALS IN SCIENTIFIC RESEARCH BE JUSTIFIED?

The use of animals and/or animal tissue in scientific or medical research raises strong emotions, with individuals either fundamentally opposed to or strongly supportive of such experimentation. Can it be justified either ethically or on scientific grounds? The aims of this seminar are to:

1. explore the case both for and against the use of animals in scientific and medical research
2. increase awareness of the ethical issues and legislative requirements surrounding such studies

#### *Seminar organisation and assignments:*

The session will be based around a series of short presentations followed by a group discussion of issues raised. Students will be divided into groups, with each group being required to prepare **one presentation** lasting a maximum of **7 minutes** (as a PowerPoint presentation or with overheads) to promote the case for **one particular point of view** or interest group. Any group going over this time limit will be stopped mid-presentation. These topics will be assigned to the sub-group randomly by the tutor to ensure that all topics are covered. The presentation should not just be a list of facts but should be a reasoned, logical argument which seeks to persuade the audience to a particular point of view (your allocated topic). Your presentation should not comprise of a list of groups that support your cause or a list of their aims or objectives. Instead, it should comprise of an introduction, the main body of the talk which provides evidence to support your cause and a conclusion. You can use emotional arguments but these should be supported by scientific facts. Even if you don't agree with your allocated viewpoint, for the purposes of this presentation you should adopt the position of a committed believer of your cause. Whilst **all members** of the group **should help write the presentation**, it should be **delivered by one** or at most two **members of the group**. Following these presentations, there will be a roundtable discussion of the issues raised.

Before the seminar, all groups should also prepare a **one page summary**, in bullet point format, of the key facts underlying of their argument. This should be **emailed to** (*tutor name*) a minimum of **48 hours before the seminar**. Assessment for this tutorial will be based on your summary, the presentation itself and your individual contributions to the subsequent round table discussion.

#### ***Anti-vivisectionists campaigning against the use of animals in research***

- British Union for the Abolition of Vivisection <http://www.buav.org>
- Animal liberation front <http://www.animalliberation.net>

- Stop Huntington Animal Cruelty <http://www.shac.net>
- Uncaged <http://www.uncaged.co.uk/iams.htm>
- People for the Ethical Treatment of Animals <http://www.peta.org.uk/>

**Organisations promoting animal welfare and the 3Rs (refinement, reduction and replacement of animal use in research)**

- Fund for the replacement of animals in medical experiments <http://www.frame.org.uk>
- RSPCA <http://www.rspca.org.uk>
- National Centre for the 3Rs <http://www.nc3rs.org.uk/>
- Universities Federation for Animal Welfare <http://www.ufaw.org.uk/>

**Scientists explaining the need to use animals in scientific and medical research**

- Understanding Animal Research <http://www.understandinganimalresearch.org.uk/>
- Association of Medical Research Charities <http://www.amrc.org.uk>

**Patients and clinicians supporting the need for animal studies**

- Pro-Test <http://www.pro-test.org.uk/>
- Coalition for medical progress <http://www.medicalprogress.org/>

Additional links can be found on the Understanding Animal Research website: <http://www.understandinganimalresearch.org.uk/> and the Home Office website: <http://scienceandresearch.homeoffice.gov.uk/animal-research/reference/>

**Tutor Notes**

A minimum of 2 hours should be allocated for this seminar

This seminar is targeted at students who have had no formal training in the ethical or legislative issues surrounding animal experiments but who may use animal tissues in the course of their studies. It is designed to explore the case both for and against the use of animals in scientific research, to increase student awareness of the ethical issues involved and to provide knowledge of current legislative requirements.

The session will be based around a series of short presentations followed by a group discussion of issues raised. Students should be divided into groups (3-5 per group) and allocated a cause (scientist, patient, anti-vivisectionist, reductionist) by the tutor. Each group should then be given sufficient time prior to the session to prepare a presentation lasting a maximum of 7 minutes (as a PowerPoint presentation or with overheads) to promote the case for their allocated point of view or interest group. The seminar should start with these presentations, with the following being used as the basis of the subsequent round-table discussions. Tutors may wish to include additional discussion points based on their own experiences.

Tutors should explain at the outset that their aim is not to change or influence students opinions but to increase student ethical awareness and to remove popular misconceptions e.g. the numbers of cats/dogs/primates utilised compared to rodents.

As a result of running these seminars, we have become aware that a significant number of students who have used animal tissue in their studies but have not been involved in the preparation of that tissue believe that they have no ethical or moral responsibility to the animal from which the tissue originated. Indeed, some students equate it to taking a piece of pre-packed meat from a supermarket shelf. Therefore, it is suggested that the discussion be opened with the following:

Q *You are likely to have used or shortly will use animal tissues in a practical class. The animal from which this tissue came from was killed for you. Do you think you have any ethical or moral responsibility to this animal or to utilise this tissue to its best extent? (Ask same question again at end of tutorial)*

Q *Must animals be utilised in scientific or medical research, are there any alternatives?*

1. *Why should we test at all, why not just take an untested medicine if we are ill?*

Would you want to use a medicine that had not been tested or evaluated, not only to determine whether it was effective in treating a particular disease or disorder but also to identify its side effects. Were these in proportion to its potential therapeutic benefits- a medicine used in chemotherapy which has mild gastrointestinal effects is acceptable, a headache tablet also cause

liver disease is not. Also, it is not just about medicines, what about the common cleaning products we keep under the kitchen sink? Are these toxic, particularly with long-term or continued use.

2. *Why not use computer models or in-vitro systems instead of humans or animals?*

These are utilised in the first instance for example in high throughput screening or initial toxicological testing. The UK pharmaceutical industry spends £300M per year to find alternatives to the use of animals in research. Ultimately however, medicines are going to be given to intact humans or animals. Our knowledge of the body systems and processes is far from complete and therefore we cannot accurately replicate these in current computer models. We utilise many chemicals in the course of our daily lives, we are also constantly subjected to environmental pollutants (e.g. lead in the air). These and medicines, in transport from their site(s) of absorption/administration to their site(s) of action, pass through and are potentially modified by multiple organs and systems; we cannot replicate these multiple processes in a test-tube. Such studies must be undertaken in whole animals. It should also be noted that animal products such as foetal calf serum are used in many tissue culture experiments

3. *Why not replace animal studies with studies solely on humans?*

Its not only about medicines for humans, many medicines developed on animals are used to treat animals. Almost 9 out of 10 medicines that are developed for humans are the same or very similar to those used by vets. If we do replace animals with humans, are all humans equal, do we all have equal rights. Should we replace the use of animals with the mentally/physically disadvantaged as occurred in the Nazi era or use criminals or those soon to be executed (as is suggested to occur in China). What about volunteers? Do you really know what you are letting yourself in for and the potential consequences of acting as a human volunteer (remind them of the recent TGN1412 trial), particularly the long-term consequences of acting as a subject. Is the person in the developing world who uses the money gained from volunteering to prevent their family from starving truly giving "informed consent"? Is it right that we "export" our clinical trials to those less fortunate than ourselves?

In summary, to fully investigate the pharmacological/toxicological action of medicines, chemicals or environmental pollutants, we must utilise a combination of computer models, in-vitro systems, whole animal experiments and studies in humans.

Q *Can animal models truly replicate human diseases?*

We have similar genes (mice share >90% of their genes with humans) and vital organs (in the same places doing the same things). Humans and animals get similar diseases e.g. dogs and cats get diabetes and asthma whilst ferrets develop a flu-like condition. In addition, the advent of genetic technologies has enabled us to create better models of human diseases (e.g. cystic fibrosis), greatly increasing our ability to understand this disorder and to develop new therapies for it. There are some differences between species that result in differences in the ways in which individual species handle or metabolise compounds e.g. thalidomide. As we become more aware of these, we can design our studies accordingly. Indeed the legal requirements throughout the world require toxicity testing in two animal species, a rodent and a non-rodent species.

Q *The antivivisection movement publicity implies that the majority of animals utilised are dogs, cats or monkeys. Is this true?*

Based on UK government statistics for 2008, less than **0.25%** of all animals used are dogs & cats which have been specially bred for research. No strays or unwanted pets can be used. **0.09%** are monkeys such as marmosets and macaques. Chimpanzees, orang-utans and gorillas have not been used in this country for over 20 years and their use is now banned. The majority of animals utilised **77%** are rats and mice, all of which are specially bred laboratory species. The remaining species are fish (17%), birds (3%), other small mammals (rabbits etc) and farm animals.

Q *Are animal experiments in the UK tightly regulated? What laws govern such studies?*

Originally, experiments were regulated by the 1876 "Cruelty to Animals Act". This lasted for 110 years before it was replaced by the current "Animal (Scientific Procedures) Act" in 1986.

Q *The Animal (Scientific Procedures) Act 1986 is widely regarded as the strictest in the world but only contains a few prohibited practices. What are they?*

“Regulated procedures” (expts on animals) cannot be undertaken on “protected animals” (all animals, foetal, half way through gestation & post-birth) unless the appropriate licences are in place. Animals must be obtained from designated breeding establishments unless specifically authorised. The use of dogs, cats, primates or equidae is not permitted unless the Secretary of State is satisfied that no other species is suitable and the lowest sentient animal must be utilised. Research on great apes (chimpanzees etc) is prohibited. Cosmetics testing is prohibited. Neuromuscular blockade cannot be used as a substitute for anaesthesia. Animal procedures cannot be undertaken for training purposes (an exception being the training of surgeons). No public exhibition or live transmission on TV.

Q *If we have few prohibitions within the Act, how does this result in what are regarded as the strictest regulations in the world?*

What is or is not allowed is based on an ethical framework within which judgements have to be made as to whether or not particular uses of animals are acceptable. The principals of the 3Rs (reduction, refinement and replacement), **Reduce** the number of animals used to a minimum (too few vs. too many, experimental design, genetically identical i.e. in-bred animals). **Refine** the way experiments are carried out, to make sure animals suffer as little as possible (bred in house, environmental enhancement, telemetry, provide analgesia or anaesthesia as appropriate). **Replace** animal experiments with non-animal techniques wherever possible. Refinement takes precedence over reduction in overall use of animals.

The 3Rs are implicit in the Act. Before a researcher is allowed to utilise animals in their research, they must first demonstrate that they have considered and applied the 3Rs; that there is no alternative to animal experiments and that the number of animals used and any potential suffering is kept to a minimum. Ethical review of licence applications is also undertaken by the Institutions Local Ethical review committee (comprising of vets, animal care & welfare officers, researchers, ethicists and lay members) and by the Home Office before a licence is granted- all can reject an application. On-going review is also provided by the applicant throughout the lifespan of project, modifying experiments or number of animals used as data is obtained.

Q *What licences are there under the Act?*

Every research establishment, animal breeding establishments or animal suppliers must be licensed (**Certificate of designation**); every room that houses animals or in which research is undertaken must be designated on that certificate; The person with ultimately responsible for what goes on in a licensed establishment is the **Certificate Holder** – usually someone in a position of authority or of financial control e.g. University Secretary or Head of Research in Industry.

Every person working with animals must be licensed (**personal licence**- details what techniques or “regulated procedures” that individual can perform).

Every procedure on an animal must be covered by a **project licence**. This sets out the 5 year programme of work and the justification for it. Held by research group leader. Sections 1-16 biographical info (place, qualifications etc), section 17 background to & objectives of proposed work; section 18 programme of work & expt design, 3Rs; Section 19 individual protocols (19b’s;- what happens to an animal from leaving home cage to death).

These licences are supplemented by guidance notes (e.g. animal welfare & housing; Educational licences; use of neuromuscular blockers)

Requirement of animal house, project and personal licence holder to maintain comprehensive records of animals used and procedures carried out. Project licence holder submits annual returns which form basis of government statistics

Q *Why should scientists comply with the act?*

They have an ethical and moral responsibility to the animals they utilise. They also have a responsibility to ensure that others similarly comply and to prevent abuse. It is also bad science. In addition there is a system of inspections. Home Office Inspectors must have medical or veterinary qualifications and are expected to have experience in scientific research. They are based in 5 regional offices, with a 24 hour right of access to all facilities, both announced and unannounced (predominantly). They utilise a combination of both to ensure that licence conditions are met and provide advice on best practice in animal welfare. They carry out > 2500 inspections per year, which means that somebody is being inspected every hour of every working day.

Q *What powers do you think the Home Office Inspectorate have?*

Ability to insist that experiments or studies are stopped instantaneously without right of appeal. Experiments can also be stopped by the **Certificate Holder, Named Veterinary Surgeon** or **Named**

**Animal Care and Welfare Officer** acting on his behalf. Penalties for breaches under the Act, 4 levels, first level (e.g. wrongly labelled cages) means that you are under report & closely monitored, more serious breaches (inadequate or absence of licences, causing unnecessary pain/suffering) maximum penalty 2 years imprisonment and/or an unlimited fine & being banned for life from undertaking any further studies under the Act. This would mean most individuals would lose their job & have to change career. Penalties can be applied not only to the personal licensee but also supervising to the project licence holder or in extreme cases, the Certificate Holder.

Q *Is the Pharmaceutical Industry similarly regulated and inspected. Do you think they are or should be?*

Exactly same regulations, checks and penalties as apply to academia. Both external (Inspectorate) and internal (project licence holders, Named Veterinary Surgeon and Named Animal Care & Welfare Officers). The only difference is the number of 19b's on an individual project licence.

Animal technicians, particularly those involved in chronic studies, work with the same animals daily for months or years. They are not going to tolerate colleagues abusing these animals. Furthermore, if abuse was suspected, it wouldn't be individual projects but entire sites or companies that are shut down. To shut down a company for a day would require the termination of significant numbers of long-term i.e. chronic studies and lose them £Ms.

Q *Do you think scientists are losing the argument with regard to the public perception of animal research?*

The numbers of individuals actively campaigning against animal experiments is minuscule compared to the numbers involved in scientific research or indirectly employed (manufacturing, NHS etc). NECTU (National Police Database) estimates that in 2005 there are 15 dedicated extremists, 50 militants who will commit crimes, 800 committed activists who will turn a blind eye to criminal activities of others and thousands of peaceful protesters motivated by particular issues (fur trade, hunting etc). In comparison, the Pharmaceutical industry directly employs 65,000 people, with 250,000 employed in related industries (ABPI figures). In addition, the NHS is Europe's biggest employer with >1.3 Million employees. However, animal rights activists run highly effective campaigns, targeting both susceptible groups (e.g. teenagers) but also taking direct and high-profile action against researchers. As a result of Government legislation and monitoring, there has been a shift from targeting companies to attacks on individuals who work for them, their suppliers (energy, builders etc) or their banks (e.g. those of Huntingdon Life Sciences). There have also been high profile incidents such as the exhumation of the body of a relative of an animal breeder. These activities have resulted in a significant reluctance by researchers to discuss their work in public and engage in the debate about animal studies. However, this is changing e.g. the recent formation of the Pro-Test group whose aim is to promote animal studies; initiatives by Learned Societies and the Pharmaceutical Companies to provide media training for individuals who wish to defend animal experimentation; the peoples petition > 21,000 signatures (as of Aug 2006) in support of animal studies; the Prime Ministers recent statement of support.

Q. *Do you think that the above tactics and actions by those opposed to animal experimentation are justified?*

Will provide evidence as to whether the students have assimilated some of the information and arguments provided during the seminar

Additional resources for tutors can be found on the following websites:

Home Office (Inspectorate, law, statistics) <http://scienceandresearch.homeoffice.gov.uk/animal-research/>

Home Office (links to other organisations) <http://scienceandresearch.homeoffice.gov.uk/animal-research/reference/>

Understanding Animal Research website: <http://www.understandinganimalresearch.org.uk/>

Science Media Centre [http://www.sciencemediacentre.org/animal\\_research.htm](http://www.sciencemediacentre.org/animal_research.htm)

# SCIENCE AND SOCIETY: CAN THE USE OF ANIMALS IN RESEARCH BE JUSTIFIED?

*Debate for use in the teaching of the arguments for and against the use of animals in scientific research.*

## Abstract

The use of animals and/or animal tissue in scientific and medical research raises strong emotions, with individuals either fundamentally opposed to or strongly supportive of such experimentation. Can it be justified either ethically or on scientific grounds?

With the current prominence of the animal rights movement and an increased public awareness regarding the use of animals in research, all scientists who work with animals or animal tissues must be knowledgeable about the issues involved and be able to justify their work to the general public. This seminar is designed for students who have completed Home Office modules 1-3 and therefore have some knowledge of the ethical issues but have not explored these to any depth. Role-play and debate are used to explore the case both for and against the use of animals in research, provide knowledge of the main arguments utilised by both sides and training in the public communication of science. End of session personal blogs allow students to reflect on their own views and whether these have changed as a consequence of this training. This workshop will make students more aware of the public perception of animal experimentation and better able to justify their work to the general public should the need arise in the future.

Students are divided into four groups (scientist, patient, anti-vivisectionist, reductionist); they then have to debate and defend the topic from the perspective of their allocated group.

## Teaching Format

2 to 3 hour session, presentations, class debate, personal reflective blogs

## Practicalities

Personal licence holders or individuals who use animal tissues in their research. It is also ideal for use in the provision of "Science and Society" training for any student in the Biological Sciences or related disciplines

## Relevant topics and issues

- Arguments for and against the use of animals in research
- Animal welfare
- 3Rs
- Public communication of science

## Student Handout

### CAN THE USE OF ANIMALS IN SCIENTIFIC RESEARCH BE JUSTIFIED?

The use of animals and/or animal tissue in scientific and medical research raises strong emotions, with individuals either fundamentally opposed to or strongly supportive of such experimentation. Can it be justified either ethically or on scientific grounds? The aims of this seminar are to:

- Explore the case both for and against the use of animals in scientific and medical research
- Provide knowledge of the main arguments utilised by both sides
- Through debating the use of animals in scientific research, provide training in the public understanding of science thereby equipping you to be better able to justify your own work in the future
- Reflect on your own personal viewpoints at the end of the session

### *Seminar organisation and assignments:*

The session will be based around a series of short presentations followed by a debate. Students will be divided into groups, with each group being required to prepare **one** presentation lasting a maximum of 10 minutes to promote the case for **one** particular point of view or interest group (scientist, patient, anti-vivisectionist, reductionist). These will be assigned to the sub-group randomly by the tutor to ensure that all topics are covered. The presentation should not just be a list of facts but should be a reasoned, logical argument which seeks to persuade the audience to a particular point of view (your allocated topic). Your presentation should not comprise of a list of groups that support your cause or a list of their aims or objectives. Instead, it should comprise of an introduction, the main body of the talk which provides

evidence to support your cause and a conclusion. You can use emotional arguments but these should be supported by scientific facts. Even if you don't agree with your allocated viewpoint, for the purposes of this presentation you should adopt the position of a committed believer of your cause. Whilst you should all assist with the preparation of the presentation, it should be delivered by just one member of the group. Following these presentations, each group will have 15 minutes to respond to questions from the opposing groups and to defend their cause.

Before the seminar, all groups should also prepare a one page summary, in bullet point format, of the main points of their argument to include supporting facts. This should be emailed to (*Tutor name*) 48 hours before the seminar, who then will circulate it to the other groups. Opposing groups' summaries should be utilised to prepare questions to ask them and a defence for your arguments in the subsequent debate.

Within 24 hours of the end of the seminar, you are required to post your personal reflections on the debate, your views on animal experimentation and whether these have changed as a consequence of attending this workshop in your personal blog in the module area of the Universities Virtual Learning Environment (VLE).

#### ***Anti-vivisectionists campaigning against the use of animals in research***

- British Union for the Abolition of Vivisection <http://www.buav.org>
- Animal liberation front <http://www.animalliberation.net>
- Stop Huntingdon Animal Cruelty <http://www.shac.net>
- Uncaged <http://www.uncaged.co.uk/iams.htm>
- People for the Ethical Treatment of Animals <http://www.peta.org.uk/>

#### ***Organisations promoting animal welfare and the 3Rs (refinement, reduction and replacement of animal use in research)***

- Fund for the replacement of animals in medical experiments <http://www.frame.org.uk>
- RSPCA <http://www.rspca.org.uk>
- National Centre for the 3Rs <http://www.nc3rs.org.uk/>
- Universities Federation for Animal Welfare <http://www.ufaw.org.uk/>

#### ***Scientists explaining the need for to use animals in scientific and medical research***

- Understanding Animal Research <http://www.understandinganimalresearch.org.uk/>
- Association of Medical Research Charities <http://www.amrc.org.uk>

#### ***Patients and clinicians supporting the need for animal studies***

- Pro-Test <http://www.pro-test.org.uk/>
- Coalition for medical progress <http://www.medicalprogress.org>

Additional links can be found on the Understanding Animal Research website: <http://www.understandinganimalresearch.org.uk/> and the Home Office website: <http://scienceandresearch.homeoffice.gov.uk/animal-research/reference/>

#### **Tutor Notes**

2 to 3 hours should be allocated for this seminar.

This seminar comprises of group presentations and a debate where each group defends their cause (for or against the use of animals in research e.g. scientists & patients vs. anti-vivisectionists & reductionists) in response to questions from opposing groups. Post seminar, students reflect on their own viewpoints

Students should be divided into four groups (3-7 students per group) and allocated their particular "cause". Students should be given sufficient time before the session to prepare both a 7-10 minute PowerPoint presentation in support of their "cause" and a 1 page summary of their presentation. Tutors should email these summaries to the opposing groups, ideally a minimum of 48hrs before the session, to enable opposing groups to prepare for the subsequent debate.

One member from each group should deliver their groups presentation. On completion of all presentations, each group should then be given 15 minutes to defend their "cause" in response to questions from opposing groups. Tutors may be required to facilitate this debate (by being provocative) but it should be as student led as possible. Tutors should have knowledge of the main arguments (for

information see links below) utilised by both sides to enable them to correct factual errors where appropriate.

After the workshop, students are required to reflect, individually, on the debate, their views on animal experimentation and whether these have changed as a consequence of attending this workshop. This could be achieved, for example, by posts in to personal blogs on a University Virtual Learning Environment (VLE). These reflections clearly demonstrate the effectiveness of this teaching in making student aware of the alternatives to animal use and the contribution made by moderate animal welfare groups to improvements in animal welfare.

Examples of these reflections include:

*"Before, if offered the choice between a computer and a mouse disease model, I'd gone for the animal method straight away. Computer modelling was something a bit geeky - not for 'proper' scientists. I am now slightly ashamed of this narrow-minded view and am much more open to at least trying alternative methodologies."*

*"Really constructive exercise, very thought provoking. I found my personal view on animal testing has altered since researching the case for 'anti-viv' - a viewpoint that I'd never really thought seriously about before."*

Additional resources for tutors can be found on the following websites:

Home Office (Inspectorate, law, statistics) <http://scienceandresearch.homeoffice.gov.uk/animal-research/>

Home Office (links to other organisations) <http://scienceandresearch.homeoffice.gov.uk/animal-research/reference/>

Understanding Animal Research: <http://www.understandinganimalresearch.org.uk/>

Science Media Centre [http://www.sciencemediacentre.org/animal\\_research.htm](http://www.sciencemediacentre.org/animal_research.htm)

# USE AND ABUSE OF ANIMALS IN SCIENTIFIC RESEARCH

*Materials for debating the acceptable boundaries with respect to the use of animals in research*

## Abstract

Individuals may have to justify their own use of animals or animal tissues for research to the public. However, what one individual may consider as an acceptable use or purpose may not be acceptable to another person; these different viewpoints may be due to cultural and religious beliefs or even nationality. These materials are therefore designed to promote discussion as to what is/is not acceptable with respect to the use of animals in research and whether intervention, however well intentioned, is the best course of action if you find a practice unacceptable.

## Teaching Format

Part of a lecture or discussion session

## Practicalities

Individuals who use animals or animal tissues in their studies or research. Provision of ethics training for students in the Biological Sciences and related disciplines

## Relevant topics and issues

- Animal welfare
- 3Rs
- Public communication of science
- Anti-vivisection movement
- Ethics: Cultural or religious influences

## Tutor Notes

### *a) Acceptable or unacceptable use*

Individuals may object to a particular piece of research because, for example, of the species used, the purpose of the experiment or the techniques/procedures. To stimulate debate, a PowerPoint slide depicting the front journal page of a published potentially controversial study should be used e.g.

Yao, Yong-Ming; Sheng, Zhi-Yong; Tian, Hui-Min et al (1995) Gut-Derived Endotoxemia and Multiple System Organ Failure following Gunshot Wounds Combined with Hemorrhagic Shock: An Experimental Study in the Dog. *Journal of Trauma-Injury Infection & Critical Care*. **38**(5):742-746

This article, published in a prestigious journal, describes the use of an emotive species (dogs) which were shot whilst under anaesthesia and then resuscitated and kept alive for a few days in order to investigate . The research was also for military purposes, it was sponsored by the People's Liberation Army of China.

### *b) Is intervention always the best course of action?*

Whilst nobody wishes to see an animal suffering, intervention, however well intentioned may not always be the best course of action; it may well increase the animals suffering or distress. PowerPoint slides showing, for example, a cartoon of the Animal Liberation Front rescuing fish from a fish farm ([www.cartoonstock.com/lowres/cgo0052l.jpg](http://www.cartoonstock.com/lowres/cgo0052l.jpg)) can be used to promote discussion of the thought process of what in many cases are well meaning, but mis-guided/influenced people and whether intervention can cause more harm than good.

# ETHICAL DILEMMAS

*Interactive e-learning website which enables individuals to consider their own and others views on animal welfare issues*

## Abstract

Animal Ethics Dilemmas is an interactive e-learning website which uses case studies to challenge user's views on the welfare in animals in different scenarios. In response to a set of questions, users generate their own "ethical profile". The site takes each individual users profile as a starting point, adapts to that specific profile and then, through the use of case studies (topics include genetically modified, zoo and farm animals) and role-play, provokes the user to reflect critically on their particular standpoint. Within individual case studies, users are required to consider different ethical dilemmas and a number of potential solutions. The choices they make leads them to new dilemmas which require further decisions to be made, challenging their initial reactions. By challenging users on their viewpoints, Animal Ethics Dilemma both highlights the attractions of alternative perspectives and enables users to see that their own viewpoint is one of many that can be taken. It provides users with a better understanding both of their own ethical views and those of others across a wide range of animal welfare scenarios.

## Teaching Format

Practical or self-directed learning session

## Practicalities

Suitable for any student whose degree programmes require the discussion of animal welfare issues or CPD training for individuals involved in animal care

## Relevant topics and issues

- Animal welfare
- 3Rs
- Genetically modified animals
- Captive-bred and farm animals

## Student handout

### ANIMAL WELFARE ETHICAL DILEMMAS

#### *Learning Outcomes:*

- Summarise and evaluate the arguments involved in current animal welfare debates, including those concerning farm, zoo and laboratory animals

#### *Session Content:*

1. Get into groups of 2 (*could also be undertaken individually*)
2. Go to: <http://ae.imcode.com/en/1001>
3. The first person should create a personal profile by clicking on "Go to questions page"
4. Create a new user profile
5. Read the instructions carefully and answer the 12 questions
6. Make a note of your personal profile
7. Select two case studies and work through them
8. Check your personal profile to see if it has changed
9. The second member of the group should repeat steps 3-8

#### *By the end of this session and through further reading you should be able to:*

- Review the five main ethical views
- Construct your own personal ethical profile that will highlight your existing views on animal ethics
- Develop a better understanding of your own ethical viewpoints and the views of others
- Reflect critically on your ethical starting point as a result of working through the provocation case studies
- Evaluate the ethical dilemma website

#### *Indicative References:*

- Armstrong, S, Botzler R (Eds) 2003 *The Animal Ethics Reader* Routledge
- Degrazia, D. (2002). *Animal Rights: A Very Short Introduction*. Oxford University Press; Oxford
- Ethical Dilemma Website (2007). Accessed from: <http://ae.imcode.com/en/1001>
- Singer, P., 2001 *Animal Liberation*. 3rd Edition. Harper Collins: London

# ANIMALS IN RESEARCH

*Interactive on-line survey and supplementary questions for teaching animal welfare issues and the ethics of animal experimentation*

## Abstract

An understanding of animal welfare issues and the ethical dilemmas surrounding the use of animals in research is essential for in-vivo scientists and others involved in animal care or husbandry. This resource comprises of two online surveys and accompanying discussion material. The first, "Animals in Research: Responsible Conduct", confronts students with different ethical perspectives on animal use, requiring them to consider what is or isn't acceptable and to learn how these perspectives influence decisions. The second, "Animals in Research", enables students, with the help of advice from on-line "Advisors", to gain familiarity with varying conceptions of animal welfare, and to use these to identify welfare issues in different scenarios. These e-learning tools are supplemented by discussion questions that students address either during completion of the survey, afterwards in classroom discussions or as a self-directed learning exercise. Together, these resources enable students to understand how a variety of factors, including the potential benefits of the research and potential harms to the animals, can influence decisions regarding the use of animals in research.

## Teaching Format

On-line survey (maximum 4 questions) supplemented with a workshop in which student responses to questions (see tutor notes for examples) on animal welfare issues, ethics or the survey itself are discussed.

## Practicalities

Undergraduates who use animals in their studies or whose programmes of study require consideration and understanding of animal welfare issues. CPD training for individuals involved in animal care and husbandry.

## Relevant topics and issues

- Animal welfare
- Animal experimentation
- 3Rs
- Public opinion

## Student Handout 1

### ANIMALS IN RESEARCH: RESPONSIBLE CONDUCT

The use of animals in medical or scientific research raises strong emotions, with individuals either fundamentally opposed or strongly supportive. What are you willing to accept? To develop better policy about the use of animals in research, we need your views on some important issues. To ascertain your view, you will complete an online questionnaire; we will then discuss some of the issues raised in class afterwards

To access the questionnaire, log onto <http://www.yourviews.ubc.ca/en/node/726>, register and complete the "Animals in Research: Responsible conduct" survey. You will be guided through a series of questions (maximum of four): **the exact sequence of questions you receive will depend upon your responses.** We will ask you to respond "yes" or "no" to each question, and invite you to also **leave a comment** providing an explanation for how you answered. If you do not wish to leave a comment, please just enter "x" so that you can proceed to the next question. The questions will lead you through an overlapping set of issues regarding the use of animals in research. Each scenario proposes to use 100 animals in the research.

When you have finished the survey, we will show you how others have responded to similar questions. You should also answer the following questions which we will discuss in class afterwards (*may be given during or after the survey or as a self-directed learning exercise*)

By the end of the session, you will have a greater understanding of the different ethical perspectives on animal use, and how these perspectives influence decisions. You will also understand how a variety of factors, including the potential benefits of the research and potential harms to the animals, can influence decisions regarding the use of animals.

## Student Handout 2

### ANIMALS IN RESEARCH

Should we use animals in research? If yes, under what conditions? Is the welfare of animals harmed by some research, and if so, do goals such as improving human health or the environment justify this harm? In this workshop, you will complete an on-line questionnaire which seeks your views on these important issues; we will also discuss some of the issues raised in class afterwards

To access the questionnaire, log onto [http://www.yourviews.ubc.ca/en/animal\\_welfare](http://www.yourviews.ubc.ca/en/animal_welfare), register and complete the "Animals in Research" survey. Some of the issues might be unfamiliar to you, so there are links to advisors who provide information to help you make your decision.

- The Animal Advocate provides information about different ethical perspectives that address concerns about using animals in research
- The Public Health Advisor provides information about the value of the research to humans, including economic considerations
- The Scientist provides information about the research goals, methods and applications
- The Veterinarian provides information about animal welfare concerns arising from the research

If you do not wish to leave a comment, please just enter "x" so that you can proceed to the next question. When you have finished the survey, we will show you how others have responded to similar questions. You should also answer the following questions which we will discuss in class afterwards (*may be given during or after the survey or as a self-directed learning exercise*)

By the end of the session, you will have a greater understanding of the concepts of animal welfare and the issues arising in different scenarios. You will also understand how a variety of factors, including the potential benefits of the research and potential harms to the animals, can influence decisions regarding the use of animals.

#### Tutor Notes

Students should log onto on of the following sites and complete the on-line questionnaire

- Animals in research: Responsible conduct (*ethics of animal use*).  
<http://www.yourviews.ubc.ca/en/node/726>
- Animals in Research (*animal welfare issues*) [http://www.yourviews.ubc.ca/en/animal\\_welfare](http://www.yourviews.ubc.ca/en/animal_welfare)

Students should also be provided with one or more of the following questions which they can address either during or after completing the on-line component, as a self-directed learning exercise or as a summative assessment.

#### *Welfare or ethical issues*

- Describe two of the main ethical perspectives useful in decisions regarding the use of animals in research? How might these different perspectives lead to different conclusions regarding the support of this use of animals?
- Are pigs 'sentient'? What does this term mean?
- What are three areas of welfare concern described by the Veterinarian?
- Name three approaches to reducing phosphorous pollution resulting from pig production or name two approaches to reducing organ transplant rejection?
- What factors influenced your decision regarding the use of the pigs in these studies? For example:
  - Did your willingness to support the research change as the scenario unfolded? If so, why?
  - If you agreed with the animal use, would you still support the study if it required 10 times more pigs than originally proposed? If you disagreed with the use of the pigs, would you have agreed if fewer pigs were required?
  - Did any of the advisors affect your responses? If so, how? Did you agree or disagree with the comments made by any of the advisors? What additional information would you have found useful? Why?
- What are the main ethical issues regarding the genetic modification of animals in research?
- What are the main animal welfare concerns regarding the genetic modification of pigs?

#### *Science and Society questions*

- This survey is set up as an experiment - 2 types of studies (transplant vs. pollution) and 3 levels of number of pigs used (10, 100, 1000) - how did these factors affect student decisions and why?

What other factors might be important in influencing decisions (type of animal, care of the animal)? Are there limits to the numbers of animals that should be used, regardless of benefits promised?

- Students had access to 'advisors' to help them make decisions. Were these advisors helpful? What is the role of 'expert' advice? Who do you turn to for help in making these decisions - experts, or other people you trust?
- In general, respondents are less supportive of the research uses GM animals - why do you think this is? Are GM animals more likely to suffer? Or do people simply reject all use of GM animals for other reasons. Would any research justify the use of these animals?
- This survey was designed to find out more about your views on these issues - what role should the views of the public have in determining public policy in this area. For example, most respondents disagreed with the use of GM pigs in the environmental research - should regulators ban this type of research?

# ARE WE ABUSING ANIMALS?

*Group debate (and suggested topics) of animal welfare issues*

## **Abstract**

An understanding of animal welfare issues and the arguments for or against the use of animals in different circumstances is essential for individuals who are involved, for example, in the use of animals in the laboratory, in the food chain or in the wild. The aim of this seminar is for students to debate animal welfare issues arising in these different scenarios. By the end of the session, they will have knowledge of both sides of the argument enabling them to make an informed decision as to whether animal welfare is compromised in each scenario and be able to ask appropriate questions relevant to the topic

## **Teaching format**

1-2 hour debate

## **Practicalities**

Suitable for any student whose degree programmes require the discussion of animal welfare issues or training and/or CPD for individuals involved in animal care

## **Relevant topics and issues**

- Animal welfare
- Laboratory, food chain and captive animals

## **Student handout**

### **ARE WE ABUSING ANIMALS?**

An understanding of animal welfare issues and the arguments for or against the use of animals in different circumstances is essential for individuals who are involved for example in the use of animals in the laboratory, in the food chain or in the wild. By the end of this seminar, you should be able to

- Summarise and evaluate the arguments involved in current animal welfare debates
- Ask appropriate questions relevant to the topic

## *Seminar Organisation and assignments*

You will be allocated to a group which is either “for” the motion under debate, against the motion or to a group that is required to ask questions of both sides. You must stay in your allocated groups. The “for” and “against” groups should prepare a 15 minute presentation which seeks to persuade the audience to their “cause”. This presentation should be reasoned logical argument based on scientific facts and delivered from a non-emotional point of view. Whilst it should be prepared by the group as a whole, it should be delivered by one member. Your personal views may not match those of the group to which you have been allocated, but for the purposes of this session, you should adopt the persona of a committed believer to your cause. The group not arguing either for or against the motion **MUST** research the topic from both sides, prepare relevant questions to pose to BOTH sides and ask these during the session.

## **Tutor Notes**

Students should be divided up into three groups: those “for” the motion under debate, against the motion or to a group that is required to ask questions of both sides. Prior to the session, the “for” and “against” groups should prepare a 15 minute presentation in support of their cause; the remaining group should prepare questions to ask of both sides. You may wish the “for” and “against” groups to precirculate a summary of the main points of their presentations to the other groups prior to the session.

Examples of issues for debate could include:

- Are Zoos an outdated institution?
- Is cloning justified?
- Should we all be vegetarian?
- Is it ethical to experiment on animals?

At the start of the session, you should conduct a survey of survey of students opinions on the topic (via agree, not sure and disagree cards or personal response systems). You should then run the debate followed by student questions and discussion. This should be followed by a student review of main points and a second survey of students opinions on the topic to see if opinions have changed (via agree, not sure and disagree cards or personal response systems). The session should end with a summary and questions

# BEHAVIOURAL ECOLOGY AND ANIMAL WELFARE

*Essay for use in the teaching of laboratory animal welfare*

## **Abstract**

This assignment is a component of a Level 3 Behavioural Ecology module. The focus of the assignment is for students to research the natural behaviours of animals; they then use this information and their prior knowledge and training in behavioural ecology to suggest the ideal environment in which laboratory animals should be housed. Students can then compare these ideal environments with actual laboratory environments to highlight animal welfare issues.

## **Teaching format:**

1200 word essay

## **Practicalities:**

Module assignment for Level 3 students in Animal Sciences, Ecology or similar disciplines

## **Relevant topics and issues**

- Animal welfare
- Behavioural ecology
- 3Rs
- Laboratory animals

## **Student handout**

### *Rationale:*

Animal Welfare Science is a relatively young and growing field of research. Part of improving the welfare of captive animals involves a comparison with their wild counterparts. Behavioural Ecology is the study of species adaptations to their environment and is therefore an important part of Animal Welfare Science.

### *Learning Outcomes:*

- To relate environmental factors to reproductive, foraging and social behaviour;
- Review, critically analyse and apply available literature to an animal welfare scenario.

### *Brief:*

Advances in Animal Welfare Science have led to an appreciation of the housing and husbandry requirements of laboratory animals. Using a chosen rodent model discuss, in a 1200 word essay, the application of Behavioural Ecology to improve the welfare of laboratory animals.

References should be primary sources drawn from peer reviewed scientific journals and reputable government and higher level educational institution websites.

## **Tutor Notes**

Whilst this example utilises laboratory rodents, the methodology within this resource could also be utilised to examine animal welfare issues arising from the use of other species of laboratory animals, animals within the food chain or in captivity.

# ANIMAL ETHICS AND WELFARE

*Student presentations on animal ethics and welfare issues*

## Abstract

Animal welfare and the associated ethical concerns can be controversial and emotive issues. Therefore, the ability to present clear, detailed and non-biased information is an important skill for an animal scientist. It is essential that they are able to discuss and support an opinion based on the evaluation of current research. This assignment requires students to select a topic of their choice and produce a presentation of the ethical and welfare issues arising from their selected topic. This format ensures that students can present clear unbiased information that evaluates recent research and hopefully allows them to make educated non-emotive decisions regarding animal welfare issues.

## Teaching format

Individual student presentations (15min + 5min Q per student) which may be delivered either solely to assessors or to a group

## Practicalities

Undergraduates on animal sciences, veterinary or related programmes. Training or CPD for animal care staff

## Relevant topics and issues

- Animal welfare
- 3Rs
- Science and Society

## Student handout

### ANIMAL ETHICS AND WELFARE

Animal welfare and the associated ethical concerns can be controversial and emotive issues. Therefore, the ability to present clear, detailed and non-biased information based on the evaluation of current research is an important skill for an animal scientist. It is essential that you are able, not only to present this information, but are also able to discuss it, enabling both you and your audience to make educated, non-emotive decisions on animal welfare issues. By the end of this session, you should be able to summarise and evaluate the arguments surrounding an animal welfare topic or issue of your choice

#### *Brief:*

You are required to give a 15 minute presentation on a subject of your choice within the field of animal ethics and welfare, followed by 5 minutes of questions. The presentation can take the form of an informative, descriptive talk or a review of a number of scientific papers. The work should include analysis and evaluation of the welfare and ethical issues surrounding your chosen topic.

All presentations should be produced using Microsoft PowerPoint. The assignment must contain a summary, introduction/literature review, methodology, results and conclusion. The objectives of the presentation must be clear from the outset and reflected in the title and any information used must be detailed, accurate and up to date. You must compare, evaluate and analyse the information you present and provide a conclusion based on this evidence. (*Tutor note- you may wish to provide your Institutions/Organisations guidance and/or marking criteria for oral presentations*)

You should submit two copies of the presentation on two CD's. You must also produce two paper copies of the presentation accompanied by a list of references on a separate sheet. **Note:** Websites should be used sparingly and should be reputable and scientific.

# **ANIMAL WELFARE: WHO IS RIGHT?**

*Evaluating and discussing video clips of animal welfare issues*

## **Abstract**

As an alternative to student presentations forming the basis of debates on animal welfare issues, the alternative is to provide the background information via the showing of video clips for and against the use of animals in different scenarios (these can be obtained from professional organisations, YouTube or Bioethics Bytes <http://bioethicsbytes.wordpress.com> )

The students are shown both clips. They are asked to summarise each clip. They are also asked to examine the factual information and discuss how accurate this information is and to discuss the ethical issues arising and the standpoints of each side. They are asked if they would recommend either clip and to justify their opinion. This allows them to evaluate information in an objective way and to understand different ethical viewpoints.

*Example clips:*

- Meet the chicken farmer - British poultry reared to highest welfare standards - find out the facts <http://www.youtube.com/watch?v=tZXf9hvPwPS>
- Live Fast Die Young - the life of a meat chicken <http://www.youtube.com/watch?v=rpbtBgLf190&feature=related>

By varying the topic of the clips, the same methodology could be tailored to different groups of students.

## **Teaching format**

1 hour seminar, self-directed learning session or summative assignment

## **Practicalities**

Undergraduates on animal sciences, biology, life sciences, veterinary or related programmes. Training or CPD for animal care staff

## **Relevant topics and issues**

- Animal welfare
- Farm animals
- Captive held animals
- Laboratory animals
- Science and Society

# ANIMAL WELFARE: WHAT WOULD YOU DO?

*Case study of an animal welfare issue*

## Abstract

Project licence holders are responsible for the care and welfare of all experimental animals in which studies are being undertaken under the aegis of their project licence. If animal welfare issues arise, in consultation with the NVS, NACWO and animal care staff, they must decide the appropriate course of action, including terminating the studies, and whether any preventative measures are required for future studies. This case study enables the discussion of these matters and highlights the roles and responsibilities of individuals under the Animal (Scientific Procedures) Act.

## Teaching Format

May be discussion session as part of a lecture or workshop or self-directed learning exercise

## Practicalities

Undergraduates or postgraduates whose studies require an understanding of animal welfare issues. Individuals with animal care and welfare responsibilities under ASPA

## Relevant topics and issues

- Animal welfare
- Animal (Scientific Procedures) Act
- 3Rs
- Roles and responsibilities

## Student Handout 1:

### ANIMAL WELFARE: WHAT WOULD YOU DO?

As a scientist, you are ultimately responsible for the care and welfare of all the experimental animals you are using in your research. What would you do if an animal welfare issue arose, who would you consult, what immediate action would you take and what preventative measures would you put in place to prevent similar problem occurring in the future?

Consider the following:

- **Rabbit:** New Zealand White, Female. Weight 2.25 kg
- **Experimental procedure:**  $10^7$  pfu vaccinia virus injected intradermally at 2 sites on the rabbits back on day 1.
- **History:** By day 6 lethargic, looking slightly emaciated and with noticeable ocular and nasal discharge. It had been reported on Monday that not much water had been drunk or food eaten over the weekend, but otherwise the rabbits seemed ok. Hay had been eaten.
- **Clinical examination:** Weight 2.04 kg (loss of 210g body weight over a 6 day period). The individual was depressed and reluctant to move, the eyelids were half closed and excessive thick white nasal and ocular discharge was evident bilaterally. Some bruising was noted at each injection site, extending approximately 2cm in length.

What would you do next?

## Student Handout 2:

### ANIMAL WELFARE: WHAT WOULD YOU DO?

Section 19b (vi) of the protocol in the project licence (PPL), did not contain any details of expected adverse systemic effects relating to vaccinia infection. The adverse effects that were to be expected at this dose rate were limited to localised skin reactions.

(vi) Describe the possible adverse effects, their likely incidence and proposed methods of prevention or control, for example by schemes of inspection, analgesic regimes and the application of specified humane end points. See *Notes to Applicants* and the *Guidance on the Operation of the Animals (Scientific Procedures) Act 1986*, and ensure that the adverse effects listed cover both the interventions to be performed and their consequences.

Mild trauma during injection. Possible sterile abscess from adjuvants (less than 5% of cases). Daily observation following administration of antigens and use of cleansing agents to remove necrotic tissue where appropriate. Affected animals will be treated appropriately and the advice of the NVS sought. Local lesion from infection with vaccinia virus and other poxviruses, complete healing expected within 3 weeks. Daily observation after inoculation of virus until virus lesion has healed and use of analgesics where appropriate. Animals not healing as expected will be treated appropriately and the advice of the NVS sought. The doses of viruses used for infection will be determined previously (protocols 19b 1, 3, 4, 5) as those inducing only mild, local or inapparent infections.

1. Having read the appropriate 19b (vi), who would you consult and what course of action would you take?
2. What would you do to prevent a re-occurrence of these problems in the future?

#### Tutor notes:

The following slides should be utilised to facilitate discussion and provide answers to the questions students are required to address:

#### Animal welfare dilemma

- Rabbit ID: New Zealand White, Female. Weight 2.25 kg
- Experimental Procedure  $10^7$  pfu vaccinia virus injected intradermally at 2 sites on the rabbits back on Day 1
- History: By day 6 lethargic, looking slightly emaciated and with noticeable ocular and nasal discharge. It had been reported on Monday that not much water had been drunk or food eaten over the weekend, but otherwise the rabbits seemed ok. Hay had been eaten.
- Clinical examination: Weight 2.04 kg (loss of 210g body weight over a 6 day period). The individual was depressed and reluctant to move, the eyelids were half closed and excessive thick white nasal and ocular discharge was evident bilaterally. Some bruising was noted at each injection site, extending approximately 2cm in length.

#### What happens next?

- Project licence consulted
- Section 19b (vi) of the protocol in the PPL, did not contain any details of expected adverse *systemic* effects relating to vaccinia infection. The adverse effects that were to be expected at this dose rate were limited to localised skin reactions.

## Section 19b (vi) of the project licence

(vi) Describe the possible adverse effects, their likely incidence and proposed methods of prevention or control, for example by schemes of inspection, analgesic regimes and the application of specified humane end points. See *Notes to Applicants* and the *Guidance on the Operation of the Animals (Scientific Procedures) Act 1986*, and ensure that the adverse effects listed cover both the interventions to be performed and their consequences.

Mild trauma during injection. Possible sterile abscess from adjuvants (less than 5% of cases). Daily observation following administration of antigens and use of cleansing agents to remove necrotic tissue where appropriate. Affected animals will be treated appropriately and the advice of the NVS sought.

Local lesion from infection with vaccinia virus and other poxviruses, complete healing expected within 3 weeks. Daily observation after inoculation of virus until virus lesion has healed and use of analgesics where appropriate. Animals not healing as expected will be treated appropriately and the advice of the NVS sought. The doses of viruses used for infection will be determined previously (protocols 19b 1, 3, 4, 5) as those inducing only mild, local or inapparent infections.

## What next?

- NVS contacted

### > What should he do?

The NVS was contacted and the rabbit presented for veterinary examination. Due to the deteriorating condition of the rabbit, a decision was made to cull this individual as recovery was unlikely and it was felt that the rabbit had exceeded its humane end points

### > What next?

- Consultation between NVS, PIL and PPL Holder

The decision to cull was made after consulting the PPL holder and also the PIL.

## *Pasteurella multocida* in rabbits

- The respiratory signs displayed by the rabbit match those commonly associated with a *Pasteurella* infection. One possible hypothesis is that the rabbit may have had subclinical disease, which was exacerbated by the body's immune response after the vaccinia administration.

- "Snuffles" Subclinical infections

Image of rabbit with "snuffles"  
[www.radil.missouri.edu/.../snuffles1.jpg](http://www.radil.missouri.edu/.../snuffles1.jpg)

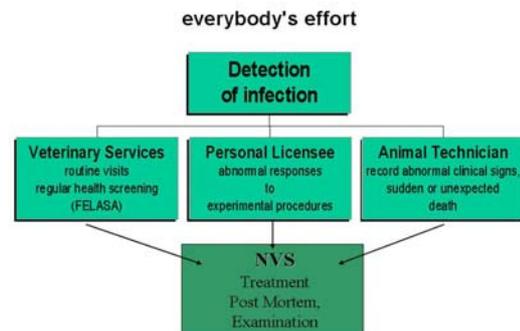
## Future plans and recommendations What should the PPL Holder do?

- Reduce the dose of virus used on primary immunisation in future, or alter the strain of virus to one known to be less virulent.
- Either will not compromise the objective of this experiment - to obtain high titre anti-vaccinia virus antiserum.
- Because both animals greater than 2.5 kg have handled the infection much better than the smaller animals (2.25 kg), stipulate use of only animals in excess of 2.5 kg.

## Future plans and recommendations What should the NACWO & NVS recommend?

- If systemic signs continue to develop in rabbits used in the future, PPL holder to apply for an amendment to the PPL, which outlines and describes the clinical signs which are expected as adverse effects.

## Working within ASPA (1986)



# XENOPUS HUSBANDRY IN PRACTICE

PowerPoint slides for Xenopus husbandry training course

## Teaching Format

Seminar

## Practicalities

Animal care and welfare staff, staff CPD, undergraduates on biology, animal sciences or similar programmes

## Relevant topics and issues

- Animal welfare
- Animal care and husbandry
- 3Rs

## Teaching Resources

All images are printed in colour in the e-version of this resource. There are also supplementary images

<h3>XENOPUS HUSBANDRY IN PRACTICE</h3> 	<h3>Xenopus Physiology</h3> <ul style="list-style-type: none"><li>• Mature in approximately 14 weeks.</li><li>• Sexual maturation- male 12 months; female 18 months.</li><li>• Physiology is temperature dependent. Heart rate 2°C = 8bpm, 25°C = 40-60 bpm</li><li>• Skin is damp and slippery due to mucus layer which protects the sensitive and permeable skin.</li><li>• Mucus layer becomes more profuse when the animal is handled.</li><li>• Has anti-microbial compounds, thus protecting the animal from skin infections.</li><li>• Well developed vibration detecting tissue along the sides of their bodies - "lateral line organs".</li><li>• Locate prey by vibration, by feel, or by smell. Can also sense fear</li><li>• Will eat non-living matter as well as live food.</li></ul>
<h3>Feeding and nutrition - Adults</h3> <ul style="list-style-type: none"><li>• Three meals a week with additional treats (3-5 hours before cleaning):<ul style="list-style-type: none"><li>&gt; Mon Pelleted food</li><li>&gt; Tues Chopped beef heart (treat)</li><li>&gt; Wed Pelleted food</li><li>&gt; Thurs Injection day</li><li>&gt; Fri Chopped beef heart (treat)</li><li>&gt; Sat Pelleted food</li><li>&gt; Sun nothing</li></ul></li></ul> 	<h3>Feeding and nutrition: tadpoles</h3> <ul style="list-style-type: none"><li>• Good nutrition &amp; adequately hard water essential for normal development</li><li>• Filter feeders- eat suspended food from P10</li><li>• Powdered egg ideal<ul style="list-style-type: none"><li>&gt; Absorb through skin &amp; gills</li></ul></li><li>• High calcium requirement<ul style="list-style-type: none"><li>&gt; Absorb through skin &amp; gills</li></ul></li><li>• Iodine deficiencies prevent metamorphosis</li></ul>

## Housing

- Housed in plastic tanks
- Tanks are filled with 4-5 inches of chlorine and chloramine free water. Aquasafe added.
- Lid to prevent escape
- Plastic pipe for environmental enrichment
- 8 toads to each tank: 4M + 4F
- 12hr/12hr light/dark cycle
- Maintains vitamin D levels and ensures correct calcium / phosphorous balance.



## Adult Xenopus – Water Quality

- Tanks are cleaned 2 times a week.
- Toads cleaned 3-5 hours after feeding to prevent regurgitation.
- Water temp 19-21°C
- Sensitive to room temperature fluctuations.
- Water used for changing tanks should be maintained at same temp. as tanks
- Water pH 6.5-8.5
- Tap water should sit for at least 24 hours to allow Chlorine to dissipate and temperature to equilibrate.
- Use high density polythene or nylon tubing not galvanised or copper pipes. Dissolved salts from these are toxic to xenopus.

## Handling: Female & Male

- Average female size is 4.6 inches
- Average male size is 2.4 inches
- Proper handling is vital to avoid stress
- Grasp the toad with the palm of the hand down while placing fingers on each side and between the legs.
- Lift the animal up and use free hand to gently but firmly secure the animal to prevent the animal squirming to escape.



## Stimulating breeding with HCG

- A pair of toads put in a fresh tank of dechlorinated water.
- Water temp 18-20 degrees C.
- Breeding stimulated with Human Chorionic Gonadotropin (HCG) injection into dorsal lymph sac
- Female injected with 0.75ml HCG (induction ovulation); male 0.25 ml (mating & sperm release)



## Stimulating breeding with HCG

- Left undisturbed in a darkened tank 16-24 hours post-injection for amplexus to take place
- After 24 hours, female releases the eggs, male fertilises them as released
- Eggs collected next day using a turkey baster
- Egg care:
  - Eggs "washed" to prevent fungal / bacteria growth
  - Limit stocking density as doesn't promote good growth
  - Checked under the microscope for signs of fertilisation
  - Necrotic eggs removed
  - Egg dishes are placed on a heat controlled mat (20-23°C) with slow bubbling of air until hatch

## Successful breeding

- Quality is more important than number of eggs
- Influenced by diet, lighting, water, type of hormonal stimulation, frequency of egg collection, age of female
- Females should be injected to breed every 3 months, normal breeding life 1-2 yrs
- Males 3 years breeding life expectancy

## Hatching Larvae

- Stage 37/8
- First sign of tadpole
- Stop feeding on own yolk
- Use decomposing jelly as interim food source
- After 3 days, transfer to tank
- Fed dried hens eggs (rehydrated)
- Stage 60, metamorphose



## Tadpoles

- Air is slowly bubbled into tank
- Room & water temp 23°C.
- Cleaned every 2 weeks.
- 25% of the water changed, replacement water same temp. Sudden temp drops kills.
- Great diversity in rate of development. This is normal but froglets should be removed and re-housed to prevent cannibalism.



## Health and Diseases

### Red Leg

Common name for bacterial septicaemia. Usually activated by stress. Mortality is particularly high in newly acquired or transported toads. Sudden death is common.

### Clinical signs

Animals become lethargic and refuse to eat. Notable red colouration becomes apparent on legs and ventral surfaces, often signs of oedema, before death. Symptoms often triggered by unsanitary conditions, overcrowding, or exposure to cold during transportation.

### Treatment

Salt bath in the initial stages, 5-10g.l<sup>-1</sup> water, 3-5days. If no improvement, Veterinary help should be sought. Oral antibiotic tetracycline commonly used



## Health and Diseases; Parasites

- Amphibians are hosts to a vast array of parasites.
- Not generally a problem unless stress from captivity & transport increases incidence/severity.

### Nematodes (round worm)

- Infection may arise as a result of damage to the skin.
- Reinfection can occur by injection of skin scrapings containing parasite eggs.
- Repeated treatments may be necessary.
- Clinical signs may not appear until 12-18 months after initial infection.
- Symptoms: Grey, rough, flaky skin usually starting in the thighs, excessive shedding of skin and rapid weight loss. Threadlike structures around injection sites.

### Treatment

- 0.2 to 0.4mg/kg Ivermectin, orally or subcutaneously.
- Tanks thoroughly disinfected
- Veterinary help should be sought.

## Transportation: Packaging

- Transported in waterproof, aerated boxes, with viewing window.
- Moist foam should be added to avoid desiccation and provide cushioning.
- Boxes should be transported using vehicles that are temperature controlled to avoid extremes.

## Quarantine

- Quarantine on arrival
- Allow animals to stabilise following transportation. Need time to get used to new environmental conditions.
- Exposure of stock, from possible disease, from the incoming stock should be avoided.
- Use separate nets etc. for quarantined animals
- Check stress from transportation has not triggered Red Leg.

## Euthanasia

- Overdose of an anaesthetic using appropriate dose depending on the size of animal
  - > e.g. MS 222 (tricain methanesulphonate) administered in bath or via injection
- Concussion of the brain by striking the cranium – in amphibians up to 1Kg – with destruction of the brain before the return of consciousness

# POULTRY HUSBANDRY

PowerPoint slides for poultry husbandry (modules 2 & 3) training course

## Teaching Format

Seminar

## Practicalities

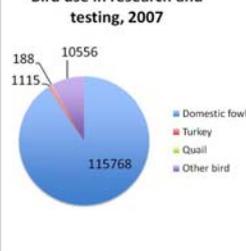
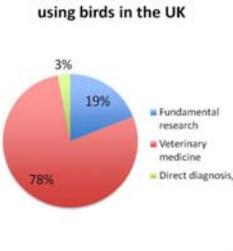
Animal care and welfare staff, staff CPD, undergraduates on biology, animal sciences or similar programmes

## Relevant topics and issues

- Animal welfare
- Animal care and husbandry
- 3Rs

## Teaching Resources

Colour photographic images to supplement these slides can be viewed in the e-version of this resource

<h2 style="text-align: center;">Poultry Modules 2 &amp; 3</h2>	<h3 style="text-align: center;">Introduction</h3> <p>Phylum Chordata Class Aves</p> <ul style="list-style-type: none"><li>• Chickens (<i>Gallus gallus domesticus</i>)</li><li>• Turkeys (<i>Meleagris gallopavo</i>)</li><li>• Ducks (<i>Anas platyrhynchos</i>)</li><li>• Geese (<i>Anser anser</i>)</li></ul> <p>&gt; Chickens-domesticated 8000 years ago from red jungle fowl</p> <p>&gt; Turkeys-domesticated 500 years ago from American Wild Turkey</p>																		
<h3 style="text-align: center;">Use of birds in research</h3> <ul style="list-style-type: none"><li>• Toxicology</li><li>• Behaviour</li><li>• Reproduction</li><li>• Surgical</li></ul> 	<h3 style="text-align: center;">Use of Birds 2007</h3> <div data-bbox="842 1323 1098 1603"><h4>Bird use in research and testing, 2007</h4><table border="1"><thead><tr><th>Category</th><th>Value</th></tr></thead><tbody><tr><td>Domestic fowl</td><td>115768</td></tr><tr><td>Turkey</td><td>10556</td></tr><tr><td>Quail</td><td>1115</td></tr><tr><td>Other bird</td><td>188</td></tr></tbody></table></div> <div data-bbox="1114 1323 1369 1603"><h4>Purpose of procedures using birds in the UK</h4><table border="1"><thead><tr><th>Purpose</th><th>Percentage</th></tr></thead><tbody><tr><td>Fundamental research</td><td>19%</td></tr><tr><td>Veterinary medicine</td><td>78%</td></tr><tr><td>Direct diagnosis</td><td>3%</td></tr></tbody></table></div>	Category	Value	Domestic fowl	115768	Turkey	10556	Quail	1115	Other bird	188	Purpose	Percentage	Fundamental research	19%	Veterinary medicine	78%	Direct diagnosis	3%
Category	Value																		
Domestic fowl	115768																		
Turkey	10556																		
Quail	1115																		
Other bird	188																		
Purpose	Percentage																		
Fundamental research	19%																		
Veterinary medicine	78%																		
Direct diagnosis	3%																		

### Numbers used in research

BIRD:	1997	2007
DOMESTIC FOWL ( <i>GALLUS DOMESTICUS</i> )	101,146	115,768
TURKEY	5,612	1,115
QUAIL ( <i>COTURNIX COTURNIX</i> )	1	0
QUAIL (OTHER SPECIES)	2,507	188
OTHER BIRD	9,826	10,566
<b>TOTAL</b>	<b>119,092</b>	<b>127,637</b>

### Biological data

Species	Weight (kg)	Lifespan (yrs)	Temp (°C)	Heart rate (per min)	Resp rate (per min)	Clutch size	Incubation period (days)
Chicken	2.2 – 2.7	5 – 8	40 - 42	350 – 470	15 – 30	8 – 10	20 - 22
Turkey	5.5 – 15.5	5 - 8	41.0 – 41.2	200 - 280	15 - 30	8 - 12	28
Japanese quail	0.1-0.2	2 – 3	38.5 – 41.5	490 – 530	40-85	1 – 14	19 – 20
Ducks	1.9-3.2	8-10	41 - 42	350 - 450	15 - 30	8 - 15	25 - 28
Geese	2.5 – 6.5	10 - 24	38.7 - 42.2	450 - 470	15 - 30	3 - 8	28 - 35

### Source & Supply

- Domestic fowl (chickens, turkeys, ducks etc) are **NOT** included under Schedule 2 of the A(SP)A 1986
  - Schedule 2 – Animals to be obtained only from designated breeding or supplying establishments e.g. quail
- Commercial hatchery
- Other Laboratories
- Poultry Fanciers
- Maintained breeding stock

### Breeding

- Sexual dimorphism (or lack of)



- Feather appendages or specialist body parts



### Breeding

- Pairs
- Breeding ratios



- Incubation
  - All lay eggs, with very specialised shape and colour
  - Most incubate own eggs (some species share, M+F; some cases role reversal)
  - Candling (Day 8)

### Husbandry

- Considerations of bird behaviour



- Environmental enrichment



### Husbandry

- Accommodation
  - Three dimensional
  - Allows full flight
  - Substrate (allowing foraging)
  - Appropriate feeding stations
  - Adequate perching (of appropriate size)



### Housing

Species and weights	Minimum floor area sq cm per bird		Minimum height cm	Minimum length of trough per bird cm
	When housed in groups	When housed singly		
Quail				
Up to 150g	250	350	20	4
150 – 250g	250	400	25	4
Pigeons	800	1225	35	5

### ETS 123

European convention for the protection of vertebrate animals used for experimental and other scientific purposes

- Birds (domestic fowl, domestic turkey, quail, ducks and geese, pigeon, zebra finch)

### Environmental conditions

- Minimum requirements

Temperature	16 – 23°C
Humidity	30 – 80%
Air changes	8 – 12 per hour
Light	8:16 light:dark

### Diet & Digestion

- No teeth
- Food picked up delicately with beak
- Oesophagus
  - capable of great distension
  - mucus glands provide lubricant
  - food is stored in enlarged section, the crop, & undergoes softening & swelling
- Glandular stomach (proventriculus) – gastric glands – chemical digestion
- Muscular stomach (gizzard) – ingested grit – physical digestion

### Diet & Digestion

- Duodenum/intestines – further digestion and absorption
- Paired caeca – cellulose breakdown via bacterial fermentation
- Large intestine→rectum→cloaca
- Voided approximately every tenth dropping – usually dark brown and glutinous. (White tip is urates)
- Food
  - Commercial balanced rations – dry mash, pellets, crumbs (chicks)
  - Specifications depends on poultry type e.g. chick, broiler, layer
  - Scavenging
  - Grit to aid mechanical digestion
  - Calcium needed for egg formation

### Handling and restraint

- Species (use of specialist equipment)



- Use of positive reinforcement techniques
- Protective clothing
  - Zoonotic disease
  - Beaks & claws
  - PPE

### Welfare Problems

- Chickens
  - Behavioural frustrations e.g. nest box, foraging, dust-bathing
  - Feather pecking
  - Restricted feeding
  - Bone problems



### Welfare Problems

- Turkeys
  - Locomotion problems
  - Heart-related problems
  - Breeding
  - Head-pecking, feather pecking



### Physical examination

- With handling
  - Stress
  - Basic behaviour
  - Individuality
- Without handling
  - Observation
  - Cage
  - Response
  - Body condition
  - Skin and feathers
  - Discharge



### Signs of pain in animals

- Posture
- Temperament
- Vocalisation
- Locomotion
- Appetite
- Respiration
- Appearance
  
- Stress recognition – stereotypic behaviour

### Diseases

- Bird welfare
- Feather Pecking
  - Choose strain with care
  - Environmental enrichment
  - Lower light intensity
  - Beak trim
- Zoonotic
  - *Salmonella typhimurium*
  - *Salmonella enteritidis*
  - *Aspergillus flavus* (Farmers lung)
  - *Paramyxovirus* (Fowl pest or Newcastle's disease)
  - Avian influenza



### Diseases

- Red Mite (*Dermanyssus gallinae*)
  - 1mm long
  - Live in housing in day, feed at night
  - Can cause anaemia, debility, death
  - Treat housing as well as birds
- Egg Bound
  - Due to calcium imbalance – dietary or stress
  - Keep bird warm, olive oil in vent
  - Calcium supplement



### Disease control

- Source of birds
- Health screening
- Colony management
- Prophylaxis

### Minor procedures

- Blood
- Faeces
- Swabs
- Dosing
  - Oral
  - Parenteral
    - i/m – pectoral / thigh
    - i/v - alar / jugular
    - i/p - mid-abdomen, caudal to sternum



### Identification

- Rings



- Digital photography
- Transponders
- Dyes

### Anaesthesia & analgesia

- Inhalation
  - Problems with birds
    - Higher metabolic rates (particularly smaller species)
    - Higher body temperatures – rapid cooling during anaesthesia
    - Respiratory system – presence of air sacs may allow build-up of anaesthesia vapour & consequent overdose
- Injectables
  - Ketamine (10mg/kg i.m.) & Xylazine (0.5mg/kg i.m.)
  - Ketamine (15mg/kg i.m.) & Diazepam (1mg/kg i.m.)
  - Ketamine (5-10mg/kg i.m.) & Medetomidine (50-100mg/kg i.m.)

### Euthanasia: Schedule 1 methods

- Overdose of anaesthetic agents
  - Intravenous
  - Intraperitoneal
- Exposure to rising concentration of CO<sub>2</sub>
  - Birds up to 1.5kg
- Cervical dislocation
  - Birds up to 3kg
- Methods for foetal, larval & embryonic forms:
  - Overdose of an appropriate anaesthetic agent
  - Refrigeration, or disruption of membranes, maceration or exposure to 100% CO<sub>2</sub> concentration
  - Decapitation: Birds up to 50g

# A QUESTION OF ETHICS

Compilation of ethical questions and issues for debate

## Abstract

Our use of animals in research, the food chain or as captive animal raises a myriad of ethical issues and dilemmas. Consideration of some of these issues could be incorporated as discussion points into any undergraduate or postgraduate training programme, training programmes for animal care staff, staff CPD or in "Science and Society" activities. Below are some of these dilemmas or issues. It is suggested that individual question or issues be made into discussion slides (with pictures where this may facilitate debate).

## Teaching format

Incorporated into other sessions e.g. HO modular training, undergraduate/postgraduate provision, Staff CPD, Science and Society activities

## Practicalities

Any individual involved with animal experimentation, care or welfare. Science and Society activities

## Relevant topics and issues

- Animal welfare
- Animal experimentation
- 3Rs
- Harm / benefit
- Ethics & morality
- Science and Society

## Teaching materials

### Introductory general ethics slides

**Ethics**

1. The philosophical study of the moral value of human conduct and the rules and principles that ought to govern it; moral philosophy.
2. A social, religious or civil code of behaviour considered correct especially that of a particular group, profession, or individual.
3. The moral fitness of a decision, course of action etc.

**Ethics**

Man has moral responsibility for actions- possesses beliefs and preferences; a life plan

**Ethics and Morality**

- Ethics
  - Exhortation without enforcement
  - Why things are right or wrong
- Morality
  - Right vs wrong
  - Was based on religion- now ?
  - Little said about animals

**Animal Rights**

Rights can only be possessed by cognizant beings who accept the responsibilities and restraints of life in civilised communities.

Roy Hattersley (The Sunday Times, 5 July 1998)

**The alternative is man!**

Cartoon of prehistoric man playing with fire  
[www.cartoonstock.com/lowres/rmc0020l.jpg](http://www.cartoonstock.com/lowres/rmc0020l.jpg)

Early experiments in Breath Freshners!

### **The ethics of animal research:**

- What is the basis for permitting humans to use animals in research?
- Is animal research for human benefit ethically justifiable
- Is it ethical NOT to use animals for medical research
- Is it unethical to work to a common good?
- Are the benefits sufficiently important
- "There is no fundamental difference between man and the higher animals in their mental faculties"
- Animals are small furry people
- Animals are just a bag of reflexes
- "Only humans fear death and feel responsibility"
- "Science should not be hampered by ethical judgements"
- "What an animal thinks or experiences is outside the purview of scientific enquiry, since mental states are not open to observation and experimentation"

### **Ethical issues from an anti-vivisectionist perspective:**

<b>ANTI The 3 UNs</b>	<b>AR-View</b>
<ul style="list-style-type: none"><li>• Unethical<ul style="list-style-type: none"><li>➢ Infringe animal's rights</li></ul></li><li>• Unkind<ul style="list-style-type: none"><li>➢ Inherently cruel</li></ul></li><li>• Unnecessary<ul style="list-style-type: none"><li>➢ Alternatives are available</li><li>➢ Can use man only reliable species</li></ul></li></ul>	<ul style="list-style-type: none"><li>• Q.....asked an animal rights activist which he would save in a fire if his house was burning down and he had to run in and save either his daughter or his cat</li><li>• A. I would have said that I would get my daughter first, because I think that her life is worth more than that of a cat, and presuming that they both are unconscious, then one is not suffering more than the other. A human has a chance to be independent, and to contribute to the good of society. The cat, although he/she can suffer, cannot do this, so the human's life is more important.</li></ul>

- Research is cruel
  - *Legislation requires that all possible steps are taken to eliminate or minimise distress*
- Research is unethical
  - *Is it unethical to work to a common good?*
  - *Is it ethical to refuse to develop new treatments?*
- Improvements in sanitation have had far more effect on health than medicines or vaccines
- Prevention is more important than treatment.
- Life style changes are needed not animal research
- Use of animals is misleading when seeking cures to human disease.
- We should carry out experiments on humans.
- WHO has stated that only 200 drugs are needed.
  - We have 18000 many of them me-too
  - This is wasteful and unnecessary, driven by the profit motive
- Alternatives are available to replace animals.
- Introduction and wider application of natural therapies (homeopathy, reflexology) are being stifled by drug research
- Disabled people do not need promises of cures "tomorrow" they want cash directed to better facilities now.

### **Questions focusing on animal welfare and harm / benefit analysis:**

- Is animal research right or wrong? What is the research for?
  - *To develop a new medicine to cure childhood leukaemia*
  - *To enable a scientist to study how the sense of hearing works*
  - *To test whether a garden insecticide is harmful to people*
  - *To test whether an ingredient used in cosmetics is harmful to people*
- Is animal research right or wrong? Does it depend on the animals to be used? What species are acceptable?
  - *Monkeys?*
  - *Rats & mice?*
  - *Dogs and cats?*
  - *Fish?*

- How can potential benefits be ranked, so that they can be weighed against animal harm?
- What might count as an 'acceptable' benefit - a sufficient reason for harming animals?
- Are the benefits sufficiently important
- Could the benefits be achieved through less or no suffering
- What do you consider to constitute a cost to animals:
  - source
  - transport
  - husbandry
  - as well as the procedure and its effects?
- Are there some harms to animals which can never be justified (some techniques which ought never to be carried out)?
- More animal suffering results from housing and unsuitable husbandry than arises out of experimental procedures
- How much suffering would you be prepared to impose to achieve your scientific objectives?
- How do you feel about using different species (or even breeds within species) and about different purposes?
- How, in practice, should the 'weighing' of harm and benefit done? Who should be involved?
- From a more positive perspective, do you take steps actively to improve welfare?
- If you had to go back and make one improvement, what would this be?
- What should you do if concerned about an experiment
  - Should I say something
  - Who to talk to
  - What sort of concerns
  - What can be done
  - Will there be any repercussions
- Would tougher or more restrictive laws achieve anything?
  - Better conditions for animals in UK?
  - Fewer experiments in UK?
  - Fewer experiments?
  - Better science?
  - Better conditions for animals world-wide
  - Export of experiments
  - Overall reduction in quality of life for animals
- The 5 Freedoms (FAWC Press notice 92/7)
 

The welfare of an animal should be considered in terms of 'five freedoms'. These freedoms define ideal states rather than standards for acceptable welfare. They form a logical and comprehensive framework for analysis of welfare within any system together with the steps and compromises necessary to safeguard and improve welfare. The concept of the 5 Freedoms is based on the Bramble Report of 1965, which was directed towards farm animals. However the concept of the "biological cost" to the animal, as a result of scientific interventions which limit one or more of the five freedoms, could be used as a means of assessing the severity of a project licence as part of the Ethical Review Process.

  1. *Freedom from Hunger and Thirst.*  
by ready access to fresh water and a diet to maintain full health and vigour.
  2. *Freedom from Discomfort.*  
by providing an appropriate environment including shelter and a comfortable resting area
  3. *Freedom from Pain, Injury or Disease*  
by prevention or rapid diagnosis and treatment.
  4. *Freedom to express Normal Behaviour.*  
by providing sufficient space, proper facilities and company of the animals own kind
  5. *Freedom from Fear and Distress*  
by ensuring conditions and treatment which avoid mental suffering.

These freedoms will be better provided for if those who have care of livestock practise:

  - Caring and responsible planning and management
  - Skilled, knowledgeable and conscientious stockmanship
  - Appropriate levels of environmental design
  - Considerate handling and transport
  - Humane slaughter.

**The religious perspective:**

Genesis Ch28 v6: "I am putting you in charge of all the fish, birds and all the wild animals"

**Protestant Christianity:** "The fact that animals may be used in scientific procedures for the benefit of the people shows that we believe that human beings have more value than animals. But the fact that we minimise the pain, suffering distress or lasting harm that animals may have to undergo shows that we regard them as having intrinsic value"

**Catholicism:** "Provided they remain within reasonable limits, medical and scientific experiments on animals are morally acceptable since they may help save human lives or advance therapies"

**Judaism:** "A very good cause can be made out for vivisection of animals provided safeguards are taken to reduce the pain to a minimum. Here the benefits to medical progress are considerable and the price worth paying"

**Islam:** "Some research on animals may yet be justified given the traditions of Islam. Basic and applied research in the biological and social sciences, for example, will be allowed if the laboratory animals are not caused pain or disfigured and if human beings or other animals would benefit because of the research.

**Additional discussion slides:**

Scientific papers: Pain and its effects on the neonate

- Anand & Hickey (1987) Pain and its effects on the human neonate and foetus. *New England J of Medicine*
  - Early studies on neurologic development concluded that .... perception or localisation of pain was not present
  - Furthermore, because neonates may not have memories or painful experiences, they were not thought capable of interpreting pain in a manner similar to that of adults
  - These traditional views have led to a Widespread belief in the medical community that the human neonate or foetus may not be capable of perceiving pain.
  - One result is that new-borns are frequently not given analgesic or anaesthetic agents during invasive procedures, including surgery.
- Anand KJS, Sippell WG, Aynsley-Green A (1987) Randomised trial of fentanyl anaesthesia in preterm babies undergoing surgery: Effects of the stress response. *Lancet*
  - The findings indicate that preterm babies mount a substantial stress response to surgery under anaesthesia with nitrous oxide and curare and that prevention of this response by fentanyl anaesthesia may be associated with an improved outcome.

**Chicken Consumption in USA/UK**

- North Americans eat almost 1 Million chickens per hour
- This is equal to 8.76 Billion (8.76 Thousand Million) per year
- Britons eat 96,000 chickens per hour
- This is equal to 840 Million per year
- Average consumption is 15.3 chickens/person/year in the UK
- KFC use 700 million chickens per year

**The Use of Animals by You**

- In the UK each person will consume in their lifetime:
- And each person in their lifetime would be responsible for:

	1000 Chickens		3 Mice
	30 Sheep		1 Rat
	30 Pigs		
	5 Cows		

**Select a Target Disease**  
The 'Maid' Matrix: Medical Need vs. Incidence

% Population

>7%	Acne	Hypertension	Obesity	Osteoporosis
4%-7%	Haemorrhoids	I.B.S.	B.P.H	Asthma
1%-4%	Oral Herpes	Fractures	Diabetes	Incontinence
0.4%-1%	Ulcers	Psoriasis	Herpes Zoster	HIV/AIDS
0.1%-0.4%	Gout	Gallstones	I.B.D.	Stroke
<0.1%		TB	Systemic Fungal	Multiple Sclerosis

LOW ← → HIGH  
Medical need

**It's not only to cure diseases!**

Picture of sports injury e.g. Busst leg break  
[http://z.hubpages.com/u/897685\\_f260.jpg](http://z.hubpages.com/u/897685_f260.jpg)

## **ETHICAL REVIEW & THE 3RS**

*Case studies and class discussions to provide training for PIL holders/Schedule 1 Users in animal welfare, ethical review processes and the application of the 3Rs in their own studies/research*

### **Abstract**

Postgraduate students or early-stage researchers who use animals or animal tissues in their research will have received a lecture on the ethics and law in their Home Office module 1 course or Schedule 1 training. They probably follow current practices in their laboratory without questioning these and they are unlikely to have written a project licence application. The aims of this seminar are to provide students with a greater understanding of the UK Ethical Review Processes (ERP); for them to consider what is morally acceptable and to review their own laboratory practices to see if they are minimising animal pain, suffering or distress; there is also the option to provide some discussion of the common arguments for and against the use of animals in scientific research. More advanced training in the public communication of science, particularly in respect to animal studies, can be gained through the additional session "Science and Society; use of animals in research"

### **Teaching Format**

2 or 3 hour session, small group discussions, class debate

### **Practicalities**

Postgraduate students or early-stage researchers who are Personal Licence Holders and/or Schedule 1 Users.

### **Relevant topics and issues**

- Ethical Review Procedures
- Animal welfare
- 3Rs
- Science and Society

### **Student Handout**

#### **THE USE OF ANIMALS IN SCIENTIFIC RESEARCH; ETHICS & THE 3RS**

#### **Part A: *The workings of an ethical review committee: Assessment of a project licence application***

##### *A STUDY OF THE PREDATOR-PREY RESPONSE.*

This study will show whether the response of prey animals to a predator is a learnt behaviour from parents, an innate inherited response, or a response that only develops on exposure of the individual to a predator.

It is proposed to use three groups of mice with different origins namely (i) wild caught mice, (ii) the first generation of mice bred from captive wild mice and (iii) laboratory bred mice obtained from suppliers licensed under the 1986 Act. These three categories will contain mice with different experience of predators. Group (iii) mice are very inbred animals, which for many generations have had no exposure to predators. They are unlikely to respond in predator-prey interactions in the same manner as mice in the wild. They will serve as controls for the wild caught mice. The first generation offspring of the wild caught mice will themselves have had no exposure to predators whereas those wild caught will have developed, by experience, avoidance responses to predators.

Mice are the animal of choice because they are cheap and a larger number can be used compared to larger species such as the rat and rabbit. The preferred predatory animal would be the farm cat. The predator animal must be aggressively predatory but also able to be handled by the licensee. The farm cat is ideal being semi-feral and able to survive on its hunting ability. The normal well fed house cat is unlikely to be sufficiently interested in the prey if it recognises it as prey at all.

#### **Protocol: three types of study will be carried out:**

A floor pen with sides 2 by 3 metres long made of galvanised metal will be used. It will be divided along the centre of the longest sides by a 10cm high 1cm square wire mesh on top of which is a transparent sheet of plastic enabling clear vision between the two areas but no physical access. Mice will be

confined to the left pen and the predator to the right. Food and water will be provided in trays placed next to the dividing mesh to ensure that mice have to have approach the area of predator. Sawdust bedding but no other cover will be provided.

**1. Normal control behaviour of mice in absence of predator odour.**

First the normal behaviour of each group of mice when in the left pen with no predator will be determined as a control. Each group will contain 25 mice and each group will be held in the pen for 48 hours. Behaviour, in particular time spent by the partition, will be observed using an infra red camera and video recorder. Faeces samples will be collected for cortisol assays to measure stress levels.

**2. Behaviour in presence of predator odour.** All mice will be removed and the predator placed in the right pen for 24 hours. Urine and faeces produced will be left in the pen when the predator is removed. Each group of mice in turn will then be held in the left pen for 48 hours and behaviour monitored as in 1. Faeces samples collected as above.

**3. Behaviour in presence of predator:** The predator will be kept in the right pen and each group of mice in turn again held for 48 hours in the left hand pen. Behaviour will be measured as in 1. The predator will be fed in the pen and offered surplus mice killed by a Schedule 1 method. It is a necessary part of the learning experience of each group of mice that they see the predator consuming mouse carcasses. Faeces samples collected as above.

*Read the above case study & then discuss within your groups the questions on the next page:*

**Questions that might be considered by an ethics committee:**

1. Is this study actually **necessary** or at least important for some well-defined and recognized purpose?
2. Is the specified protocol acceptable or are there flaws that required it to be improved?

Considerations:

- i) Is it scientifically necessary and ethically justifiable to locate the prey's food in such close proximity to the predator?
- ii) Would it be sufficient just to leave the predator's faeces and urine at a discreet distance?
- iii) Should the mice be given nesting material as well as the saw-dust?
- iv) Is it strictly necessary for each group of mice to see the predator consuming mouse carcasses?
- v) Is there sufficient provision for removing the scent of mouse groups so that trials with successive cohorts are independent (mistakes on this point might require all experiments to be repeated)?
- vi) Is the choice of mice as the prey species adequately justified? Is their cheapness a relevant consideration?
- vii) Is the number of mice to be used adequately justified?
- viii) Is the choice of predator adequately justified?
- ix) Is it sufficiently clear what would happen to the mice at the end of the study? If not what should be specified?

**Part B: Application of the 3R's to you own work**

The Animal (Scientific Procedures) Act has very few restrictions as to what is/isn't allowed within it, yet it viewed as one of the strictest such acts within the world, This is a result of the application of the principals of the 3R's, (replacement, refinement, reduction).

Think about your own studies and laboratory practices. What are you doing to:

Avoid or **replace** use of animals

**Refine** procedures to reduce animal suffering or pain and improve animal welfare

**Reduce** animal use

*Consider what you do first for a few minutes before discussing these with your group*

*For those of you who don't utilise animals or animal tissues in your studies, consider the following project licence abstract*

## Central control of autonomic function

We are studying how the brain controls the cardiovascular, respiratory and gastrointestinal systems, focusing on the motoneurons within the hindbrain which control these systems. Our aim is to identify the mechanisms and pathways by which these neurons are regulated by higher brain regions. We are doing this in order, not only to increase our understanding of how these body systems that are essential for us to maintain life are regulated, but also to identify the mechanisms by which dysfunction in these brain pathways can lead life-threatening diseases such as heart disease or obesity.

We will first trace the inputs that these motoneurons receive by injecting neuronal tracers, dyes which are carried along the axons of neurons, into different brain regions and observing the course of the labelled axons. We will then use slices of brain tissue to identify the neurotransmitters released by the different pathways and the mechanisms by which individual neurotransmitters alter the activity patterns of the different populations of cardiovascular, respiratory and gastrointestinal motoneurons. Having identified the neurotransmitters released, whole animal studies will be undertaken to identify the functional consequences of blockade of individual pathways e.g. the effects on blood pressure, respiratory rate or gastric motility.

The brain pathways that control these systems are immature at birth and are therefore susceptible to modulation either in-utero or in early life. One factor which plays a critical role in the development of brain circuits is maternal diet. There is evidence to suggest that an altered maternal diet during critical periods of pregnancy or weaning can lead to an abnormal development of pathways within the brain, predisposing the offspring to chronic illnesses in adulthood. Therefore, we will also investigate whether western (e.g. high energy, high fat) diets during pregnancy and weaning leads to an altered development of the brain pathways which control the cardiovascular, respiratory and gastrointestinal systems and whether this results in heart disease or obesity in adulthood.

## **PART C: Public perception & justification of animal studies (Optional)**

*In this final session, we are going to talk about the public perception of animal studies, consider different viewpoints and the arguments for and against their use so that equipped with this knowledge you will be better able to justify your work in the future.*

### **Tutor Notes**

*Introduction. Determine why students came on course & what hope to gain from it*

*Outline objectives of the session: to make participants think about the ethics of the use of animals or animal tissues in scientific research, specifically with regard to their own studies and the public perception of such studies. To debate what is and is not allowed under the act, to consider and apply the central tenet of the Animal (Scientific Procedures) Act, the principals of the 3R's (refinement, reduction and replacement) to their own studies; to debate the common arguments for and against the use of animals in scientific research so that they are both aware of current public opinion but also better able to justify their work in the future.*

*Obtain indication from participants as to who has a HO personal licence & who is licensed for schedule 1 methods of tissue acquisition. If anybody hasn't completed HO module 1, brief overview of Animal (Scientific Procedures) Act, licences and responsibilities under the act and review of Schedule 1 methods.*

*Split students into groups of 4-5 to consider this case study & the attached questions (20min) before bringing all groups together to discuss collectively (20min)*

### **Part A: The workings of an ethical review committee: Assessment of a project licence application**

*Questions that might be considered by an ethics committee:*

1. Is this study actually **necessary** or at least important for some well-defined and recognized purpose?
  - Not only medically related studies but also studies of animal behaviour allowed under act
  - Learned behaviours critical part of human development

Can it be argued that it will cause needless suffering to mice, and thus should not be approved?

- May cause stress / anxiety but not more than that seen in the wild, no physical pain

2. Is the specified protocol acceptable or are there flaws that required it to be improved?

Considerations:

- i. is it scientifically necessary and ethically justifiable to locate the prey's food in such close proximity to the predator?
  - no
- ii. Would it be sufficient just to leave the predator's faeces and urine at a discreet distance?
  - Depends on air movement & size of chamber
- iii. should the mice be given nesting material as well as the saw-dust?
  - Yes or providing unnatural environment & additional stressor
- iv. is it strictly necessary for each group of mice to see the predator consuming mouse carcasses?
  - Visual cues are as important as smell as sensory cues
- v. is there sufficient provision for removing the scent of mouse groups so that trials with successive cohorts are independent (mistakes on this point might require all experiments to be repeated)?
  - no, thorough cleaning & bedding removal
- vi. is the choice of mice as the prey species adequately justified? Is their cheapness a relevant consideration?
  - Cost not a consideration, act requires lowest sentient species & appropriate species, in this instance normal prey of predator
- vii. is the number of mice to be used adequately justified?
  - Requires power calculations
- viii. is the choice of predator adequately justified?
  - Yes, natural
- ix. is it sufficiently clear what would happen to the mice at the end of the study? If not what should be specified?
  - Schedule 1 killing

### **Part B: Application of the 3R's to you own work**

The principals of the 3Rs are central to the Animal (Scientific Procedures) Act. Postgraduates or early-stage researchers who have completed HO module 1 training or similar (Schedule 1 users) would have been told about the 3R's as part of this training but are unlikely to have thought about them in any great depth or applied them to their own studies. They are highly likely to be following current practice in their lab..

Introduce the topic by stating that when you apply for a project licence, you have to document how you are going to apply the 3R's to your proposed research, therefore they should consider, with respect to their own studies/research, what they are doing to:

Avoid or **replace** the use of animals

**Refine** procedures to reduce animal suffering or pain and improve animal welfare

**Reduce** animal use

Get students to think individually about how their own laboratory practices & procedures, what they are doing to implement the 3Rs and how they could modify these to improve animal welfare and minimise suffering (5-10 min). Bring students into small groups (4-5) to discuss this within their groups before collective discussion between all seminar participants (20-30 min). Consider each "R" in turn

Students who don't utilise animals or animal tissues in their studies should consider the project licence abstract "Central control of autonomic function" on the handout

### **Potential applications of the 3Rs include:**

#### **Replacement**

- Computer modelling, in vitro methodologies, human volunteers
- Established animal cell lines and animal cells, tissues and organs where the animal was killed by a humane technique before collection of the material
- Abattoir material

- Mammals, birds and reptiles up to half way through gestation or incubation
- Larval forms of amphibians and fish up to the point where the animal becomes capable of independent feeding
- Invertebrates, such as Drosophila and nematode worms

### **Refinement**

- refers to improvements to husbandry and procedures which minimise actual or potential pain, suffering, distress or lasting harm and/or improve animal welfare in situations where the use of animals is unavoidable.
- refers to the lifetime experience of the animal.
- Providing appropriate anaesthetic and analgesic regimes
- Appropriate schedule 1 method
- Training animals to co-operate with certain procedures (e.g. taking blood samples) so the animals are less stressed
- Ensuring that accommodation meets the animals' needs (e.g. providing opportunities for nesting for rodents)
- In house breeding
- Schedule 1 within animal facilities not in labs
- No visualisation of procedures in other animals
- Reducing lab holding times
- Transport arrangements between facilities / appropriate containers
- Use of new techniques/technologies – imaging, telemetry

### **Reduction**

- refers to methods which minimise animal use and enable researchers to obtain comparable levels of information from fewer animals or to obtain more information from the same number of animals, thereby reducing future use of animals.
- Improved experimental design and statistical analysis
- Techniques, such as imaging, which require smaller numbers of animals
- Genetically similar animals
- Sharing of animals/animal tissues (e.g. whiteboards indicating future use in animal facilities)
- Use of new techniques/technologies
- Recording multiple parameters in single animal

## **PART C: Public perception & justification of animal studies (optional)**

*In this component, the tutor should act as an antivivisectionist, questioning the students aggressively; to put them on the spot and force them to justify their use of animals, just as would happen if they had to do this in a debate with an anti-vivisectionist. Some questions which might be posed are given below:*

*An alternative way to provide training in the arguments for and against the use of animals in research and the public communication of science is to use a combination of role-play and debate. See the Science and Society seminar on "The use of animals in research"*

- You utilise animals or animal tissues in the course of your studies, do you ever discuss with your families or friends outside science what you actually do in the name of scientific research. If not, why not. If you are so proud of your science why don't you discuss it.
- 3 million animals are used in medical/scientific research in the UK each year. The numbers are increasing (13 year high), they also exclude animals killed by schedule 1 methods. How can this excessive usage ever be justified. Why don't you re-use animals
- How can the use of dogs, cats but especially monkeys be justified
- Surely there are alternatives to animal use
- Why not use humans instead, why do we have the right to subject animals to pain and suffering that we are not prepared to inflict on humans
- You say that you are trying to find cures for human disease, animals are different from humans so how can they mimic human diseases
- For all the animals used in medical research, drugs are still coming onto the market that have serious side effects and can potentially kill. Think about the recent TGN1412 fiasco at Hammersmith, haven't we learnt from thalidomide 40 years ago?

- If you are allowed to cause this much suffering under the Act, what additional suffering goes on in contravention of the Act. Would you step in if somebody in your lab or your supervisor was causing unnecessary pain or suffering to an animal?
- Even if you do get caught, nothing will happen to you?

*Additional questions can be found within the “Question of Ethics” and the “Science and Society Activities in Schools” resources*

# ERGODYNIA- HOPE AT LAST!

*Workshop for the teaching of experimental design and Ethical Review Processes*

## **Abstract**

Training in experimental design, particularly in replacing the use of animals with alternatives and minimising animal numbers, is an essential skill for future in-vivo scientists. This workshop, which uses fictitious case studies and publications, requires students, rather than just passively following an instruction sheet, to build on their prior scientific knowledge to design a series of experiments to address a scientific question and to complete an Ethical Review Process application. It teaches them some general areas of experimental design (e.g. choosing the correct n number, ensuring proper controls) as well as making them consider specific ethical issues of in vivo experimentation.

## **Teaching Format**

3 hour workshop (incorporates group work and class discussions)

## **Practicalities**

Level 2 or 3 Undergraduate students who use animals in their studies. May also be useful to teach experimental design to other groups of students

## **Relevant Topics and Issues**

- Ethical Review Processes
- Animal models of disease
- Experimental design
- 3Rs

## **Student Handout 1**

### **ERGODYNIA: HOPE AT LAST!**

#### *Introduction*

Today's session is very different to other practical sessions on this in that we're not going to run any experiments. Instead we're going to look at the process of experimental design – how we go about planning our experiments and the various factors we have to consider in doing so. The process of getting a degree is all about memorising lots of facts, but it's also important that you learn how to use what you've learned and to critically analyse data. Over the next couple of hours, we're going to discuss the way we design a new series of experiments, and produce an application to the University Ethical Review Panel (ERP) for permission to apply for a Home Office Project Licence to cover this work. Usually a new project proposal would take weeks or months to produce, as it requires a large amount of background reading to fully understand an area. However, we're going to speed things up by discussing our ideas as a group, and you will be provided with extra information as you need it.

Our area of interest is a pain condition called ergodynia, which you'll read more about in a moment. A recent study identified a protein called dolorin as a possible molecular trigger for ergodynia. The project proposal we're going to put together is for research that will provide supporting evidence for this hypothesis, with the eventual goal of persuading a drug company to invest in dolorin as a new drug target.

#### *Assignments*

- Split into groups (3 or 4) and read background information and ERP form. Particularly focus on key features of ergodynia that would be relevant to research, and on the type of information that is needed by the Ethical Review Panel.
- Discuss experimental plan in groups – how can we test the hypothesis that dolorin is somehow causing the symptoms of ergodynia?
- You don't need to focus too much on specific experiments, but instead think about what evidence would convince you that this is the case.

#### *Supporting information*

The following text is a recent press release from the BEST, the British Ergodynia Support Trust:

### **Ergodynia – hope at last?**

How would you feel if a simple action like picking up a pen or turning on your computer was excruciatingly painful? For sufferers of ergodynia this is an everyday reality. However, from the sadness of a recent

tragedy, hope has sprung that a better understanding of their condition and maybe even a cure will soon be in reach.

In March 2008, a car carrying several ergodynia sufferers to a meeting of the British Ergodynia Support Trust (BEST) crashed, killing all the occupants. Their families felt strongly that some good should come from their misfortune, and so agreed to donate tissues to a team at the University of North Yorkshire to aid their research into ergodynia. The team, led by Prof. Tou Teng identified high levels of a key molecule that they believe causes the pain. Prof. Teng said "This is a very exciting discovery, and we hope that it will stimulate research into cures for this terrible disease."

Traditionally doctors have just labelled ergodynia sufferers as lazy or mentally ill. Many GPs still dismiss patients who come to see them, attributing their symptoms to "growing pains". However, ergodynia is now recognised as a real disease like chronic fatigue syndrome and irritable bowel syndrome. It affects about 1 in every 50,000 people, and there are currently around 1,050 diagnosed sufferers of ergodynia in the UK.

Ergodynia sufferers experience pain when working, and in some cases even when just contemplating work. Sufferers describe headaches, and pain or numbness / tingling in their hands and feet. This inability to work commonly causes people with ergodynia to have low self-esteem and become depressed and isolated from the world. No cures are currently available, but BEST provides support and advice to sufferers and their families.

For further information, please contact the BEST press officer on 0845 456999

---

*This paper appeared in the November 2008 issue of the European Journal of Pain:*

**Eur J Pain. 2008 Nov;12(8):970-6.**

***Over expression of dolorin in skin nerve fibres, dorsal root ganglia and trigeminal ganglia in human ergodynia.***

*Behrens, C., Stevenson, G., Eddy, R., Mathieson, J., Teng, T.*

*Human Pain Research Group, Clinical Sciences Building, Hope Hospital, Stott Lane, Skipton, N.Yorks, BD23 8HD, UK. tou.teng@skipton.ac.uk.*

Ergodynia is a chronic pain condition with onset in puberty that commonly persists for 20 years. It belongs to the group of functional somatic syndromes that includes chronic fatigue syndrome and fibromyalgia, although unlike these syndromes it primarily affects males. It is characterised by dysaesthesia / paraesthesia of the extremities when working. The molecular mechanisms of ergodynia pain are poorly understood, hampering the development of novel therapies. Tissue was collected from ergodynia patients (n=5) and non-sufferers (n=7). Samples were examined by immunohistological methods. Dolorin-positive intra-epidermal nerve fibres were significantly increased in skin sections from ergodynia patients (dolorin fibres / mm epidermis, median [range] - no pain group, 0.69 [0-1.27]; pain group, 2.15 [0.77-4.38]; p = 0.021). Increased dolorin expression was also seen in sections of dorsal root ganglia (levels C6 – C8; S1) and trigeminal ganglia taken from the ergodynia group. The increased expression was seen both as a greater number of dolorin-positive neurons, and as a greater mean intensity of staining in the neurons. These data suggest that dolorin, a cytoplasmic protein of unknown function, plays a role in the pathology of ergodynia. Further understanding of the cellular roles of dolorin may reveal new drug targets to treat this disease.

PMID: 18514036

---

## Ethical Approval of an Application for a Home Office Project Licence

**Please answer all questions as fully as possible. Your application should not exceed 3 sides of A4 paper.**

**Name:**

**Personal Licence Number:**

**E-mail address:**

**Department:**

**Title of Project:**

### 1. Main purpose and benefits of research

- Applicants are requested to write a summary of the proposed research to indicate the main objectives, which they hope to achieve during the duration of the licence, and the benefits that will be derived from this.
- This should be written to give an intelligent non-scientist a clear view of why your work should be supported (for non-scientific ERP members, posting on H.O website, released by the University under FOI request).

### 2. Justification for the use of animals in the project

- Please indicate why you must use animals in this project. You should state what steps you have taken to find alternatives to the use of animals (e.g. library and Internet searches) and whether there are any in vitro preparations that could be used, and you must justify why you are using the species you have selected.

### 3. Use of animals

- Please describe how you intend to use animals in your study, clearly stating why this is appropriate, and beneficial to your research

### 4. Numbers of animals

- Please indicate what steps you have taken to minimize the number of animals used in this research (e.g. statistical advice on experimental design, improvement in sensitivity and variability of assays etc.)

### 5. Control of pain and suffering

- What measures will you be taking to reduce pain and suffering in the animals in this project?

---

## Student Handout 2

### CAN WE MODEL ERGODYNIA IN ANIMALS?

-Remember that animal models only ever model aspects of the human disease experience:

1. Not all symptoms can be recreated
2. The presence certain symptoms or disease aspects (e.g. spontaneous pain) can't be measured
3. Animals can't describe what they're experiencing

-It is important to consider what the key features of the pathology are, and recreate these in the animal model

#### Animal model 1: Surgically-generated

**Species:** Primarily rats because of size, but also mice

**Strengths:** Very specific targeting possible

**Weaknesses:** Surgery causes inflammation; requires precise knowledge of pathology to determine site of intervention; modulation at whole organ / organism level; difficult to perform

**Method:** None yet described

#### Animal model 2: Chemically-generated

**Species:** Rats or mice (depending on endpoints assessed)

**Strengths:** Allows targeting of organs and / or cellular processes; easy to use

**Weaknesses:** Off-target effects; variability in effects

**Method:** Intravenous injection of iododilaurylether (IDLE) - produces gait disturbances on treadmill; affective changes (depression)

Animal model 3: Transgenic animals

**Species:** Primarily mice because of cost and rate of breeding, but also rats

**Strengths:** Allows targeting of organs and / or cellular processes; litter-matched controls available

**Weaknesses:** Compensatory changes; costs of running colonies

**Method:** Dolorin knockout mice generated – grossly normal, decreased sensitivity to non-noxious touch / brush stimuli; decreased mechanical hyperalgesia after intraplantar carrageenan

Animal model 4: Spontaneous mutants

**Species:** Rats or mice

**Strengths:** Link to disease-causing mutations in humans

**Weaknesses:** Unlikely to be available for most diseases

**Method:** No spontaneous mutants identified

---

**Student Handout 3**

**OVERVIEW OF TECHNIQUES**

**1. Immunohistochemistry**

**Overview:** Tissues cut into very thin sections ( $\approx 20\mu\text{m}$ ) and treated with antibodies that recognise the protein(s) of interest (primary antibodies). The sites where the primary antibodies have bound (i.e. the areas where the proteins of interest are present) are then identified using secondary antibodies that bind to the heavy chains of the primary antibodies. Secondary antibodies usually have fluorescent labels so they can be visualised under a microscope.

**Strengths:** Gives a clear idea of the cell types and cellular locations of target proteins

**Weaknesses:** Quantification can be difficult, as it varies greatly with method of antibody treatment; antibodies must be very specific

**Number of animals required per treatment group: 3**

**2. Quantitative reverse-transcription polymerase chain reaction (qPCR)**

**Overview:** Tissues are processed to destroy the extracellular structure and break open cells. The cellular mRNA content is then converted to DNA (cDNA) by the enzyme reverse transcriptase. The amount of DNA can be quantified by PCR by comparing the rate of amplification with known amounts of DNA. Changes in the amount of mRNA are thought to lead to changes in protein expression.

**Strengths:** Very sensitive, so even small volumes of tissue can be assayed

**Weaknesses:** RNA rapidly degraded by RNAses; prone to contamination; changes in RNA don't necessarily mean that protein levels have changed

**Number of animals required per treatment group: 3-5**

**3. Western blotting**

**Overview:** Tissues are processed to destroy the extracellular structure and break open cells.

Proteins with the samples are separated according to size by electrophoresis on acrylamide gels, and then transferred to membranes. A protein of interest is identified by its size, and by the binding of a specific antibody (primary antibody). The primary antibody is detected by the binding of a secondary antibody, usually with a fluorescent or enzymatic tag. Amounts of protein can be quantified relative to the amount of other proteins whose levels don't vary ("house-keeping" proteins e.g. actin).

**Strengths:** Directly measures changes in protein expression

**Weaknesses:** Requires specific antibodies

**Number of animals required per treatment group: 3-5**

**4. In vivo electrophysiology**

**Overview:** Animals are terminally anaesthetised and neurons exposed by dissection. Electrodes are placed into nerve bundles to monitor firing of action potentials. Nerves can be directly stimulated by electrical / chemical means, or tissues can be exposed to stimuli (e.g. heat, pressure) that cause nerve firing. The sensitivity of neurons can thus be determined by the intensity of stimulus that produces an action potential.

**Strengths:** Can measure connections between neurons and conduction speeds

**Weaknesses:** Very sensitive preparations (difficult to set up, commonly fail to work)

**Number of animals required per treatment group: 5**

**5. Behavioural measurements**

**Overview:** Many different behaviours can be studied in rodents. Pain behaviours are commonly assessed by measuring how sensitive an animal is to heat / pressure applied to the plantar surface of

the paw (e.g. von Frey hairs). Another indicator of pain is altered mobility, so the ease of walking on a treadmill can be monitored by video camera, then analysed to look for changes in gait.

**Strengths:** Provides clear evidence of whole animal effects of treatments

**Weaknesses:** Debatable correlation with human pain; very variable data

**Number of animals required per treatment group: 8-10**

---

### Tutor Notes

Students should be split up into groups of 3 or 4, given the background information and the ERP form. They should discuss and prepare an experimental plan to test the hypothesis that dolorin is somehow causing the symptoms of ergodynia. They should be advised to focus not so much on specific experiments, but instead, think about what evidence would be required to prove this, focusing their attention on key features of ergodynia that would be relevant to research, and on the type of information that would be needed by the Ethical Review Panel.

A suggested timetable for the session would be:

<b>00:00 – 00:10</b>	Class arrives; introduction
<b>00:10 – 00:30</b>	Small groups: Reading background / ERP form; initial discussions
<b>00:30 – 01:15</b>	Class discussion: Feedback, key features of ergodynia, important expts (why is <i>in vivo</i> necessary?), animal models
<b>01:15 – 01:45</b>	Coffee break / thinking time
<b>01:45 – 03:00</b>	Class discussion: Specific techniques, 3Rs, other issues from ERP form?

You may wish to save the techniques handouts (2 & 3) till later in the session; this encourages students to apply things they'd learned already to a new situation, but they typically very scared of having to do this! Students are asked to design the experiments without any further information than is provided in the handout. Therefore you can be quite lenient about details of experimental design when you are marking the assignment (particularly if they have had limited experience at this stage e.g. Level 2 students). It is suggested that your main marking criteria are based on whether they have understood how the ethical / legal obligation of the 3Rs fits into experimental design in a "real" situation.

The aim of running the practical in this way is that it pushes the students towards using their acquired knowledge, rather than just passively following an instruction sheet. It also (hopefully) teaches them some general areas of experimental design (e.g. choosing the correct n number, ensuring proper controls) as well as making them consider specific ethical issues of *in vivo* experimentation. As the ethical review form is essentially the same as that used within individual Institutions, it gives them a taste of what we have to do in "real" research. Finally, you may wish to let the students know at the end of the session that ergodynia isn't real, as they waste a lot of time on PubMed / Google trying to find it!

# DESIGNING IN VIVO EXPERIMENTS

Workshop to teach experimental design and application of the 3Rs

## Abstract

Training in experimental design and the application of the 3Rs in this process, is an essential skill for in-vivo scientists. This workshop requires students to work in groups to design a series of experiments to address specific scientific questions, to identify the contribution of in-vitro versus in-vivo techniques and to apply the 3Rs within this design process

## Teaching Format

Two hour workshop (30 min per question), with additional time if class discussion of answers is required. Alternatively, individual questions could be set as a self-directed learning exercise or examination assessment

## Practicalities

Undergraduate and postgraduate students who use animals in the course of their studies. The questions supplied provide training in in-vivo physiology or pharmacology; the same format but alternative questions could be used for other groups of students

## Relevant topics and issues

- Experimental design
- 3Rs
- Alternatives

## Student handout

Training in experimental design and the ability to apply the 3Rs (Reduction, Refinement, Replacement) in this process is an essential skill for in-vivo scientists. In this workshop, you will work in groups to design a series of experiments to address specific scientific questions. You will have to consider both in-vitro and in-vivo experimental approaches and apply the 3Rs when deciding on your series of experiments

You should discuss each of the following 4 questions, spending approximately 30 minutes on each question. When answering the questions, you should consider:

1. Experimental procedures needed to answer the specific scientific question
2. Experimental design issues that relate to *in vivo* studies
3. How the 3Rs have been considered in the experimental design
  - a) Reduction: minimising the animal number required
  - b) Refinement: how suffering is minimised
  - c) Replacement: *in vitro* alternatives have you considered

### Question 1

As part of a drug development programme, a novel 5-HT<sub>1A</sub> ligand has been identified. This drug may be useful as a novel approach to treating depression but it is not yet known if this drug is an agonist, partial agonist or antagonist when acting in the brain. Central 5-HT<sub>1A</sub> agonism is associated with a decrease in blood pressure. Describe the experiments you might perform to address these questions and how you have considered the 3Rs. What *in vitro* data would you consider necessary before progressing to *in vivo* studies?

### Question 2

During assessment of a new genetically modified mouse expressing a mutated subunit of the GABA<sub>A</sub> receptor complex, a preliminary behavioural screen revealed an anxiogenic profile in the open field arena. Describe what further procedures you could undertake to determine the specificity of the anxiogenic phenotype (brief model description only)? Describe in detail how you would design an experiment to test whether these animals show a change in a) locomotor function, b) sensitivity to the anxiolytic and sedative effects of a GABA<sub>A</sub> agonist.

### Question 3

Alpha<sub>2</sub>-adrenoceptor agonists have been shown to be anti-nociceptive in animal models of pain but they are also associated with sedation. In a preliminary study, a novel alpha<sub>2</sub>-adrenoceptor partial agonist was found to be anti-nociceptive in the formalin test when administered in conjunction with morphine. Describe an experiment that would enable you to further test the effects of this drug alone and in combination with morphine in relation to a) anti-nociception b) sedation. Discuss how the 3Rs have been

considered in your experiment design. Why might the effects of a partial agonist differ between *in vitro* and *in vivo* studies?

*Question 4*

Drugs used in the acute treatment of asthma interact with receptors located in the bronchioles and induce bronchodilation. In general, these drugs are administered via an aerosol directly into the lungs, however, in severe cases, a drug may need to be administered via an intravenous route. Describe studies you might undertake to determine the intravenous effects of a novel bronchiole dilator in terms of lung function. As cardiovascular effects are a potential side effect with these drugs, how might you test the effects of this novel compound on cardiovascular function. How might *in vitro* preparations be used to isolate the different effects of the drug in relation to lung function, peripheral vasculature and heart function?

# ALTERNATIVES TO ANIMAL EXPERIMENTATION

PowerPoint presentation of the alternatives to animal experimentation

## Abstract

It is essential that individuals who undertake animal experiments are fully aware of the alternatives to animal use in scientific studies and in the design of their experimental studies, actively seek to replace or minimise animal use. This PowerPoint presentation provides knowledge of some of the potential alternatives to animal use in scientific research

## Teaching Format

1 hour presentation

## Practicalities

Undergraduate and postgraduate students on Biological Sciences, Life Sciences or similar degree programmes who may use animals in the course of their studies, PIL and PPL licence holders, staff CPD.

## Relevant topics and issues

- Animal experimentation
- 3Rs

## Teaching Resources

### Alternatives to animal experiments

### WHY CONSIDER ALTERNATIVES?

ASPA s5(5) states "The Secretary of State shall not grant a project licence unless he is satisfied -

- (a) that the purpose of the programme to be specified in the licence cannot be achieved satisfactorily by any other reasonably practicable method not entailing the use of protected animals; and
- (b) that the regulated procedures to be used are those which use the minimum number of animals, involve animals with the lowest degree of neurophysiological sensitivity, cause the least pain, suffering, distress or lasting harm, and are most likely to produce satisfactory results.

This section (18) should provide information that allows the proposed programme to be evaluated against these criteria. It should make clear for each section of the planned work why alternatives to protected animals could not be used. It should also show what results are sought, how they would be judged as satisfactory, and why the proposed plan and experiments would use minimal numbers and minimal severity, as well as explaining why the proposed species were chosen.

### Reference to alternatives within PPL

#### 18b. Achieving the objectives

Show overall strategy, staging the work and indicating how the stages are related and the relationship of animal work to in vitro/ex vivo or human studies.

A Flow diagram(s)/decision tree would show how you will meet your objectives using both the section 19 protocols and other approaches, **put in-vitro work or work on human volunteers in context**, and identify decision points to use animals and particularly to use special species and substantial severity protocols.

**Why animals have to be used:** Explain why alternatives not involving the use of protected animals are not suitable for achieving this objective.

### Scientific Responsibility

- Reduce duplication
- Computer structure allows more compounds to be screened
- Less painful and invasive procedures
- Awareness of new procedures
- Economic factors / charity funding?

Cartoon of scientist pulling rabbit out of hat

**BUT ALSO TAKING INTO CONSIDERATION  
ETHICAL & SOCIAL RESPONSIBILITIES**

## Literature searches – 1<sup>st</sup> port of call

Information Portal NC3Rs (www.nc3rs.org.uk)

- **ALTWEB**  
Alternatives to Animal Testing on the Web serves as a gateway to alternatives news, information and resources on the Internet and elsewhere. Altweb has been redesigned and now includes a **guide to searching for alternatives**
- **ALTBIB**  
Bibliography on Alternatives to the Use of Live Vertebrates in Biomedical Research and Testing, National Library of Medicine
- **AnimAlt-ZEBET Database**  
A full-text database of alternative methods (3Rs) to animal experiments in biomedicine and related fields (Click on Databases, then Databases A-Z, and then on AnimAlt-ZEBET)
- **In Vitro Methods**
- **ECVAM SIS(Scientific Information Service) Database**  
Provides factual and evaluated information on advanced non-animal methods for toxicology assessments; offers full method descriptions, including development and validation status (Includes INVITTOX test protocols)
- **INVITRODERM**  
Alternatives to skin irritation/corrosion testing in animals

## Replacement

- Use of non-animal methods
- Use of less sentient species
- Use of earlier developmental stage of vertebrates, not covered by Act
- Relative replacement: instead of an in vivo procedure, using a Schedule 1 Killing to provide cells / tissues / organs

## Non-animal methods - computer modelling

- **QSAR (quantitative structure-activity relationships)**  
<http://www.qsarworld.com/>
  - > Enhanced understanding of fundamental processes & phenomena in medicinal chemistry & drug design.
- **CoMFA (Comparative molecular field analysis)**
  - > describes 3D structure activity relationships in a quantitative manner
- **Advanced Biomedical Computing Center: Rapid Virtual Screening of Large Drug Databases**
- **Computer simulations of animal behavior: Sniffy the Virtual rat**
- **Dissection simulations**

## Non-animal methods - Human subjects

- Proximity to medical school - possibility of human tissue samples
  - but Ethical procedures, Data Protection Act
- Banks of human tissue e.g. Medical Research Council
- Firms which will collect primary tissue eg Promocell ([www.promocell.com](http://www.promocell.com))
- Human cell lines, Promocell, Institute for the Advancement of Science ([www.iam.org](http://www.iam.org))
- Micro dosing human volunteers
- Clinical drug trials <http://www.entertrials.co.uk/clinical-trials-home>
- **Epidemiological studies? Limited use?**

## Relative replacement

- Less sentient species
  - > Primate > dog/cat > rabbit > guinea-pig/rat > mouse  
*NB justify use of species chosen vs. disease of study*
  - > Ames test: salmonella for chemical mutagenesis
  - > Limulus amoebocyte assay for endotoxins
- Earlier stages of development
  - > Half way through gestation (mammals) or incubation (birds) or stage of independent feeding (amphibians/fish)

## Cell, tissue and organ culture

- In many disciplines, these in vitro systems are not seen as replacement alternatives, but as the norm, especially for studies at the cellular and molecular level.
- In many cases they are only relative replacements, because they require freshly obtained animal cells and tissue.
- However, even when freshly isolated material is required, the animals are used more economically, because a single animal will provide tissue for a number of cultures.

Cell culture image

## Relative replacement

Subcellular fractions:

*Organelles and membranes prepared from homogenised tissue* e.g. mitochondria, nuclei, sarcolemmal membranes

**Advantages:** to define subcellular mechanisms of action of interventions

**Disadvantages:** difficulty in obtaining absolute purity, possibility of damage during isolation

image of 3D structure of mitochondria

## Relative replacement

**Primary cell culture:** *Cells isolated from fresh tissue by the use of proteolytic enzymes* e.g. hepatocytes, adult or neonatal cardiac myocytes

**Advantages:** More than one person can work on tissue from same animal, no cell-cell interactions, no endogenous transmitter release, ability to assess proportion of viable cells, elimination of one source of compartmentation of receptors/second messengers, genetic manipulation possible.

**Disadvantages:** potential damage during isolation, lack of integrated function, relatively short culture time before dedifferentiation.

**Relative (absolute) replacement**

**Cell lines:** *Stable (immortalised) lines of tissue-specific cells* e.g. fibroblasts, skeletal muscle cells, HEK, CHO

**Advantages:** Pure cell population, ease of manipulation, wide variety of assays possible, stable through numerous passages, experiments can be replicated, transient or stable transfection, cells can be stored frozen.

**Disadvantages:** lack of integrated function, possible drift from source tissue, may be chromosomally abnormal.

**Relative replacement**

**Organ / Tissue culture:** *3-D culture retains some/all architectural & functional characteristics of whole organ* e.g. Liver slices, whole perfused hearts, cardiac ventricular trabeculae, skin slices

**Advantages:** More than one person can work on tissue from same animal, organs retain function, retains potential for cell-cell interaction, Morphogenesis in cultured fetal tissues comparable to that in vivo, method eliminates effects of reflex changes to intervention in whole animal, wide variety of measurements possible.

**Disadvantages:** Limited time (days or weeks), deterioration of function, eliminates effects of reflex changes to intervention in whole animal

Image of Skin2TM human tissue test system, Advanced Tissue Sciences

**Future possibilities for replacement**

**Stem cell-derived cell lines:** Embryonic (and maybe adult) stem cells have potential to differentiate into any cell type in the body. e.g. liver, heart, neurones

Image of stem cells

**Advantages:** Human & mouse lines available, ES cells can be passaged indefinitely, cells can be genetically manipulated - changes that are embryonic lethal in transgenic mice can be studied in ES-derived lines

**Disadvantages:** ethical considerations, optimum conditions derivation not defined for every cell type yet.

**Summary**

- An in vitro assay is only an "alternative" if it decreases the use of animals in research & testing.
- Some alternatives, while useful, are costly and technologically complex.
- Carefully consider if an experiment involving animals is scientifically necessary & not redundant, plan it well using appropriate species, groups and numbers, proper staffing, & adequate support.

Map of location of 3Rs groups in Europe  
see \* below

\*Map: <http://caat.jhsph.edu/programs/workshops/testsmart/hpv/proceedings/graphics/liebsch01.jpg>

# STRATEGIC PLANNING FOR RESEARCH PROGRAMMES

*Planning chart for reducing animal use in Biomedical Science*

## **Abstract**

Good planning and design can have a major impact on reducing animal usage in research programmes and on the welfare of the animals used. To help researchers using animals in biomedical research, FRAME has developed this flowchart for planning a programme of experiments. It outlines steps to follow during research involving animals, taking account of ethical considerations. Experiments using animals do not normally occur as isolated 'one-off' studies, and assessment of experimental results in the context of the complete programme may offer considerable scope for decreasing overall severity and reducing the number of animals. Experimental design texts usually provide no guidance on how to design an individual experiment to minimise severity, or on how to organise a sequence of experiments. A well-planned programme incorporating the steps indicated here should allow the achievement of an experimental goal that involves minimal animal use and severity, while maximising the quality of the resultant scientific output.

The poster is available to download from the FRAME website

[http://www.frame.org.uk/dynamic\\_files/strategic\\_planning\\_poster\\_updated.pdf](http://www.frame.org.uk/dynamic_files/strategic_planning_poster_updated.pdf)

## **Teaching Format**

Incorporation into a larger session which focuses on project design and application of the 3Rs or for use in self-directed learning.

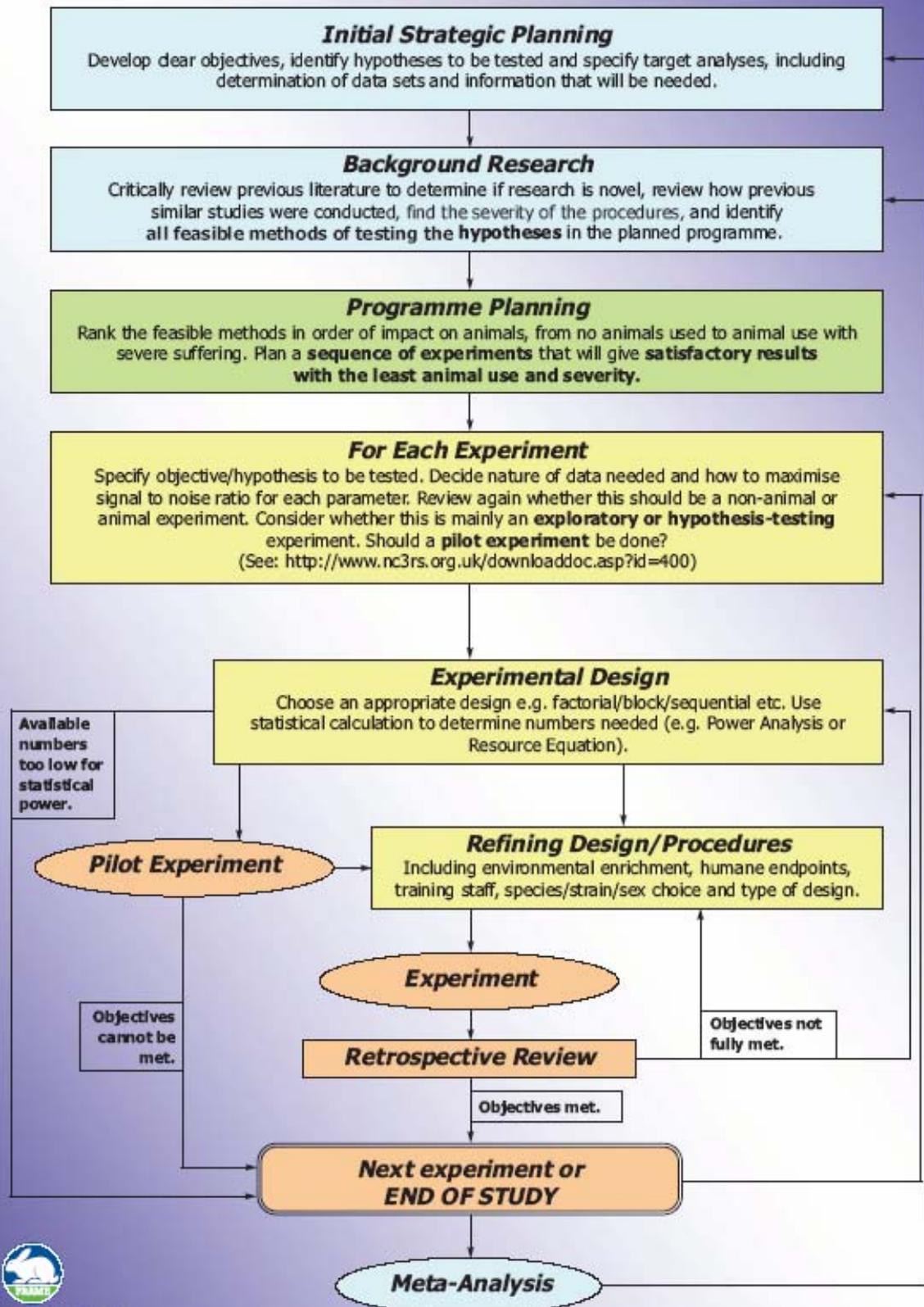
## **Practicalities**

PDRAs or staff CPD training. Use as above and/or poster could be displayed in laboratories. May also be utilised in a workshop on experimental design for undergraduate students

## **Relevant topics and issues**

- Experimental design
- 3Rs
- Alternatives

## Strategic Planning for Research Programmes



www.frame.org.uk

For additional copies email: michelle@frame.org.uk

Reference: Gaines Das, Fry, Preziosi and Hudson, ATLA 37, 27-32, 2009

# APPLYING THE 3Rs IN PROJECT DESIGN

*Discussion of strategies by which the 3Rs can be applied before and during a project*

## **Abstract**

Scientists using animals in scientific procedures have an ethical and legal obligation to ensure that the Three Rs, namely Reduction, Refinement and Replacement, are implemented wherever possible. The application of the strategies outlined in these posters, designed by the *Focus on Alternatives* group, help scientists meet this obligation. Poster A depicts a strategy for the early planning of a project which might involve the use of animals whilst Poster B depicts a hypothetical project to illustrate how the above strategy might be implemented.

Both posters are available to download from the FoA website

<http://www.focusonalternatives.org.uk/available%20information.htm>

## **Teaching Format**

Incorporation into a larger session which focuses on project design and application of the 3Rs

## **Practicalities**

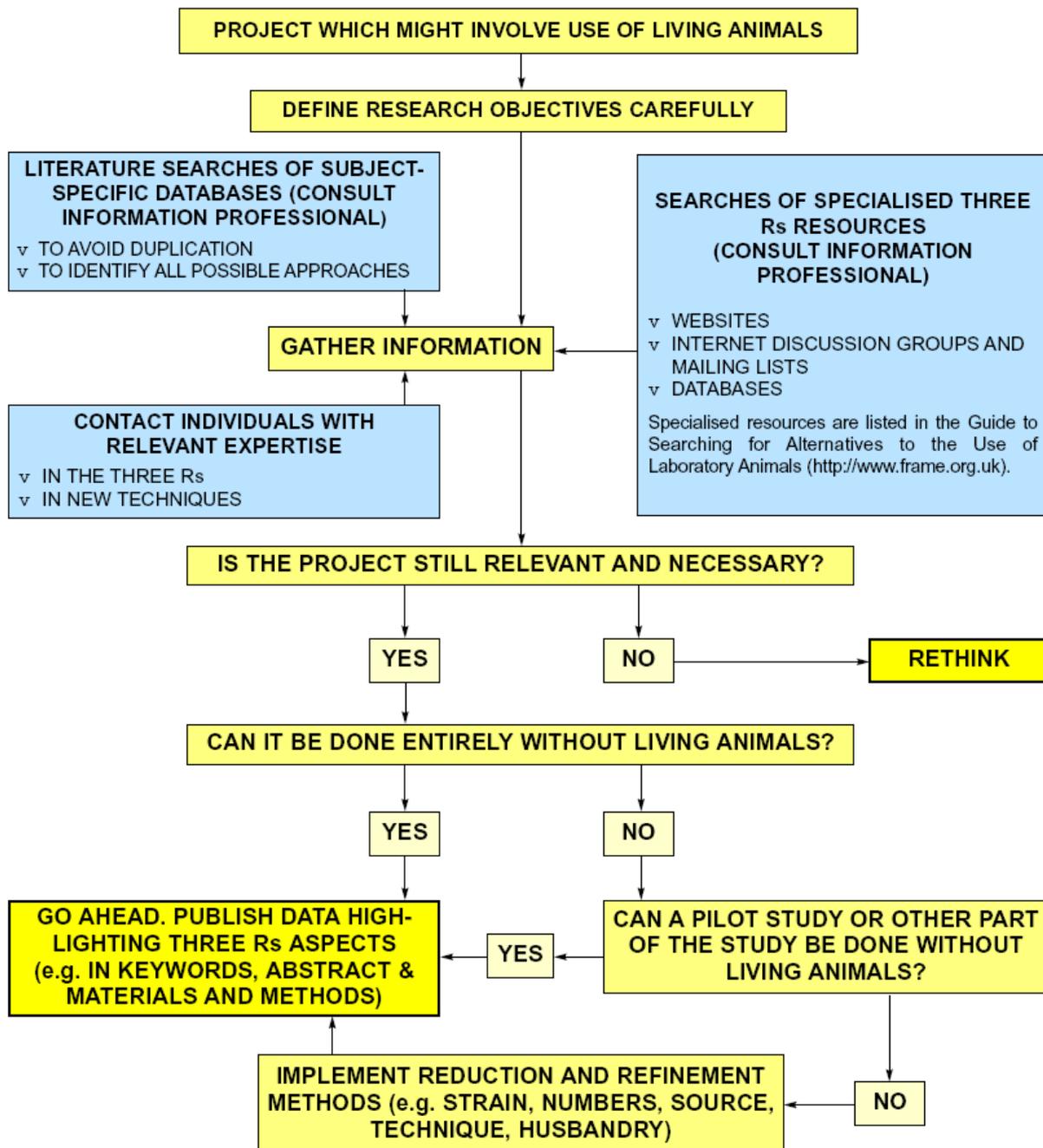
PDRAs or staff CPD training. May also be utilised in a workshop on experimental design for undergraduate students

## **Relevant topics and issues**

- Experimental design
- 3Rs
- Alternatives

# EARLY PLANNING FOR A PROJECT WHICH MIGHT INVOLVE THE USE OF ANIMALS

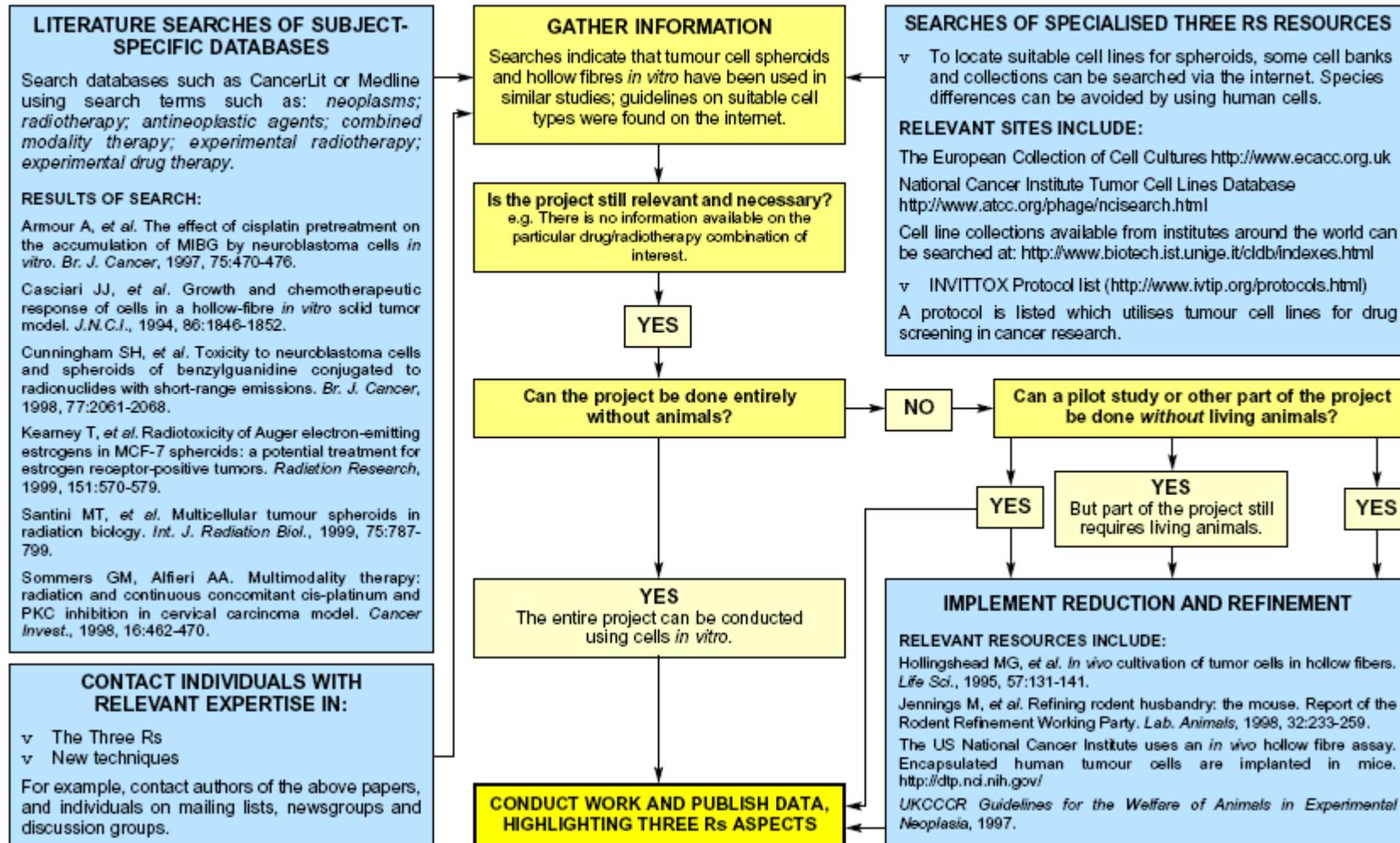
Scientists using animals in scientific procedures have an ethical and legal obligation to ensure that the Three Rs, namely **Reduction, Refinement and Replacement**, are implemented wherever possible. This strategy was designed by the *Focus on Alternatives*<sup>1</sup> group to help scientists meet this obligation. The strategy should be applied at the beginning of a project, and at regular intervals throughout. Advice should be sought from the Ethical Review Process and Home Office Inspectorate.



<sup>1</sup>Membership of the *Focus on Alternatives* committee includes the Dr Hadwen Trust, FRAME, The Humane Research Trust, The Lord Dowding Fund, RSPCA, St Andrew Animal Fund and UFAW. Copies of the poster are obtainable from FRAME, 96-98 North Sherwood Street, Nottingham, NG1 4EE. Tel: 0115 958 4740. Fax: 0115 950 3570. E-mail [frame@frame.org.uk](mailto:frame@frame.org.uk).

## An Investigation of Experimental Combinations of Radiotherapy and Chemotherapy in Cancer Treatment Using Immunodeficient Mice Bearing Human Tumour Xenografts

This hypothetical proposed project, prepared by *Focus on Alternatives*, illustrates how the general strategy shown overleaf would operate.



# DIRECT ETHICAL IMPLICATIONS AND WIDER SOCIAL IMPACT OF A PROGRAMME OF RESEARCH

*Applying training in ethical thinking to consider the ethical issues and social impact of a programme of research*

## Abstract

The QAA Biosciences Benchmark states that students should be “*confronted with some of the scientific, moral and ethical questions raised by their study discipline, to consider viewpoints other than their own, and to engage in critical assessment and intellectual argument*”. As a consequence, many Departments have incorporated training in ethics and ethical thinking within their degree programmes such that students should be able to apply this training to ethical issues or dilemmas as and when they arise, either in their studies or in their future careers. One way to assess the effectiveness of this training is to require students to consider the ethical issues arising from a programme of research they have undertaken e.g. projects. This could be incorporated into the discussion sections of Final Year Undergraduate project dissertations or postgraduate thesis's.

## Teaching Format

Discussion forums, research project thesis or dissertation, end of year transfer vivas/reports (PhD students)

## Practicalities

Undergraduate or postgraduate students undertaking research projects. Paragraphs to be included in project dissertations/thesis and/or end of year transfer vivas/reports (PhD students)

## Relevant topics and issues

- Ethical issues arising from distinct programmes of work
- Scientific integrity
- Societal impact of research

## Student Handout:

### DIRECT ETHICAL IMPLICATIONS AND WIDER SOCIAL IMPACT OF RESEARCH

You are required to include a paragraph in the discussion section of your thesis or dissertation in which you consider the direct ethical implications and wider social impact of your research. The following are some things you might wish to consider. This list is not exhaustive, the ethical implications and the potential benefits are going to be highly dependant on the nature of research undertaken, they will, however, give you an idea as to how laterally you should be thinking.

- Does the research use personal data, human participants, tissues or biological samples? Was informed consent obtained?
- Does the research involve the use of animals or animal tissues? Are there any alternatives to animal use? Was best practice in animal welfare and the 3Rs applied?
- Is any harm done to trapped animals? Is care taken to ensure their wellbeing before release?
- Are sufficient organisms taken from the study area to cause long-term effects on population structure of any species?
- Does the research involve the use or production of genetically modified organisms? Has sufficient containment been practised?
- Does the research have an environmental impact, either in its outcomes or as a by-product (e.g. production of toxic waste, use of large amounts of energy, generation of a large number of carbon miles etc)?
- Does the research generate outcomes that could be misused for harmful purposes (including harms to humans, animals, environment) or for bioterrorism/bio weapons?
- Has the research been conducted to the highest ethical standards (e.g. academic excellence, integrity and professionalism)?
- Have the contributions of others to the work been properly acknowledged?
- Why has this research been conducted? What are the benefits to Society? Will the research improve human health, reduce suffering or cure disease? Will it give environmental benefits, such as protecting threatened species or environments, reduce the effects of pollution, aid carbon sequestration?
- Do the potential benefits to Society outweigh the harms?

- If there are no ethical implications or benefits to Society, say so. However, if the latter is the case, state why you conducted this research.

(Optional)

The idea is that you help each other with this. To facilitate this, you are required to post your paragraph on the discussion forum within the module area of the University Virtual Learning Environment by (*insert date*). You should read and comment/provide feedback on each others posts. The module manager may also comment on a few. You should use these comments/suggestions to modify your paragraph before you include it in your dissertation or thesis.

### Tutor notes

Students are required to apply their training in ethical thinking by considering the ethical issues arising from a programme of research (e.g. final year or MSc project, PhD) they have undertaken and incorporating this as a section within their dissertation/thesis discussion. To assist them with this, students may be given general guidance (see student handout above, this can be modified depending on the type/nature of research undertaken). You may wish to also provide the option of an on-line discussion forum where students can post their ethics paragraphs and receive comments/feedback on these from their peers. These comments can then be used by students to modify their paragraphs before inclusion of the final version of their dissertations/thesis.

An example from a Final Year Undergraduate Research Project is as follows:

<b>Subject:</b> Ethical Considerations for an In Vivo Project		<a href="#">Reply</a> <a href="#">Quote</a> <a href="#">Modify</a> <a href="#">Set Flag</a> <a href="#">Remove</a>
<b>Author:</b> -----		<a href="#">Next Post &gt;</a>
<b>Posted date:</b> Thursday, April 23, 2009 2:48:35 PM BST		<b>Overall rating:</b> ★★★★★ <b>Previously rated:</b> 5 stars
<b>Last modified date:</b> Thursday, April 23, 2009 2:48:35 PM BST		
<b>Total views:</b> 118 <b>Your views:</b> 2		
<p>My project involved looking at the effects of postnatal over nutrition in rats, on the neuronal circuitry of certain brain pathways involved in the gastric accommodation reflex (the idea being that people who are overfed during early life may become susceptible to obesity later in life through altered brain pathways regulating meal size). Over nutrition during the lactation period was established by reducing the litter size to three pups per lactating female (2 groups), and this was compared against a control group consisting of 8 pups. The gastric accommodation reflexes of these rat pups were then looked at during postnatal week 5. Experiments were conducted in anaesthetised animals.</p> <p>The use of live animals in this investigation has clear ethical implications. As already mentioned, the environment in which the animals were housed and all of the experiments performed in this study were conducted in accordance with the United Kingdom Animal (Scientific Procedures) Act 1986 and the European Communities Council directive 1986 (86/609/EEC). Ethical Review was also provided by the University of Leeds Ethical Review Committee, who made sure that every attempt was made to minimise the number of animals utilised and their suffering.</p> <p>It was observed from an early stage that culling the litters to a small group of 3 pups resulted in a great deal of stress to the lactating mother. To minimise this stress, the mother was first removed from the cage and housed separately upon weighing the pups. Attempts were also made to minimise disruption to the nest by the experimenter rubbing their hands in the cage bedding before picking up the pups, so as not to transfer any foreign scents onto the pups. Pups were then placed back into the nest before the mother was returned. It was also decided that the pups would be weighed on alternate days rather than daily, so as to modify the upset caused to the pups and their mother.</p> <p>All experiments were carried out under general anaesthesia, the depth of which was constantly monitored by trained personal licence holders to ensure no pain was felt by the animal. At the end of data collection, or when there were untoward changes to the animal's vital signs, it was terminated in accordance with Schedule 1 by an overdose of I.V. anaesthetic. Death was then confirmed before carrying out dissections. Parts of the animal not used in this study were made available to others in order to minimise the use of animals in scientific research in general.</p> <p>Types of research looking at the effects of altering postnatal nutrition on CNS development would be deemed highly unethical to perform in humans, particularly since the effects of this are still under scrutiny. Not only this, but the developmental period of human infants is much longer than those of other mammals, and hence would have resulted in greater cost in terms of both time and finance. Therefore, the only viable alternative is to use animals. Rats were used since the CNS pathways under investigation undergo significant development in the first few weeks after birth, assembly and maturation of which has been previously very well characterised.</p> <p>Can this research be justified? To answer this question the possible benefit that this research has provided to the understanding of obesity has to be weighted against the moral cost, i.e. the animal suffering involved. Obesity is a rapidly growing epidemic worldwide and is not only reducing many people's quality of life, but is also putting a massive strain on the NHS. This research has provided insights into the detrimental effects of altered nutrition during early life on the vago-vagal circuitry, although further studies would need to be conducted in order to confirm the results seen here. In order to improve the ethical justification by lowering the moral cost of this research the 3R's were vigorously implicated at all stages. For example, an appropriate species were used with methods that have been deemed reliable through previous research (REF), and appropriate statistical tests were employed for the number of animals used so as to reduce the probability of type I error (false positive results).</p>		
<b>Subject:</b> Ethical Considerations for an In Vivo Project		<a href="#">Reply</a> <a href="#">Quote</a> <a href="#">Modify</a> <a href="#">Set Flag</a> <a href="#">Remove</a>

# **ANIMAL EXPERIMENTS; CRUEL OR NECESSARY?**

*Ethics-based "Science and Society" events; an alternative non-laboratory based Final Year Research Project*

## **Abstract**

Financial, staff and space constraints mean that there is an increasing need for Bioscience Departments to develop alternatives to traditional wet, laboratory-based research projects for their final year students. Furthermore, since less than 20% of Bioscience graduates go onto careers in scientific research, there is also a requirement to offer alternative projects more suited to the final career destinations of the majority of our graduates.

There is currently considerable public interest in scientific ethical issues. Ethics is also increasingly being incorporated within GCSE and A-Level science curricula. However, significant numbers of teachers do not have the knowledge, confidence or time to provide this teaching. The following projects, in which students design and deliver ethics-based "Science and Society" activities for local school children, evaluating and writing up this exercise as their final year research project, address all of these needs. These sessions could be delivered as part of a local or Institutional "Festival of Science", National Science Week or within individual schools themselves. Furthermore, these "Science and Society" projects encourage students to be enterprising and innovative. They provide an academically equivalent alternative to traditional wet, laboratory-based projects; they also result in the development of additional key transferable skills, notably science communication. They are therefore ideal alternatives for students who intend to follow non-research careers such as science communication, scientific writing or teaching. Finally, "Science and Society" sessions such as these can be a valuable tool, both in the promotion of the public understanding of science, the Institution itself and its teaching.

## **Teaching format**

Two hour "Science and Society" activity for Key Stage 4 or 5 school pupils developed as part of a nine week Final Year research project

## **Practicalities**

Final year undergraduates in the Biosciences. Topics need not be ethics-based but could cover any topic within the National Curriculum

## **Relevant topics and issues:**

- Animal welfare
- Animal experimentation
- Anti-vivisection movement
- Science and Society

## **Student handout**

- At the start of the project, you will be given a "Brief" by your Supervisor as to what is expected (e.g. topic, year group, delivery method (if appropriate), deadlines etc). The assessment for this project will include an element as to how well you fulfil this brief
- You are free to choose whatever format you wish for your session. However, it must be interactive and include some means of evaluating the experiences of your audience (pupils and staff) and whether the learning outcomes were met
- At the end of week 1, you should provide your Supervisor with a Gantt chart showing the timelines for the project
- You should undertake a pilot study, run focus groups and reflect on good/bad teaching practice prior to wider distribution/testing of your resource. Details of these should be included in your methods and the outcomes detailed in your results
- Your Supervisor will require you perform a full rehearsal of the proposed activity for them, a minimum of 1 week before the actual "Science and Society" event. If your Supervisor decides that your proposed session is not of a suitable standard, they may opt to run the event for you.
- Dissertation
  - Introduction- should include a complete review of the relevant educational / pedagogical / sociological literature, place within the curriculum, evaluation of existing resources, aims and learning outcomes etc.
  - Methods- to include details of the educational setting, design and description of the resource, evaluation criteria (driven by learning outcomes) and methods of evaluation including any statistical tests used.

- Results- details of the resources produced and outcomes of any evaluation and/or user (staff or student) feedback including from focus groups or pilot studies
- Discussion – must include discussion of the suitability of resource developed with reference to the pertinent literature, did it fulfil the desired learning outcomes, evaluation of any feedback, suggested modifications and future developments etc
- Appendix- you should provide a copy of your resource including activity plans, tutor/user notes etc as appropriate. These are excluded from the word count
- The novelty and appropriateness of your resource (relative to the Brief you were given and the learning outcomes) will be assessed as a component, both of your “productivity” mark, and in the results sections of your dissertation.

### **Tutor notes**

At the start of the 9 weeks allocated to the project, each student should be given an individual Brief to develop a 2 hour interactive ethics-based "Science and Society" session which should include topic, year group, delivery method (if appropriate), deadlines etc. They are free to choose whatever format of the session they wish but it must be interactive and include a means by which both pupil and Staff experiences are evaluated and whether the intended learning outcomes are met. Potential formats could include a brief introduction of the topic followed by group then plenary discussion of case studies or brief presentations for and against a topic followed by a debate or group then plenary discussion of prepared questions. Questions for discussion work best if accompanied by appropriate visual images

In the first week of the project, students should provide their Supervisor with a Gantt chart showing timelines for the project. In the week prior to National Science Week (or whenever event is to be delivered) they should be advised to concentrate on researching and developing the content for their proposed session including pedagogy and the GCSE science curricula. Weekly meetings with supervisors enable the provision of guidance as the materials/session is developed. Students must recruit focus groups and trial the sessions on these groups beforehand, modifying their materials/sessions in response to any feedback received. They also have to recruit any facilitators/helpers they would require for the session and train/provide notes for these facilitators. The deadline for completion of the development and trialling of this activity should be 1 week before the event. Students should be informed that failure to meet this deadline or if the proposed session was not of a sufficient standard, they will not be allowed to run it as part of National Science week. Instead, the Supervisor would run the session

On completion of the session, the project is written up in a similar manner to wet, lab-based projects (introduction, methods, results, discussion). Specific guidance as to what is required is provided (see student handout). All teaching materials used during the activity (e.g. slides, facilitator notes, questionnaires) should be incorporated into the appendices. The dissertation is assessed using the same criteria as per traditional lab projects, with the novelty and appropriateness of the teaching session itself being assessed, both as a component of the "productivity" mark and in the results section of the dissertation.

# SCIENCE & SOCIETY ACTIVITIES IN SCHOOLS

*Materials and ideas for schools presentations*

## Abstract

There is considerable public interest in animal experimentation. Often facts can be overlooked and therefore it is essential that, as a scientific community, we actively seek to gain public understanding and acceptance of the need for humane animal research in the UK, by maintaining and building informed public support and a favourable policy climate for animal research.

One key group from which to gain support are teenagers (Key Stage 4 and 5). These individuals are at an impressionable age; their opinions are often formed by what they read in the teen or popular press. It is therefore essential that we provide them with knowledge of the key facts about animal experimentation and engage them in the debate. Discussion of the ethics of animal experimentation and the drug discovery processes are also now an integral part of the GCSE and A-Level science curricula.

To engage and inform school pupils about animal research, Understanding Animal Research (<http://www.understandinganimalresearch.org.uk>) co-ordinates an extensive "Speakers in Schools" programme, matching schools with speakers and providing resources and training for its volunteers. A suggested format for a school seminar on animal experimentation is outlined below.

## Teaching Format

1-2hr seminar

## Practicalities

Key stage 4 and 5

## Relevant topics and issues

- Animal welfare
- 3Rs
- Harm / benefit
- Science and Society

## Teaching Resources

Extensive resources ("model" PowerPoint presentation, video clips, images, FAQ, classroom exercises) and training are available from "Understanding Animal Research"

<http://www.understandinganimalresearch.org.uk/>

Their suggested format is a 20 minute presentation in which you should first spend a few minutes introducing yourself/your science or involvement with the use of animals in research. The main body of the talk should cover the following 4 points:

- Essential for medical progress
- Everyone benefits- both humans and animals
- Every care is undertaken to ensure that the research is humane and that pain, suffering or distress is minimised

Only undertaken when there is no other alternative.

This presentation should be followed by a question and answer session. If students don't ask questions, you might like to pose the following:

- 45% of animals used have been "made in the lab"- genetically modified. Should we be using genetically modified animals?
- Do animals have rights? Are we abusing these rights when we use animals in scientific research?
- Do the public support animal experiments? Should anti-vivisectionists be allowed to use whatever means necessary to stop these experiments?
- What happens to the animals afterwards? What do you think should happen to them?
- Animal experiments can't guarantee that a new medicine is totally safe. These (thalidomide, TGN1412) all passed animal testing. Why should we still use animals if it doesn't always work?
- Isn't the use of animals for research against God or religion?
- If you were an MP drawing up a new law to regulate animal experiments, what would you put in it? What do you think should be banned?
- Over 50% of studies don't use anaesthetics or pain killers. Can this be justified?

## LINKS TO TRAINING MATERIALS AND OTHER RESOURCES

### ANIMAL WELFARE & 3Rs

- **AHWLA Assessing the Health & Welfare of Laboratory Animals**  
Tutorials and materials for implementing the 3Rs <http://www.ahwla.org.uk/site/Tutorials.html>
- **ALTBIB**  
Bibliography on Alternatives to the Use of Live Vertebrates in Biomedical Research and Testing, National Library of Medicine <http://toxnet.nlm.nih.gov/altbib.html>
- **Altweb**  
Gateway to educational and research resources on alternatives to animal testing. Includes a searchable database <http://altweb.jhsph.edu/>
- **AnimAlt-ZEBET Database**  
A full-text database of alternative methods (3Rs) to animal experiments in biomedicine and related fields <http://www.dimdi.de/static/en/db/dbinfo/zt00.htm>
- **Animal ethics infolink**  
Educational and training materials in the 3Rs. Includes substantial links to other resources <http://www.animaethics.org.au/home>
- **Animal Welfare Science, Ethics and Law Veterinary Association (AWSELVA)**  
Information, meetings and a newsletter on animal welfare issues
- **Digires**  
Digital resources for training in animal care/welfare, handling, anaesthesia and experimentation <http://www.digires.co.uk/>
- **European Centre for the Validation of Alternative Methods (ECVAM)**  
Provides factual and evaluated information on advanced non-animal methods for toxicology assessments; offers full method descriptions, including development and validation status (Includes INVITTOX test protocols) <http://ecvam.jrc.it/>
- **European resource centre for alternatives in higher education**  
Information and resources for alternatives to animal use in higher education. Includes searchable database <http://www.eurca.org>
- **Focus on Alternatives (FoA)**  
Materials and resources on alternatives to the use of animals in research <http://www.focusonalternatives.org.uk/index.html>
- **Fund for the Replacement of Animals in Medical Experiments (FRAME)**  
Materials and resources on alternatives to the use of animals and the promotion of the 3Rs <http://www.frame.org.uk/index.php>
- **Institute of Animal Technology (IAT)**  
Resources (Books, syllabus, DVDs) for education and training in animal care and welfare <http://www.iat.org.uk/>
- **Laboratory Animal Science Association (LASA)**  
Includes resources, reports, guidance for implementation of best practice in 3Rs and A(SP)A Position papers, reports, guiding principles advance this knowledge of the care and welfare of laboratory animals and to promote refinement of scientific procedures <http://www.lasa.co.uk/index.html>
- **Learning Curve**  
Resources (DVDs, worksheets) and courses for the provision of training for animal technicians, scientists and support staff <http://www.learningcurvedevelopment.co.uk/index.php>
- **National Centre for the 3Rs (NC3Rs)**  
Resources for implementation/good practice in all aspects of the 3Rs. <http://www.nc3rs.org.uk>
- **Netherlands Centre for Alternatives to Animal Use (NCA)**  
Includes searchable database on alternative to animal use and CDROM on humane endpoints <http://www.vet.uu.nl/nca/home>

- **Norwegian Reference Centre for Laboratory Animal Science & Alternatives**  
Information and resources on laboratory animal science and alternatives to the use of animals in research, teaching and school dissection classes.  
<http://oslovet.veths.no/dokument.aspx?dokument=80> Video clips <http://film.oslovet.veths.no>
- **Royal Society for the Prevention of Cruelty to Animals (RSPCA)**  
Science Group: resources for improving the welfare of wildlife, laboratory, farm and companion animals  
<http://www.rspca.org.uk/servlet/Satellite?pagename=RSPCA/RSPCARedirect&pg=sciencegroup>
- **Universities Federation for Animal Welfare (UFAW)**  
Resources for improving the welfare of animals as pets, in zoos, laboratories, on farms and in the wild <http://www.ufaw.org.uk/index.php>
- **World Society for the Protection of Animals (WSPA)**  
CD/ DVD course on animal welfare aimed primarily at developing countries [www.WSPA.org](http://www.WSPA.org)
- **Xenopus laevis Frog Colony Care**  
Information about housing, rearing, and care of *Xenopus laevis* and, to a lesser extent, *Xenopus tropicalis* frogs. <http://www.xlaevis.com/>

## ETHICS

- **Boyd Group**  
Reports on the ethical issues arising from the use of animals in different areas of biomedical research <http://www.boyd-group.demon.co.uk/>
- **Nuffield Council on Bioethics**  
Resources on the ethics of animal experimentation  
[http://www.nuffieldbioethics.org/go/ourwork/animalresearch/publication\\_178.html](http://www.nuffieldbioethics.org/go/ourwork/animalresearch/publication_178.html)

## LEGISLATIVE

- **Animal Procedures Committee**  
Government advisory committee on Animals (Scientific Procedures) Act 1986. Includes resources for advice/implementation of ASPA and implementation of 3Rs  
<http://www.apc.gov.uk/>
- **Animals Scientific Procedures Division**  
Links to: Animal (Scientific Procedures) Act, guidance on the Act, licence application forms, training, animal welfare, annual statistics and extensive links to other reference sources  
<http://scienceandresearch.homeoffice.gov.uk/animal-research>

## RESEARCH TRAINING RESOURCES

- **Bioethics Bytes**  
Resources to assist in the teaching of bioethics, with particular emphasis on multimedia materials (film, TV, streamed media) <http://bioethicsbytes.wordpress.com/about/>
- **DSS research**  
Web-based tools for calculating sample sizes or power calculations  
<http://www.dssresearch.com/toolkit/default.asp>
- **Isogenic info**  
Resources to provide training in experimental design and statistical analysis  
<http://www.isogenic.info/html/design.html>, animal models  
[http://www.isogenic.info/html/animal\\_models\\_in\\_research.html](http://www.isogenic.info/html/animal_models_in_research.html), the use of isogenic animals  
<http://www.isogenic.info/html/isogenic.html> and toxicity testing  
[http://www.isogenic.info/html/toxicity\\_testing.html](http://www.isogenic.info/html/toxicity_testing.html)
- **Journal of Visualised Experiments (JoVE)**  
Videos of experimental procedures in life sciences. <http://www.jove.com/>
- **Mouse dissection**  
E-learning guide to dissection of mice <http://www.geocities.com/virtualbiology/>

- **Pharma-CAL-ology**  
Teaching and learning technology-based materials (includes mouse watch) for pharmacologists distributed by the British Pharmacological Society <http://www.pharmacology.com/>
- **Sniffy, the virtual rat**  
Computer simulation of rat psychological (learning and memory) studies.  
[http://www.wadsworth.com/psychology\\_d/templates/student\\_resources/0534633609\\_sniffy2/sniffy/main.htm](http://www.wadsworth.com/psychology_d/templates/student_resources/0534633609_sniffy2/sniffy/main.htm)
- **The Laboratory Rat: A Natural History**  
Training resource on animal welfare. Film & accompanying website about domesticated rats released into the wild. <http://www.ratlife.org/Home/0Main-frameset/Mainframeset.htm>
- **Quantitative structure-activity relationships (QSAR)**  
Online resource for structure-activity relationship modelling <http://www.qsarworld.com/>

## SCIENCE AND SOCIETY

- **Animal Welfare Institute (AWI)**  
Organisation which seeks to reduce the suffering of laboratory, farm and captive animals  
<http://www.awionline.org/ht/d/sp/i/214/pid/214>
- **Dr Hadwen Trust for Humane Research**  
Medical research charity that funds and promotes exclusively non-animal techniques to replace animal experiments. <http://drhadwentrust.org/>
- **Understanding Animal Research (UAR)**  
Resources to promote understanding and acceptance of the need for humane animal research in the UK. Factsheets, videos and images of the use of animals in research. Speakers in schools presentations and training. <http://www.understandinganimalresearch.org.uk/homepage>

## OTHER RESOURCES

- **MGI Mouse Genome Informatics**  
Database resource for the laboratory mouse, providing integrated genetic, genomic, and biological data <http://www.informatics.jax.org/>
- **Whole Mouse Catalogue**  
Links to numerous resources of particular interest to scientific researchers using mice or rats in their work including animal supplies and suppliers, animal care & welfare, alternatives, technical guides and protocols, videos, software and much more.  
<http://wmc.rodentia.com/>



National Centre for the Replacement, Refinement  
and Reduction of Animals in Research