Animal Ethics Committees and animal use in a monitored environment: is the ethics real, imagined or necessary?

Proceedings of the ANZCCART Conference held in Wellington, New Zealand, 26–28 June 2005

ANZCCART 2005

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Introduction

This highly successful conference was held from 26 to 28 June 2005 at the Royal Society of New Zealand. The conference focused on what Animal Ethics Committees do in regulating and monitoring the use of animals in research and teaching, and the public's and scientists' expectations of the process. Questions considered during the conference included: Who is responsible for striving for best practice? Are ethical standards necessary, should they be raised, and by whom? Are AECs just compliance gatekeepers or do they have a role in defining ethical standards? Is public opinion of animal ethics known or just imagined? What can AECs learn from human ethics committees?

The conference programme was structured into six sessions over the two days.

Session 1: Animal Ethics Committees: what do they really do, what should they do, and why should they do it.

Dr John Schofield, University of Otago, discussed whether Animal Ethics Committees (AEC) are a help or a hindrance to researchers. He presented a virtual Animal Ethics Committee meeting to discuss a scientific proposal from an institution, to illustrate issues of accountability and responsibility.

Professor Graham Nerlich, University of Adelaide, tackled the issue of the "ethics" of Committees. He considered that AECs do good ethical work but asserted that AECs don't (and shouldn't) "do ethics" and explained why he thinks that.

After these two talks the delegates split up into 6 groups to discuss one of three fictitious protocols and to report back to the whole conference whether or not approval should be given for such an experiment. The feedback from the breakout session was that it was a great icebreaker at the beginning of the conference to initiate networking.

Session 2 "Ethics Committees: their function"

Professor Don Evans, University of Otago, delivered the Cam Reid Oration. This paper noted and evaluated the varying degrees with which an affirmative answer has been given to the question "Are animals our equals?" It considered what guidance, if any, might be contained in these affirmative responses for members of AECs who have responsibility for providing ethical approval of research proposals.

Dr Deborah Middleton, Australian Animal Health Laboratory, Melbourne, discussed, from an Australian perspective, how to get all the elements of an AEC working successfully together. She explained how AECs are set up, their composition, the stakeholders, and operating guidelines, and how engagement with the highly committed animal welfare representatives on the AECs is critical to preserving the validity of the AEC process.

Session 3: Animal Ethics Committees: the social dimension

Dr Mark Fisher, Kotare Bioethics Ltd, discussed the necessary, the real, and the imagined aspects of AECs. AECs have a unique perspective of animals, science and people. They represent the social contract between animals and humans, and between institutions involved in research, testing and teaching and the public. Mark suggested that engaging in the manifestations of these contracts will help society develop the science and educational objectives it wants. Thus while AECs reflect society, they inevitably help shape the future of the relationship between people and animals. He said that is possible to imagine AECs playing a greater leadership role in this process but questioned whether they should.

Dr Tim Dare, University of Auckland, considered personal attitudes and public regulation with respect to animals and ethics. Our attitudes towards non-human animals contain deep inconsistencies. We distinguish without very clear grounds between companion animals and other species; we create systems of animal welfare regulations but carefully design them so they only minimally restrict our conduct. Dr Dare explored some of these tensions to try to see what a genuine respect for non-human animals might require of us. He felt that consideration of ethics by AECs, rather than just ensuring compliance with regulations, was important.

Session 4: Animals in research: the laboratory

Dr Simon Festing, Research Defence Society, UK, explained that although the UK is a world leader in medical research and produces more new medicines, more scientific papers and more Nobel Prize winners per head of population than almost any other country in the world, it paradoxically has the most vitriolic and influential anti-vivisection movement in the world, as well as the most aggressive animal rights extremists. Since there is limited room for debate or dialogue to find common ground with abolitionist organisations he said that in order to safeguard the future of biomedical research in the UK, it is vitally important that those involved in the use of animals understand the tactics of these groups and deploy appropriate counter-measures. This means engaging with the media and with politicians to ensure that animal research is not seriously undermined. Proactive lobbying is required to ensure that the Government takes appropriate measures to crack down on animal rights extremists and protect those involved in legitimate bio-medical research. The research community cannot go it alone, but must work with those who are skilled in communications and public affairs. He said it is far better to be open and transparent so that the public can get information about what goes on in research centres, and so that researchers do not give the impression of having something to hide. This message is equally applicable to New Zealand in safe-guarding the future of animal research.

Dr Ailsa McGregor, University of Auckland, spoke about neurodegenerative disease modelling and why it is necessary. She described the importance of whole animal models in neurodegenerative disease research and also their limitations. She discussed how these models have been refined to provide, as far as possible, clinically relevant information within the constraints of an animal.

Session 5: Alternatives and cost

Dr Richard Clothier, FRAME Alternatives Laboratory, UK, talked about the development of acceptable alternative methods. The process of validation is an important one when considering how alternative assays are going to be acceptable as replacements for the present animal-based methods. There is a formal process in the EU whereby in vitro assays can be validated, and these criteria are being extended to new proposed animal tests. He reviewed the issues that underlie the FRAME Research programme which funded the work on alternatives that he described in his talk.

Dr Robert Baker, Department of Primary Industries and Resources, South Australia, talked about public accountability in animal use for scientific purposes in Australia and national data and auditing of AECs and institutions. As there is no national animal welfare legislation regulating the use of animals for research and teaching in Australia, each of the eight States and Territories has its own legislative requirements and system of AECs. This has made the collection, collation and interpretation of national data on animal use in research and teaching very difficult. This paper provided the Australian data for five of the eight jurisdictions for 2003, together with some interpretations and comments. Compliance with the Australian Code of Practice for the Care and Use of Animals for Scientific Purposes is a legal requirement in all jurisdictions. The 7th edition published in 2004, included for the first time a requirement for regular external review of the operation of institutions and their AECs, defined the required scope and outcomes of the reviews and recommended how they should be conducted. While such reviews are already undertaken in some states, this is a new requirement in many jurisdictions. This paper briefly outlined how this may be undertaken and concluded with some general comments on public accountability of AECs in Australia.

Session 6: Out of the lab and into the wild

Bruce Warburton, Landcare Research, spoke about managing ethical issues in vertebrate pest control research. New Zealand has a range of introduced vertebrate pests that have negative impacts on conservation, animal health, and production values. Species such as possums, ferrets, stoats, feral cats, rats, mice, pigs, goats, deer, and tahr all receive some form of lethal control in order to minimise

the impact they have. For possums alone, more than $80m is spent annually on control using poisons (1080, cyanide, anticoagulants, and cholecalciferol), traps and shooting. This significant control effort is underpinned by a range of research projects that, by necessity, use a considerable number of experimental animals. This paper detailed Landcare Research's animal use, and highlighted some specific challenges that research on wild animals pose for researchers and AEC members.

Mason, NZSPCA, outlined considerations and perspectives in animal welfare at home. New Zealanders, like many Westerners, make their homes in a variety of places—from high-rise urban apartment buildings, to the traditional bungalow on the quarter acre section, to country houses on extensive farms. But no matter where they make their home, they will in all likelihood interact with a variety of animals there. Typical categories of animals found at home include companion animals, wildlife and insects. The nature of interaction with these animals will be influenced by the individual's make-up; the animal's make-up; the physical environment; and applicable laws and regulations. Interactions between humans and animals have the potential to both enhance and compromise the welfare of both. For most Westerners, their interaction with animals at home represents most, if not all, of their interaction with species other than their own. It is not then surprising that they struggle to comprehend animals, and animal welfare, in other contexts, such as in farming or research. With technological advances occurring at an exponential rate, it may be that the future will see greater use of technology, such as mobile phones and the internet, as vehicles for facilitating interaction with animals at home. This will in turn potentially impact on the welfare of those animals.

The conference concluded with an update on the recommendations that arose from the 2003 ANZCCART Conference in Christchurch and agreement for inclusion of

Session 1
Animal Ethics Committees—what do they really do, what should they do, and why should they do it?

Animal Ethics Committees: a help or a hindrance?

Dr John Schofield

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Abstract

The paper given at this meeting was a powerpoint presentation designed to provoke and challenge the audience. The ideas and concepts in this paper are a personal view and do not represent the official position of any organisation. A series of graphic images was used to illustrate the main themes. Some images are reproduced here.

In considering whether Animal Ethics Committees (AECs) are a help or a hindrance, I propose to explore some operational features of AECs, by considering four basic performance models of committee function. I will then review the AEC-Principal Investigator (PI) relationship.

I believe there is merit in considering how far we have come with legislative compliance in the monitoring and management of manipulations in research, testing and teaching.

The picture above depicts William Harvey the English doctor (to King Charles I) doing bench research without AEC approval. In my view we are looking at a greyhound on the table. Harvey appears to be incising its abdomen without anaesthesia. This is animal research as it was back in 1620. In those days people thought that food was turned into blood in the liver, and then consumed as fuel by the body. But Harvey had the radical idea that the heart circulated blood around the body. His medical practice dwindled as a result; his patients thought he was crazy.

There are at least two perspectives of AEC operation. First, committee members in general believe they make a difference in terms of animal welfare by ensuring that best practice procedures are employed. Otherwise, I doubt that members would continue to serve on AECs. The second perspective is that of the research scientist, some of whom, in my experience, regard the AEC as an obstacle or a hindrance. Both groups usually agree that AECs are a permanent feature of the experimental animal landscape. The interactions between these two groups can raise issues and concerns, which I have briefly summarised in the following proposed models of AEC performance:

Model 1: "The Papal Infallibility Model"

The AEC is characterised by:

- a very user-friendly and compliant relationship with the researchers
- the researcher is regarded as the expert in all matters
- unquestioning acceptance of the researchers' explanations
- on occasions the AEC may be intimidated by the researcher

The net effect of this model is rubber stamp approval of applications without serious consideration of the content, in the belief that the researcher is infallible.

Model 2: "The Inquisition Model"

The AEC is characterised by :

- confrontational challenge of each application
- questions are often asked; 'have we missed something here?' or 'can we approve this without finding something to complain about ?'

The net effect of this model tends to be volatile with explosive encounters between the researcher and the AEC, which can degenerate into dysfunctional relationships.

Model 3: "The Belt & Braces Model"

The AEC is characterised by:

- constant indecision and fear of making mistakes
- an overly precautionary approach, hence the belt and braces to ensure that the AEC avoids any exposed regions
- the not-in-my-backyard philosophy

The net effect of this model tends to be pedantic precaution by a committee which operates within the limits of its own experience. Researchers become frustrated by the behaviour of the AEC.

Model 4: "The Evidence Based Ethics Model"

Evidence-based medicine is the internationally accepted practice which uses scientific findings to determine appropriate medical treatment. I propose the term 'evidence- based ethics' to describe a method by which an AEC can operate on a similar basis, as indicated below:

The AEC is characterised by:

- requesting evidence from researchers to support their particular proposals
- a requirement that current or best practice is routinely used
- a policy that obsolete practice is avoided. For example, few AECs would consider approving the Draize test. In this assay, test compounds were placed on the eye of a conscious rabbit and the potential toxicity thereby evaluated.

The net effect of this model tends to be harmony when the AEC asks reasonable questions. So what kinds of questions is an AEC entitled to ask? We have sought legal advice on this question and understand that the committee can ask any question as long as it is relevant to the operation of the AEC.

But what if the AEC overlooks a key question?

The National Animal Ethics Advisory Committee (NAEAC) has developed guidelines on some key questions which it believes should be asked of researchers each time an application is made to use live animals. A copy of these guidelines is enclosed as Appendix 1.

I did not explore the issue of the AEC's failure to ask key questions, during the presentation, but will do so here. In my experience most AECs operate more or less as described in Model 4 above; using the "evidence-based ethics" approach. It is generally expected, in my view, that the Principal Investigator will provide sufficient information for the committee to judge whether the proposal meets the criteria for approval, as set out in section 100 (a) to (m) of the Animal Welfare Act 1999. One of these criteria is (h):

'whether adequate measures will be taken to ensure the general health and welfare of animals before, during, and after the manipulation.'

It is interesting to consider to what lengths the committee should go, in order to ensure that animal welfare is not compromised. Imagine a situation in which the researcher has overlooked the long-term consequences of a manipulation, which might have serious consequences for the animals involved in the study. For example, in science projects which involve the monitoring of wildlife populations, any threat to the future breeding potential of individuals or colonies should always be carefully considered. I pose the question; where does the responsibility lie in the event of a catastrophe? With the researcher or with the AEC which approved the project, or both?

To illustrate this situation, I presented a hypothetical case study from a hypothetical institution which I will call the University of Norfolk Island. The School of Biological Sciences at this university has a strong wildlife management programme. The university has an Animal Ethics Committee which complies with current legislation. The members of the committee are an eclectic mix of talents and phenotype, well suited

to the rigours and challenges they face. They are:

Capt Hook, Dept of Marine Sciences; chairs the committee with an iron fist

Ms Fiona, secretary

Prof Yoda, Dept of Physics, specialist in electromagnetic radiation

Ms S White from the Early Childhood Development Centre and her 7 helpers

Prof D Vader, Dept of Pathology

Dr Alice, Psychiatry Institute

Dr T Bell, Dept of Zoology, specialist in human powered flight

Rev Shrek, external member, has a BSc in statistics

The AEC was presented with a protocol entitled: "The evaluation of EM radiation to prevent by-catch in *Diomedia norfolkei*".

In summary: the island's albatross colony is threatened by a foreign offshore fishing fleet and albatrocities result from long-line fishing techniques. EM devices are to be fitted to trawlers to scare birds away.

Aims: to study the effects of electromagnetic radiation (EM) on the Norfolk Island population of albatross to prevent their by-catch resulting from commercial fishing. Up to 300,000 birds a year are estimated to be killed as a result of by-catch fishing. This method will give protection for this rare species and all other birds. Preliminary studies indicate that EM is effective in small caged species.

Methods:

1) to field-test a novel EM device initially by a land-trial. In this trial the EM device will be set up near the roosting area and bird behaviour will be observed by students.
2) to then test the device on the institution's research vessel.
3) to conduct 10 sea trials: 5 with EM and 5 without EM over a 3-month period.
4) to count the numbers of birds caught and analyse the results by statistical methods using ANOVA.

Qualifications: Dr Pan BSc, MSc, PhD, MRAEC, MAOS, has 16 years in aeronautical engineering and 3 years in wildlife management studies.

There was vigorous and prolonged committee debate, summarised below:

- Prof Vader alleges a conflict of interest between the applicant Dr Pan and Dr T Bell.
- Rev Shrek complains that in the budgie backyard study $N = 5$; not enough birds.
- Ms White worries that the EM will compromise the parental behaviour of the adults.
- Prof Yoda confirms the force will be sufficient for seabirds based on the budgie trial.
- Dr Alice is concerned that the EM will crack the shells of nesting birds during the land-trial.

After 4 hours of debate the 7 dwarfs are sent out for donuts and coffee.

Finally the AEC is convinced by the evidence and has considered all possibilities. They cleverly decide that the main study should be subject to a satisfactory pilot land-trial.

The School's trawler is fitted with the device and ten fishing trips are completed, five without EM and five with the EM force field over a period of 3 months. The reduction in by-catch is significant. Dr Pan is quietly confident. He feels a knighthood just around the corner.

But 6 weeks later, the albatross colony manager reports an alarming decrease in bird numbers. Chick survival is threatened.

The following week this article in the Sydney Morning Herald is published:

"The NSW Department of Wildlife Management is reported to be concerned regarding the situation with Norfolk Island's albatross colony, following a new study by a researcher in the School of Biological Sciences. The scientist identified as Dr P Pan, declined to be interviewed; however, the colony manager, Mr Ross Petrel, is quoted as saying...

"...it's really weird, birds we have followed and documented for decades, have suddenly failed to return to their nests, this leaves their mate behind alone to raise the chicks. Its almost like they lost their way somehow....? I never was happy about that fairy anyhow..., they should never have let him have a go with that force field nonsense."

The University of Norfolk Island AEC is now faced with the dreadful possibility of a lost and wandering albatross generation.

To return to the initial question of this paper; was the AEC a help or a

hindrance? This scenario leads one to ask; who is responsible for this

jurisdictional gap? Will the AEC serve as both the judge and the jury?

Clearly the AEC acted as a judge in reviewing the case, (the research application) and deemed it to be acceptable. Now after the event, will the AEC also act as a jury to pronounce their verdict for or against Dr Pan, the researcher involved? Put another way, should the AEC have to function as both 'Camp Mother' and 'Camp Leader'?

Like all good fairy stories, this one too, has a happy ending. Several months later the Sydney Morning Herald published the following report:

LOST BIRDS FOUND !

"In response to a report last night from Chilean Government officials, the lost birds have been sighted on Easter Island. The Prime Minister Mr Howard has sent the Australian Frigate 'HMAS Emu' with a party led by Mr Ross Petrel to recover these birds...and Dr Peter Pan was not permitted to join the rescue party."

To conclude the afternoon session the conference delegates were asked to consider three examples of protocols that had been submitted by a hypothetical Animal Ethics Committee. The delegates were divided into six committees and were provided with the NAEAC guidelines for drafting an AEC protocol application. (Appendix 1). The objective of this exercise was to decide what evidence was present, or absent, in the applications and to formulate advice and guidance for the applicants.

Appendix 1

NAEAC guidelines for drafting an Animal Ethics Committee protocol application

These guidelines have been drafted to assist Animal Ethics Committees (AECs) to review the criteria listed in section 100 of the Animal Welfare Act 1999. These criteria must be considered during any application for the approval of a project. It is recommended that project application forms include directed questions that provide the AEC with the key information detailed in the nine categories outlined below.

The National Animal Ethics Advisory Committee (NAEAC) has a legislative role in providing information and advice to AECs.

It is recognised that each AEC will deal with different animal models and facilities; these can range from small rodent colonies to large herds of domestic livestock at pasture. NAEAC believes that these guidelines can be applied to all protocol applications, however, it is acknowledged that not all categories listed below will be applicable for all proposals. The nine categories listed below contain abbreviated notes on key information. It is not intended to be a comprehensive discussion document.

1. Overall project details

A	Laypersonís summary Rationale, ethical concerns Application of the Three Rs (reduction, replacement, refinement)
B	Description of study, relevant previous studies
C	Aims, objectives and expected experimental outcomes Projected benefits to animals or humans
D	Grant support, duration
E	Justification for any duplication of an experiment
F	Approvals from other agencies, e.g. DoC or ERMA Application has been submitted to another AEC
G	Justification of numbers proposed
H	A commitment to ensure that the findings will be promoted or published

2. Overall animal welfare and husbandry considerations

A	Species, sex, strain, age
B	Source of animals
C	Confirm any previous research use of the animals
D	Housing and use locations
E	Specific requirements, e.g. transgenic animals
F	Transport requirements

3. Overall safety issues

A	Biohazard, carcinogen, or radioisotope exposure of personnel or other animals
B	Risk management and containment strategies

4. Surgical and other manipulations

A	Anaesthetics used, drugs dose rates and admin frequency Any proposed use of muscle relaxants
B	How depth of anaesthesia will be monitored during the procedure
C	Adverse effects and their management ñ pain management - degree of harm, multiple procedures/ surgeries on one animal

5. Euthanasia

A	Methods, drugs, routes
B	Personnel involved

6. Endpoints of the overall study: consider the 3 basic endpoints:

A	Humane endpoints ñ animal welfare considerations
B	Death endpoints ñ if animal is left to die (i.e. death is the endpoint) this must be fully justified
C	Study endpoints ñ duration of the study per animal
D	Consider adverse effects of manipulations and a plan to manage them
E	NAEAC severity scale details

7. Personnel details

A	Names and contact details ñ emergency contacts
B	Training and experience
C	How additional training will be provided

8. Animals used in teaching

A	Preparation of students for animal use, ethical reviews
B	Consistency of supervision of students
C	Qualifications of students
D	Copy of laboratory handout
E	Do students witness euthanasia or participate in animal euthanasia

9. Declaration details to confirm that all personnel involved have read and signed the application form

A	Has read application and the Code of Ethical Conduct
B	Only procedures listed will be used
C	Signatures of compliance from all listed personnel
D	Signature of Head of Dept or CEO

For further information, the NAEAC Secretary can be contacted at naeac@maf.govt.nz

Where did all the ethics go?

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Abstract

Animal Ethics Committees (AECs) do good, ethical, work. Really. If I didn't believe that, I wouldn't be a voluntary, unpaid Category D member. (A Category D member is a person who has never been involved in the use of animals for scientific purposes and who is not associated with the institution.) It would be pointless drudgery. Mainly AECs exist to further human values, to allow scientific and medical work to flourish because that fosters the quality of our lives either through better health or through the cultural riches that pure scientific knowledge brings and for other reasons. As things stand at present, these human values can be effectively pursued only at a high moral cost. We must kill and injure animals and make them sick. Not just a few. A quite sobering multitude of them, every day, everywhere. That is a significant evil, a moral evil, but necessary for a greater moral good. We must do what we can to minimise the evil, not only for the sake of animals, but to guard ourselves from callous, uncaring, hardness of heart. But unless those values ***are*** a greater good, AECs should close all animal experimentation down, unless it benefits animals themselves.

I am not sure whether these bald claims will strike you as terribly obvious or obviously terrible. But that is my view. We should remind ourselves—often—that our task has a grim side!

So AECs have before them two ethical values to balance somehow in the practical work that will follow their deliberations. How far an experiment might advance the welfare of humans and animals or how far it might broaden or deepen our grasp of the living world, are truly ethical concerns. Exactly what would be done to animals if the work proceeds is one thing and what the welfare cost would be to them is another. The balance is a third.

None of this is "doing ethics". Does that make it seem as if our meetings aren't about ethics? "Doing" ethics is ethical theory, rather than ethical practice. Yet the coal face work of AECs surely considers good or evil. A rat in a Bollman cage is an evil, however necessary. Both AECs on which I serve frequently go beyond compliance with the *Australian Code of Practice for the Care and Use of Animals for Scientific Purposes* in fostering the welfare of animals in the experiment. What is ***done*** counts more for ethics than theory counts.

But more fundamental questions, worrying, fascinating ones, need to be asked and, like it or not, members of AECs act on large assumptions about them. We should not take them for granted. We owe it to ourselves and to human and animal communities to have better than gut feelings about them. We should all at least scrape some acquaintance with the views of those who do "do ethics".

They are hard questions. They matter a great deal to all of us involved in this work whether or not we ***think*** they do. I want to go on in a moment to try to say something —not nearly enough—about why they resist agreement and why AECs in committee mode should leave them well alone.

I should come clean. I am not well read in applied ethics. My interest in ethics is general; it is not my main area.

Australian Code of Practice for the Care and Use of Animals for Scientific Purposes

The A*ustralian Code of Practice for the Care and Use of Animals for Scientific Purposes* (the Code) acts like a lens, focussing broad, abstract, chaotic, frightening ethical debates into focussed, narrowed, assumptions about what may be ethically done. Working out the rights and wrongs of the assumptions is doing ethics. The Code marks out relevant territory, and states some best practices and minimal standards. It leaves the rest to us. Without those sharpened pictures we would never get through our agendas. It gives all AECs a consistent, manageable framework to work within. Its thrust is plainly ethical. It never aims to justify itself. Nor should it.

We make two large ethical assumptions: (i) experimental work on animals can be justified; and (ii) the cost to animals must be minimised.

I take for granted that it is a good Code.

Why ethical issues do not resolve

Ethics is not a science, not even a bad one. Science aims to tell us how the world is; ethics tells us how it ought to be—something utterly different. Science is based on observation, and involves belief, evidence, reason and theory. Ethics is based on values, and involves desire and action. While it needs evidence, reason and theory too, they work differently in ethics. Belief aims at truth, but desire aims at possibility. The way reason engages with belief and truth is quite alien to the way it engages with desire and value. The cognitive content of desire is represented in conflicting pairs of states of affairs, one actual and unwanted, the other possible but desired. That partly explains why reason works differently there. If your beliefs conflict, one of them must be false; but if your desires conflict they may be equally possible and valuable. The way things are is the ethical ***problem*** not its ***answer***.

This vague wave at differences suggests why ethical questions may be messy. But, in human life, ethics is unavoidable and pervasive, just as speaking language is, and for closely related reasons. We are naturally well equipped to acquire both. Each is both the source and the outcome of a cultural life. No viable group of normal human animals has ever been found which lacked language, culture or ethics. We take to it all like ducks to water. Moral choice and moral life are often profoundly inconvenient and frustrating, but they will not go away.

Floating in deep ethical waters, we can't touch bottom. That is unnerving, because that is often when we must make up our minds, or stumble upon their being already closed about our deep values without our quite knowing why. We lack grounds firm enough to bear the weight of our gravest choices, yet they ***matter*** so much. Acting on uncertain choices leaves us vulnerable to sharp judgement—not least dismaying, to our own judgement. After all, ethical action largely makes us what we are; it makes up the largest part of the ***meaning*** of anyone's life. So getting the choices wrong is a frightening prospect. This leads some of us to pretend (to others and ourselves) that we ***can*** touch bottom. This curses ethical debate with pathologies: dogmatism, posturing, bad faith, hypocrisy, self righteousness, indignation and self-congratulation.

It also saddles us with a range of easy subterfuges, corruptions of ethical debate. I list just two.

Evasions in ethics

Authority

Appeal to ethical authority is one such dodge. It places responsibility beyond us. Long ago Plato put his finger on why this will not work. It is a simple dilemma:

Does God command something because it is good, or is it good just in that He commands it?

That is not a challenge to religious belief. Belief is not the point; the point is ethics and authority. God figures just as the highest conceivable authority. Even there, appeal to authority will not work.

If we choose the first alternative, we may see God as our most reliable ***advisor*** on ethics. But He looks beyond his mere will before advising. He looks to what is good. For Plato, and for me, this is the right way to go: look to what is good. Ethics cannot be based on an ethically arbitrary authority, however exalted. When we obey authority, we remain responsible for what we do. No use pleading that we only followed orders if the authority is bad.

The second alternative has its followers. If you think God's edict is that you should fly a loaded airliner into a tall building, then you simply do it. It is improper to consider whether, in itself, the act is monstrous. The only moral fact is that it is an edict. That nourishes fanaticism, fundamentalism, bigotry. In the story of Abraham and Isaac, the Bible commends Abraham for

following the second alternative, willing to sacrifice his beloved son at God's unscrutinised behest. Appalling! But, it would seem, God Himself follows the first way and chooses the good above His arbitrary will. He lets Abraham off. Here the sacred text has a bob each way on Plato's disjunction. So do lots of bigots.

Relativism

Relativism is a polar opposite evasion to authoritarianism. You can dodge the need for careful ethical reasoning by insisting that ethics is subjective. What is right for anyone is what they feel is right. As for belief, there is no such thing as absolute truth. There is only what is true for me or for you. What is good, like what is true, is only relative.

Here is Plato again. Relativism is strictly indefensible. The relativist cannot defend himself against my claim that he is absolutely wrong for he concedes that absolutism is true for me. If I say that relativism is folly for everyone who holds it, the relativist can't both dispute this and admit that it is true for me.

Relativity to a society or a culture is no better. The social relativist cannot disagree with the Nazi, for instance. He cannot say the death camps were evil. Worse, the social relativist must insist that those in Germany in the late 1930s who opposed Hitler were evil. They opposed the current ethics of their society. For the social relativist, the reformer is always, automatically, wrong. Incredible!

I concede that solutions of ethical problems are not unique. But they are not subjective any more than engineering solutions are. There may be a dozen equally good ways of bridging a particular river or crossing an ethical divide. But that is not relativism.

Corruptions like these occurred in the tortured case of Terri Schiavo recently.[1] It is clear how they can poison committee type debates. They should be considered, but in other contexts.

Equally sharp anxieties connect with the ethics of experimenting on animals. I will thumbnail sketch one theory that says our practice is ethical, then mention a hard case. I stress that it is a particular theory, quite different from Singer's utilitarianism.[2] That theory sees ethical concerns as a list of interests or preferences, abstracted from the concrete life of animals. You just weight the interests and add to maximise. But if we think of ethics as what is humane, as a core aspect of human life, the picture can change in detail and focus so it is about whole animals—us as well as them. That is like the difference between in vitro and in vivo studies, but I have no time to develop that today.

Us and them

We and our laboratory animals are alike in being sentient agents. We can suffer and enjoy; that makes both of us one kind of value object. It is morally wrong to inflict pain on, or maim or frustrate sentient agents. Yet we do that to animals in the name of science. It is a necessary evil—necessary for a greater good. To justify this evil demands a difference between us and them—something morally relevant, not merely a biological, species difference. We must understand ourselves as, ***ethically***, more than sentient agents.

And we are—we are moral agents. ***We*** do good or evil. No other animal does. We can ***imagine*** other moral agents. Science fiction swarms with aliens, extravagantly non-human, but considerate of right and wrong. Thus, we separate the ethical and biological categories easily in thought, although we have never found other moral agents. Moral agents are objects of a higher value than sentient agents are.

What is a moral agent? I must be brief. They are smart, self-understanding, masters of articulate language (with grammar, structured syntax, etc.), at home in a culture of appraisal, criticism, aspiration. They are masters at critiquing themselves and others. They do not just live. They lead their lives.

We are not responsible for the ethical difference between us and animals; it is a natural given. It is surely relevant to what we are as objects of moral concern. What is not given is how should we act in the light of that difference? Observation cannot tell us. We have to decide, commit ourselves to courses of action by somehow weighing the values at stake. That is where the ethical turn begins. Commitment sounds like a leap in the dark. It need not be, but there is no hope, today, of making that good.

That is fairly straightforward, but it will not see us out of the woods. Consider why should we not experiment on those unfortunate human beings who

[1] Terri Schiavo was a brain damaged ("brain dead") Florida woman. A heated debate ranged round the issue of continuing her life by artificial means.

[2] See Singer's "Animal Liberation: a new ethics for our treatment of animals". New York, Random House, 1975.

are not moral agents, but only sentient ones—the demented, in a word? Then we could bypass animal models. That question surely provokes all the anxieties and all the doubts of the Schiavo example. She was no longer an agent and, arguably, not even sentient. We cannot justifiably say simply that animals are just animals and humans are humans. Only a moral distinction can sustain a morally defensible difference in treatment. I do not myself have a final answer to the question which I can defend in depth although I know how to begin. Even that would take too long.

Finally, let me repeat: any AEC member needs views on these painful issues. But committee meetings are no place to forge them.

Session 2
Animal Ethics Committees—their function

The Cam Reid Oration 2005
Are animals our equals?

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Figure 1 The picture of the air pump (1768) by Joseph Wright of Derby.

Introduction

Joseph Wright's celebrated painting (Figure 1), repeating Boyle's experiment demonstrating the need of an animal for air by evacuating the air from a glass jar in which the animal is placed, conveys all the reactions to the use of animals in research which we confront almost three hundred years later. One reading of the painting is that the demonstration occurs in the home of the audience. The audience is reminded of the slender line between life and death by the presence of the carious human skull, used as a symbol of mortality. [1]

The audience is aware that the animal might suffer and die in the experiment and they react variously. The demonstrator exercises the power of life and death by means of his left hand on the stop cock which could either provide or deny life-giving air to the bird. The father is concerned that his wife and child learn from the demonstration, whereas the mother cannot bear to look. Is she squeamish or does she refuse to be party to such cruelty? The serious gentlemen acutely observe the event lest they miss a vital piece of information. The couple on the left glance apprehensively towards each other torn by doubt about whether they should look and learn at such cost. And, finally, who is the boy who hoists away the cage, sadly resigned to the death of the animal. Is it the son of the house whose pet the bird is?

Such reactions I propose to examine by asking the question 'Are animals our equals?'

The oddness of the question

On the face of it this seems to be a strange question to ask if only because there seems to be an obvious answer to it. We are familiar with public health measures involving the planned destruction of certain animals which pose threats to the wellbeing of people. We vote for environmental programmes which seek to eradicate whole species of non-indigenous animals from our country which, aside from presenting a threat to public health in some cases, threaten the purity of

[1] Schupbach, W. 1987: A select iconography of animal experiment. Pp. 346-347 *in*: Vivisection in historical perspective, Nicolaas A. Rupke *ed*. Croom Helm.

Figure 2

our environmental heritage. Most of us choose which animals to eat and regard them as a major part of our diet to safeguard our health. In this connection we also support a vast industry which informs us of the most interesting and innovative ways to prepare the meat to titillate our palates (Figure 2).

Before the age of mechanical transport we used animals to power our vehicles, pull our ploughs, and detect unsafe gases in our mines. We still use them to produce dairy products and some fabrics. Above all, in the area of research, we use them as tools to test our drugs, and help us understand the nature of our diseases, cognitive processes and behaviours. We even produce them with compromised immune systems and genetic abnormalities, and inflict injuries and disease conditions on them to further our knowledge about people's health and welfare. So why bother to pose the question at all? Charles Darwin commented on our reluctance to reflect on this question when he wrote: 'Animals, who we have made our slaves, we do not like to consider our equal.'[2]

Some surprising answers

There are some who have so reflected and their affirmative answer has led them to draw radical conclusions. Though a small minority, their views are well known and include, in some cases, the avoidance, if not banning, of most or all of the above activities.[3] There are others from within the research environment who have also reflected on these matters and have answered with a qualified 'yes'. They have proposed ways forward in using animals in research. I have in mind especially the originators of "The Three Rs" proposal to **refine** the use of animals by minimising suffering and distress, **reduce** the numbers of animals used and **replace** the use of living animals by other means in research activity.[4] It took a long time for their message to register in many quarters. For example, the notorious LD50 test[5] used in the pre-Phase1 studies of new pharmaceuticals was widely used up until the Organisation for Economic Co-operation and Development (OECD) recommendation to abolish it in 2000 which became effective in December 2002. This ban covers 30 countries including the United States.

We might still want to ask what these groups mean when they provide their answers to our question as, for others, those answers might still appear to be counter-intuitive. Reflection on the matter might provide us with some useful guidance for approving or disapproving the use of animals in research.

The robust response

It is not only animal liberationists who have answered our question with a firm yes. A range of bioethicists concerned with what it is which marks out an individual for moral consideration have gone this way. Consider briefly one example.[6] Harris approaches a robust affirmative answer to our question in the following manner. He asks for an account of why we should insist on a negative answer to our question in that he seeks to discover reasons for valuing human lives above those of animals.

The ultimate question for medical ethics, indeed for any ethics, is also in a sense the very first question that arises when we begin to grapple with moral problems.

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[2] Darwin, C. (Notebooks 1837–1838).

[3] Regan, T. 1984: Pp. 381–382 *in*: The case for animal rights. Routledge, & Singer, Peter 1990: Animal liberation, 2nd ed. Random House, New York.

[4] Russell, W. M. S; Burch, R. L. 1959: The principles of humane experimental technique. London: Methuen.

[5] The Lethal Dose 50% test involved using increasing doses of experimental substances on cohorts of animals until 50% of them died, as a means to determining safe doses for first time into human studies.

[6] Harris, J. 1985: The value of life. Routledge, London.

The question is simply: what makes human life valuable and, in particular, what makes it more valuable than other forms of life?[7]

He frames his investigation around the issue of what it is that qualifies us for the status of persons as such. This he expresses in the form of 'having what it takes to be a person'. Further, armed with this information he asserts that we shall be enabled to identify others as persons, including aliens, so that 'we will be deciding whether an appropriate response to them would be to have them for dinner in one sense or the other'.[8] He proposes that the defining characteristic of persons is the ability to value one's own life.

This view has consequences for the way in which we view the moral considerability of animals too. He readily

Figure 3

accepts the consequence that, on his account, some human lives are less valuable than others, for example, foetuses, mentally and physically handicapped individuals, some aged individuals, the terminally ill, and so on.[9] He further notes that his account commits him to conclude that lack of the ability to value one's own life might be a reason for ranking the value of a human being below that of a chimpanzee and for bestowing the label of person on the latter rather than the former.[10] (Figure 3*).*

This view of what marks out the definitive difference between morally valuable lives from others, persons from others, certainly provides a radical answer to our question for it entails that the life of a healthy chimpanzee might be more morally considerable than the life of a mentally handicapped human being.[11] To adapt a well known remark, on Harris's account all animals are equal (including human animals) but some are more equal than others (including chimpanzees).

Harris is not alone in adopting this kind of view. Many who have opposed the use of animals in research agree with him. The most prominent academic proponents of this position hold that we should behave towards living beings, including human beings, in ways which take due account of their interests which are dependent on their capacity for suffering and enjoyment.[12] Though this is a different test from Harris's, it has similar consequences, viz. that some animals will be seen to have interests which some human beings cannot have because of their relative capacities. It follows that it would be mistaken to be more concerned for the welfare of a senile or insane human being than for a healthy higher primate. This mistake would be evidence of a prejudice against animals which has been labelled 'speciesism'.[13]

There are numerous problems associated with this view. Not least amongst them are the counter-intuitive conclusions which we have noted follow from it. Such conclusions might be construed as constituting a *reductio ad absurdam* of the position from which they are derived rather than a compelling case for changing moral attitudes towards human beings and animals.

It has been argued that to confuse the question of the differences between animals and humans (such as their relative capacities in different circumstances) with

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[7] Harris, J. 1985: P. 7 *in*: The value of life. Routledge, London.

[8] Harris, J. 1985: Pp. 8–10 *in*: The value of life. Routledge, London.

[9] Harris, J. 1985: Pp. 7–8 *in*: The value of life. Routledge, London.

[10] Harris, J. 1985: Pp. 7–8 *in*: The value of life. Routledge, London.

[11] Harris, J. 1985: Pp. 19–21 *in*: The value of life. Routledge, London.

[12] For example consider the following required qualifications:
Tooley, M. 1972: having the concept of a continuous life, 'Abortion and Infanticide'. *Philosophy and Public Affairs 2*: 37–65.
Singer, P. Wells, D. 1985: being self-conscious? Making babies.
H. Tristram Engelhardt Jr., H. 1996: being self legislating, P. 141 *in*: The foundations of bioethics, 2nd ed., OUP.
Gillett, B. 1987: having intentional interests, 'Reply to J M Stanley: Fiddling and Clarity'. *Journal of Medical Ethics 13*: 23–25.
Bole, T. J. 1990: being a psychologically integrated unity capable of morally imputable actions, *Journal of Medicine and Philosophy 15*: 637–652.

[13] Ryder. 1975: The victims of science: the use of animals in research, Davis-Poynter.

the question of the difference between human beings and animals, a pervading difference in attitudes and conceptualisation arising out of the fabric of human life and institutions, affords the position more plausibility than it deserves.[14] Diamond's argument is that the moral difference between humans and animals is not based on our response to their various capacities (i.e. to differences between them) but rather on our perceptions of what they are, our attitudes towards them. It is this difference which explains why we do not eat human beings and why we conduct funerals at their death, not their capacities to feel distress or pain, or to value their own lives. Indeed I have never seen Harris defend the propriety of eating handicapped persons or human foetuses on the basis of their failing his personhood test, despite the role he ascribes to that test in the dinner invitation aside which was noted above.

Animals can engage in aspects of our lives which call for sophisticated ethical responses, but never in such a way as to erase this difference. But that is because of our relationship with them and not because of innate capacities which they have.

This profound difference in moral considerability between animals and humans is exhibited in the following example. Some time ago I was consulted about the case of a mother, whom we shall call Jean. Jean was already mother of a son and daughter when she, happily, found herself pregnant again. She was told to expect a daughter. It later emerged that the foetus was anencephalic. Offered the chance of a termination she refused, knowing full well the nature of the problem. Her reason for refusal was that she wished to do as much for her daughter as she had done for her other children. The clinicians respected her decision and she carried the child to term. Her little girl was born, baptised, cherished for a few days and then died. Was Jean mistaken? On the Harris account she certainly was for this was no person which she bore and, had she survived, she would never have become a person. But to the family she was a daughter and a sister. They gave thanks for her, loved her and grieved for her. These are not notions foreign to people outside the philosopher's study. The mother's behaviour was admirable. This is not, of course, to say that she was correct. It is not a question of being mistaken or otherwise. It is rather a question of attitude which finds its roots elsewhere than in the baby's lack of qualifications for personhood. The following pictures in Figure 4 contrast an anencephalic

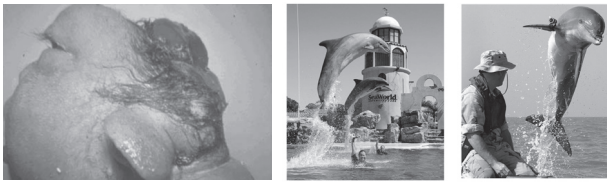

Figure 4

child, who has no potential to master any skills with dolphins who were taught sophisticated tricks and dolphins who trained to carry out under water reconnaissance.

Humans, animals and capacities

Rejection of the equality of humans and animals in the robust sense outlined above does not entail that we should not take seriously the various qualities that living individuals, both human and non-human, have. Those qualities will have much bearing on what we consider to be ethically permissible in the treatment of those individuals. In the sense that many of these qualities will be commonly found in people and animals they will, equally, call for our attention when we make decisions about what it is permissible to do to them. However, despite the fact that they call for equal attention it does not follow that they be given equal weight. For example, should a choice have to be made between the provision of relief for serious pain to a person and a dog then the interests of the dog would clearly take second place. On the other hand the commitment of a fox to a painful and terrifying end in the pursuit of the pleasure of the members of the local foxhunt would, at least, raise the question of its moral propriety. In other words, the infliction of unnecessary suffering calls for moral justification whether it be experienced by a man or an animal, whereas the preference to relieve the suffering of a man before that of an animal does not.

However, there are various kinds of suffering and pleasure which may or may not be shared between one animal and another and between people and animals. These will carry different weights in considerations of what it is proper or not to do to them. In some cases there may be some doubt as to where to draw the

[14] Diamond, C. 1991: P. 354 *in*: 'Experimenting on Animals' in her book, Wittgenstein, Philosophy and the mind. MIT Press, Boston.

line with respect to the capacities of some animals to experience suffering or pleasure of certain kinds. At the more fundamental level we are able to ascribe certain psychological descriptions to animals because of certain similarities between themselves and us. What we are prepared to say will vary from animal to animal.

It is easy enough to extend the concepts of 'sensuous' experience to creatures fairly like human beings, such as cats, dogs, and horses; when we try to extend them to

Figure 5 Would it make sense to say that we can tell that this earthworm is not angry?

creatures extremely unlike human beings in their style of life, we feel, if we are wise, great uncertainty—not just uncertainty as to the facts, or as to the possibility of finding them out, but uncertainty as to the *meaning* of saying: 'I now know how to tell when an earthworm is angry'.[15]

These lines are drawn with reference to the degree to which animals are able to share in the lives of people. It is here that we run up against the possibility of the sentimentalist criticism. A common reaction to protests against the use of animals in research is that to object to such practice is to sentimentalise the human/animals relation. How much purchase is there in such allegations?

How human beings relate to animals is in part facilitated by the manner in which animals enter into the lives of people. This is not universally the same in either time or place. People of different cultures at different times have developed a variety of interactions with animals which have resulted in a multitude of perceptions about their significance. These range from the worship of animals to, as we have noted, their instrumental use for either food or labour, such as the use of the dogs pictured in Figure 6.

Figure 6

The possession of a face is particularly important in this regard, which is why some vegetarians refuse to eat anything with a face. This has little to do with sentimentalising animals. Just try to doubt that a snarling dog baring its teeth is not angry!

However, animals can enter into the lives of people at a more profound ethical level than this. It is here that moral obligation to animals takes on a deeper meaning than simply not causing suffering or distress. Prince Llewellyn is said never to have smiled after thrusting a spear in to the heart of his hound Gelert. He had mistaken the blood upon its jowls for the blood of his infant son, whom the Prince had left in the dog's protection, only to discover subsequently the dead form of a wolf lying beside the unharmed child. Gelert is a byword for faithfulness in Welsh culture and Llewellyn suffered guilt for his lack of trust of the dog. We could enumerate many examples of sophisticated relationships of this sort between man and animals. The pit ponies who laboured in the Welsh coal mines easing the labour of the miners were rewarded with summer holidays in the fresh air and peaceful retirements in the countryside. Why should this be regarded as sentimentality rather than the repayment of a debt?

Animals in the research setting

So how should we relate to animals in the research setting? It would therefore be a mark of moral insensitivity to regard animals in research settings merely as sophisticated tools, as has often been the case.[16]

The instrumental use of animals in research can easily blind us to ethical dimensions of our relationships with them. This is consonant with other instrumental uses of animals as Darwin's observation noted earlier in this paper. But what did he mean by his ironic use of the word 'equal'? Clearly there are some aspects of

[15] Geach, P. 1957: Pp.113–114 *in*: Mental acts: their content and their objects. Routledge and Kegan Paul, London.

[16] Eccles, J. C. 1971: Animal experimentation versus human experimentation. Pp. 285–293 *in*: Defining the laboratory animal. International Committee on Laboratory Animals and the Institute of Laboratory Animal Resources, National Research Council, National Academy of Sciences, Washington D.C.

our relationship in which we can never be equal. We can, for example, have moral perceptions of them but they cannot have such perceptions of us, nor can they enter into a wide range of the spectrum of emotions which we can experience, due to the fact that they are not language users and do not participate in the host of social institutions which identify our feelings and us. However, to jump from this fact to the conclusion that they are not morally considerable and deserving of our moral respect is to jump too far, even though it might be a convenient move to make. Where we draw the line will itself be a matter of moral dispute. The polarised views which would either demonise animal researchers or ridicule protesters as sentimentalists are each wide of the mark. But where in between can we find ground that respects both the research enterprise and animals?

Darwin's use of the notion of slavery offers us a clue to a partial solution of this problem. Slaves were people who had become the tools of others. Their own independent lives counted for nothing as their sole purpose was to effect the designs and wishes of those who had the right to own and employ them. That is not to say that all slave owners were sadistic and heartless exploiters of these lives. Far from it for we have good evidence to distinguish caring and beneficent owners from others. Whether out of concern to preserve the most effective workforce or out of higher motives many owners were willing to house, feed and protect their slaves. Nevertheless slaves they remained with no possibility of leading lives that were their own. In retrospect we do not condone even the kindliest employment of slaves. However, within that tradition the chances of an imaginative relationship between slave and master, which respected the independence of the life of the slave, were almost nil. The idea of respecting the independent life of a slave would not occur to an owner for whom moral obligation ended with the decent treatment of the slave as a slave. The context of the relationship constrained the possibility of a wider sense of concern which would have characterised the relationship between a slavemaster and an equal.

It is this constraint to which Darwin refers. We can see how the analogy fits by considering an example from animal research. [17] Sir Lauder Brunton, a celebrated pharmacologist, was keen to demonstrate the humane character of his research on animals. He cited the example of a dog on which he had made a gastric fistula. The dog showed no sign of pain and, moreover, whenever the dog was examined

> …it showed great delight—just like a dog that has been sitting about the house, and wants to run out for a walk. When it saw that I was going to look into its stomach, it frisked about in the same way as if I was going to take it out for a walk.[18]

Diamond observes that there is another possible reaction to this scene, viz. 'what a miserable life for an animal' as opposed to 'oh good—no pain!' Thinking

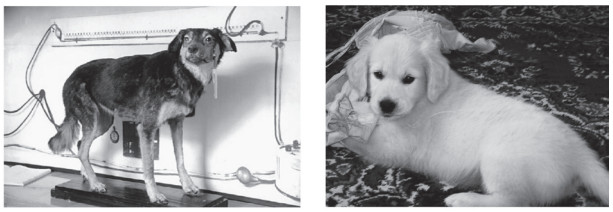

Figure 7

outside the square of the laboratory setting Brunton would no doubt have deplored such restrictions in a dog's life which the mere absence of pain would not have mitigated. Such a contrast is seen in the juxtaposition of the images of the experimental animal and the pet in Figure 7.

The figures contrast Pavlov's dog, exhibited in the Memorial museum-estate of academician I. P. Pavlov in Ryazan, Russia and my colleague's pet Golden Retriever.

Diamond observes that it is for this reason that the charge that animal experimentation makes one callous is levelled. It is a case of special pleading which might result in a carelessness in calculating the moral cost of such experimentation. That is not to say that given an awareness of that cost, given a greater moral sensitivity on the part of the researcher, the research would not proceed. Some might not but some might, though with a sense of regret that such a price is demanded by the worthiness of the goal to be achieved.

If we need further stimulation to think of how easy it is to engage in this kind of compartmentalisation of mind

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[17] I owe this example to Cora Diamond's article 'Experimenting on Animals' at p. 354.

[18] Paget, S. 1912: P. 90 *in*: For and against experiments on animals: evidence before the Royal Commission on Vivisection. New York.

we have only to think back to the beginnings of serious ethical review of clinical research. The Nuremberg Code arose out of the Nuremberg trials in which Nazi doctors were indicted for crimes committed against humanity in the name of medical research. Their attitude to their research subjects was mirrored in the Nazi attitude to slave labour where, for political purposes, people were no longer seen as leading worthwhile individual lives. Some modicum of ethical regard was due them in this political square but its expression might strike us as an inversion of moral consciousness:

We shall never be rough and heartless when it is not necessary, that is clear. We Germans, who are the only people in the world who have a decent attitude towards animals, will also assume a decent attitude towards these human animals.[19]

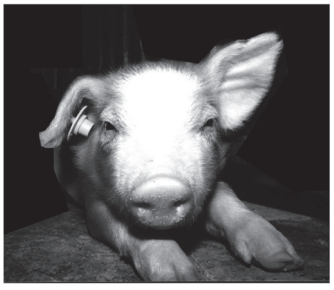
As surely as human beings in a given context can be seen in an ethically restricted frame, as human animals, so animals themselves, in the context of the laboratory, might be viewed in an ethically less imaginative light. They may become laboratory animals, animals to which a whole range of ethically significant attitudes is no longer thought appropriate. This constitutes a blunting of moral sensitivity which might be extended well beyond the laboratory.

> Nowadays we do not think much of a man's love for an animal; we laugh at people who are attached to cats. But if we stop loving animals, aren't we bound to stop loving humans too.
>
> Alexander Solzhenitsyn

Animal Ethics Committees

Members of Animal Ethics Committees have to draw some of the difficult lines we have referred to when asked to approve research trials. What kind of suffering can the test animals properly be considered to suffer? And how can it be measured? As they answer these questions I am calling for a willingness to think outside the square. Such thinking will often enlarge the estimate of the suffering involved. This will increase reticence to approve studies, and rightly so, without hindering good research. Such thinking will be exhibited in the weighing of the moral cost of the experimental treatment against its worthwhileness. Does the gain in knowledge aimed for in the proposal merit such a moral cost? In many cases the answer will be yes, but where the cost is seen to be higher than it might previously have appeared some experiments will be turned down or approved on the condition of significant amendments rather than receive uncritical approval.

Ethical review might then produce an increased sensitivity in researchers which will reinforce the Three Rs' approach to the research involving animals. This will in part be characterised by a continued search for alternative methods or the more widespread use of alternatives already adopted by sensitive researchers for achieving research aims. For example, **refinement** of the use of animals might be achieved more frequently by using animals which rank lower in the scale of capacities to suffer. **Reductions** of numbers of animals used might be additionally achieved by greater awareness of the moral cost and not simply the economic cost of their employment. **Replacement** of animals in research might be further achieved by the moral imperative to minimise suffering providing *a* stimulus to devise *in vitro* methodologies using cells, tissues and whole organs where these are able to achieve objectives currently aimed for in whole animal research.



[19] Himmler, H. Speech 4, October 1943

The Animal Ethics Committee: getting it all to work

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Abstract

The Commonwealth Scientific and Industrial Research Organisation's (CSIRO) Australian Animal Health Laboratory (AAHL) is part of CSIRO Livestock Industries, a division of CSIRO charged with developing research solutions to enable Australia's livestock and allied industries to be globally competitive.

The goals of animal research at the AAHL site focus especially on increasing the value of livestock by improving the inherent capacity of animals to deliver current and new products, particularly by means of better vaccines and meat free of antibiotic or other growth-promoting drugs, and with a particular focus on the intensive livestock systems. Project themes also comprise developing approaches to increase the beneficial environmental impacts of livestock production and anticipate and address community concerns about livestock and livestock products—including investigation of disease-associated declines in populations of native fauna, pest animal control (e.g., cane toads), and emergence of new human and animal diseases from wildlife. In addition, within the biocontainment facility there is a responsibility for emergency animal disease diagnosis, with animal usage associated with development and validation of new diagnostic tests (for example, very virulent Infectious Bursal Disease, West Nile Virus) as well as a training role in emergency disease diagnosis for which some animal infection models are used.

Within Australia, institutions are awarded a Scientific Procedures Premises Licence to carry out research activities using live animals under certain conditions that include the constitution of an institutional Animal Ethics Committee (AEC). AECs must include a representative of the veterinary profession, a user of animals in science or teaching, a person with a demonstrated commitment to animal welfare (usually via active membership of an animal welfare organisation), and also someone with no background in animal welfare or experience of scientific use of animals. The AEC is then charged with ensuring that scientific projects carried out by the institution's staff are aligned with the National Health and Medical Research Council (NHMRC) *Code of Practice for the Care and Use of Animals for Scientific Purposes*, with code guidelines that are open to interpretation rather than being highly prescriptive.

When assessing whether or not an AEC is "working", it is necessary to consider the meaning of this term from the perspective of four groups of stakeholders in the outcomes of the AEC deliberations. It is they who will judge. Within any of these groups may rest largely non-negotiable belief systems (either for or against animal experimentation) and each group of stakeholders has a unique perspective on what makes an AEC effective.

Clearly, the first group of stakeholders is the animals themselves. While in some respects this is the group on which the AEC decisions have the greatest impact, it is also the group for which it is most difficult to determine impact as appreciated within the group. For example, the capacity for reflection, perception of self, valuation of refinement of experimental intrusions, and so on can often be neither measured

nor communicated. Anthropomorphism provides the best approximation.

The second group of stakeholders includes research institutions and funding bodies where an effective AEC permits ongoing animal research, as a part of how research outcomes are measured in today's way of doing business in biological science.

Third, there are scientific investigators for whom a functional AEC allows progression of scientific thought and encourages the emergence of new ideas, and builds reputations and careers in modern science. For these individuals a positive AEC experience may range from engagement with a committee that is reasonable (*sic*) about ethics issues and helps rather than obstructs the investigator; gives clear guidelines as to what information is required by the AEC; provides suggestions about improved husbandry and sampling procedures; and provides support for approved welfare decisions in published articles, to one that offers suggestions for alternative scientific methods to replace animal usage; actively challenges "the way we have always done it" and gives an objective "non-scientific" assessment of welfare issues with constructive criticism.

Last are the AEC members themselves, a diverse group that will almost certainly include those whose focus is entirely on support for the interests of the animal and who would prefer to have no animal usage whatsoever.

Achieving a balance between the sometimes opposing stakeholder perspectives is not necessarily a measure of the success of the AEC. After all, the principles of replacement, reduction and refinement embody the concept of change, and with technological advances, experience, and a willingness to try new ways of doing things come new benchmarks in animal experimentation—there is no state of grace. Ultimately, the AEC which works the best may be considered as the one that has put itself out of business, but to the satisfaction of *all* its stakeholders.

So, bearing in mind that **change** is the key to making it all work, it becomes necessary to mobilise the people who provide the tools for change—people have different responses to change and these must be differently managed.

It is clear from the range of comments above that scientific investigators can be grouped classically according to change theory as resistors, traditionalists, bystanders and change agents with respect to their interactions with AECs. However it is important to recognise that the members of the AEC may also be usefully categorised in these groups, and recognition and management of these groups of members is an important role for the Chair.

On the basis that AEC decisions are reached by consensus,

—***resistors*** must be confronted and asked to buy in to the process, or buy out and leave the AEC. Scientific investigators unwilling to support progress in the Three Rs fall in to this category. Interestingly, the inflexibility of Animal Welfare representatives holding an uncompromising abolitionist view also places them into this group although they sit at the opposite end of the ideological spectrum.

—***traditionalists*** may be scientific staff who have worked successfully in the past with certain animal model systems and are uncertain or fearful of having to come to terms with new technologies and techniques; or external members (including veterinarians and welfare representatives) of the AEC who are not confident about "rocking the boat". Provision of learning materials and support by the Chair is key to turning their roles in decision-making into positive and contributory ones.

—***bystanders*** are risk averse by nature, but respond to change drivers when the case is made for the advantages, and opportunities for improvements in animal welfare are worked through in discussion.

—***change agents*** are precious creatures on an AEC, with major buy-in to change at a personal level. These individuals should be empowered and supported by the Chair. They may also be the most focused members of the AEC and are driven by animal welfare concerns, either by virtue of being veterinarians or representing animal welfare groups.

Steering change at AAHL has particular challenges and complexities. Although much of the animal research is at first impression "animal-focused", that is the animal or other individuals of that species are the direct beneficiaries of the research effort, it is the intensive livestock industries in particular that often have the role of interested party and reap the research rewards. Thus the research provides support to animal industries that are themselves the subject of community animal welfare concerns. The physical structure of the AAHL containment facility places genuine restrictions on aspects of animal monitoring, both with respect to ease of access to animal rooms and also animal accessibility by staff within the room: it is important that these limitations are addressed in

creative ways so that the infrastructure does not of itself compromise animal welfare. Added complexity is provided by the requirement to work with a diversity of animal species including non-traditional experimental animals with different levels of domestication, diverse accommodation and enrichment needs and requiring different handling and technical skills. Particularly challenging areas of activity involve ongoing animal usage in areas where the use of alternatives is moot, such as certain teaching activities and in biological product testing for the presence of extraneous disease-causing agents, as well as induction of serious infectious diseases for the purpose of vaccine evaluation, disease characterisation and validation of diagnostic tests.

Over the past few years the AEC has built on the passion and commitment of its change agents to limit studies with intensive livestock industry husbandry conditions to those near industry application of a product. It has approved certain projects, especially those involving new challenge combinations of animal species/virus where disease timelines and outcomes are less certain, within the containment facility on condition of installation and use of observational cameras allowing real-time external monitoring of animals. The approval of others is conditional on provision of defined levels of staff resources for in-room monitoring purposes. The challenge of species diversity has been addressed by focusing on environmental enrichment and fostering natural behaviours, with demonstration of background research in species handling and husbandry having been carried out by the investigator through consultation with national (or international) experts and the gaining of appropriate technical experience. A major training programme using animals for teaching is undergoing review to ascertain whether the learning outcomes can be delivered using alternative methods, and certain innocuity tests have been replaced by *in vitro* assessments. With respect to initiation of animal infections with agents that may cause serious illness, there has been a strong focus on early intervention with establishment of clear scientific objectives in disease induction work. In some instances this has included conducting pilot studies to better define the disease model. Mobile endpoints are also sought, whereby increasing familiarity with an infection model permits earlier intervention in subsequent studies.

It is in the nature of things that the primary drivers of change are often external to the research institution and include the animal welfare representatives of the AEC, and ongoing engagement with these often highly committed people is critical to preserving the validity of the AEC process. However, it is also true that only a commitment by the AEC to listen to the voice of the animal welfare community, and to promote continuous improvement for the lot of animals under its care, will ensure that this engagement persists into the future.

Session 3
Animal Ethics Committees—the social dimension

The necessary, the real, and the imagined aspects of Animal Ethics Committees

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Abstract

Societies have long been concerned with the relationship between people and animals. The use of animals in science is no exception. Individuals involved in research, testing and teaching are no longer able to exclusively determine and shape the intricacies and boundaries of the relationship. This role has been entrusted to Animal Ethics Committees but their legislative mandate perhaps does not do justice to what committees do and don't do, or what they could do. Should society place more effort on critiquing the scientific and educational objectives which underpin the use of animals? Committees have significant practical and tacit knowledge; could we make more use of it? By virtue of their unique perspective of animals, science and people, it is possible to imagine Animal Ethics Committees playing greater leadership in shaping the future; should they?

Introduction

The relationship between mankind and animals is diverse, complex and important. Which aspects are acceptable, and which are not, can be contentious. Animal Ethics Committees (AEC) add the social dimension to the interface of science and animals. In a sense they provide the social context for the use of animals by representing the contract between animals and humans, and between science and the general community.

The present contribution attempts to encourage thought about what role AECs could play in bringing the social dimension to science. Although this stance could be construed as taking the position of God's or the Devil's advocate, it is not my intention to criticise scientists (I am one), or suggest that ethicists have all the answers ("ethicists and moralisers are creators of human disasters"). I reflect on my time as the Chair of an AEC, as a scientist, with the insight of a distinctive and pragmatic understanding of ethics, and above all as a member of society. In addition, I reflect from the vantage point of now being outside a traditional scientific institution.

The theme of this contribution is to consider how AECs could or should listen to those they represent. Not the scientists undertaking research, testing and teaching, and not the animals involved in these activities, but the people comprising our society now and in the future. Although understood in this way, it is as well to remember that science is also part of society, as indeed are animals. I've chosen to focus on three aspects—that which society has decreed as necessary, that reflecting the reality of AECs' roles, and finally that of the relationship between people and animals which we might imagine. These three aspects give rise to three challenges for those involved with AECs.

The necessary aspects of Animal Ethics Committees

In the 1768 painting by Joseph Wright of Derby "An experiment on a bird in the air pump" (the painting is exhibited at the National Gallery in London), a travelling lecturer is shown demonstrating that air is vital to life. A pet cockatoo is imprisoned in a glass

flask from which air is being extracted, the bird's fate controlled by the lecturer who can readmit air to the flask. The reactions of the family watching the bird gasping for air at the bottom of the flask vary from awe, fright and anxiety to admiration and hope. Two girls are frightened and sad, one cannot bear to watch; the girls' father appears to comfort them or perhaps explain the scientific importance of the experiment and why it is necessary to use their pet; an old man contemplates, perhaps the necessity of the experiment, perhaps the inevitability of death; another man seems to be timing the experiment; one young boy is fascinated, another eager to help but somewhat concerned; and a young couple are more interested in each other, seemingly oblivious to the experiment (Daniels 1999)

The painting captures the contentious nature of animals in science, the dilemma between the value of teaching and concern for the welfare of, in this case, a bird. People have different reactions to the plight of the animal. Those reactions are significant, so significant that we no longer unquestioningly entrust the welfare of the bird with the lecturer. This role resides with AECs through the requirements of the Animal Welfare Act 1999 and institutional codes of ethical conduct. However, "the law will never be the answer to ethical dilemmas" (Callahan 1988), partly because science and its context can be quite complex, and often understood only in hindsight. While we can obviously question how the bird should be treated, we can also question the value and need for the demonstration. Two more recent examples serve to illustrate the social complex which underpins science.

One of the more interesting and readable accounts of the progress of science is Blum's (2003) *Love at Goon Park—Harry Harlow and the science of affection*. As recently as early last century survival rates of children in orphanages were terrible. This was at the time of the rising recognition of the value of cleanliness in preventing disease. Combined with a desire to make the young field of psychology into a truly objective science, it led to a professional crusade by JB Watson, among others, against the evil of affection ("mother love is a dangerous instrument"). As extraordinary as it now seems, affectionate physical contact with children was ill-advised. Against this background, Harlow demonstrated the importance of love and affection by supplying young monkeys with surrogate cloth and wire mothers. Although Harlow may have overstepped the boundaries of justifiable science with some of his work, overall the programme appeared necessary for the progress of science. It did not, however, seem necessary for common sense, Harlow stating "the apparent repression of love by modern psychologists stands in sharp contrast with the attitude taken by many famous and ordinary people."

The second example concerns the alleged relationship between the triple vaccine against measles, mumps and rubella (MMR) and autism. A 1998 study, although based on just 12 children and later retracted by most of the co-authors, claimed that MMR might trigger autism. The vaccine was blamed for an apparent rise in autism rates and understandably vaccination rates plummeted in the UK. In some regions, there was an increase in measles. Further evidence of the link was "seen" in the rise in autism rates in California after the introduction of the MMR vaccine. However, that study did not account for the rise in California's population, for changes in the criteria by which autism was diagnosed, or the trend to diagnose children at a younger age, all of which might explain the apparent rise in autism. A subsequent more rigorous study in Yokohama (based on 31,426 children) showed no link between MMR vaccine and autism (Coglan 2005).

These examples demonstrate the complexity of issues contributing to advances in scientific knowledge. It is suggested that more critical examination of these aspects might well impact on the science which is subsequently undertaken. Rather than prevent research, there is a need to be more thoughtful about the type of knowledge we seek, why we seek it, and then to use that knowledge ethically (Hodges 2003).

Challenge 1—should we place more effort on critiquing the scientific and educational objectives which underpin the use of animals?

The real aspects of Animal Ethics Committees

There are several ways of looking at, or windows for looking through, and understanding the world—through the physical and social sciences, through examining case histories and narratives, and through an understanding of what it means to be human (R. Downie, pers. comm.). And being human means balancing all our ways of knowing—common sense, ethics, imagination, intuition, memory and reason (Saul 2003). In apparent contrast to this humanist

approach, science appears to be objective and as a consequence emotions are stigmatised. The following extract from a novel (*Valhalla Rising* by Clive Cussler) seems to suggest there is something wrong about not having emotions.

"Miller broke off suddenly as Amaru, his features utterly lacking the least display of emotion and his black eyes venting evil, removed a Heckler & Koch nine-millimetre automatic from a hip holster. With the paralysing inevitability of a dream, he calmly, precisely, shot Doc Miller in the chest."

In a similar vein, there were calls to "let science guide the GM (genetic modification) debate ... with rational application of sound scientific principles". Such calls are eerily reminiscent of the advice given by Watson to parents: do not hug or kiss children but treat them in a detached and distant manner like young adults. While such policy may have had little to do with science, it was accepted because its proponents were objective and scientific experts. In contrast (see Goldsmith 1996), the Scottish philosopher David Hume stated "reason is the slave of passions and should be." Furthermore, Enrich Fromm held that "reason flows from the blending of rational thought and feeling. If the two functions are torn apart, thinking deteriorates into schizoid intellectual activity and feeling deteriorates into neurotic life-damaging passions".

One seemingly underrated way of viewing science is through science fiction. Stories give us a powerful source of insight or understanding because they can connect with our feelings, expressing our hopes and fears and helping us to come to terms with the world. In contrast, reflecting the ethos of science, scientific language is usually one of objectivity, it nullifies the personal and the subjective. The methodology and logic, impassive scientific rhetoric, and process are also often seen as existing independently of human matters. The archetypal example of science fiction is Shelley's *Frankenstein,* arguably more influential today than the scientific "truths" discovered when it was written some two centuries ago. Shelley was inspired by her father's teachings to be both fascinated and terrified by new science and technology. The novel sets out themes such as the getting and using of knowledge, the power that knowledge may confer, a power dramatised by the creation of life (Turney 1998). While it has subsequently transformed into the "mad scientist" story which has such a pervasive presence in modern society, we continue to grapple with the novel's themes.

In which way do we wish AECs to operate, following the ethos of science, or using the fullness of human attributes? How do we ensure that AECs have the opportunity to see research, testing and teaching through different, and even unauthorised windows and not rely exclusively on limited views thereby risking tunnel vision?

A similar issue is raised when considering who should look at subjects like animal welfare. One view is that "there is no doubt that veterinarians are the best-equipped and most committed profession to lead the community in animal welfare debate" (Denney 2000). Such a view ignores the fact that animal welfare is a social construct and not exclusively scientific or veterinary. In contrast, it is generally accepted that we do not rely exclusively on our GPs for our health care. As well as ourselves and our GPs, we also value physiotherapists, osteopaths, neurosurgeons, occupational health and safety nurses and acupuncturists, among others. The issue is not so much who is best qualified, but who brings knowledge, and practical experience, whether as a veterinarian, a scientist, a pet owner, a shepherd or whatever.

In providing different insights borne of looking through different windows, AECs provide unique insights into animals and how they should be treated, and into the results of the research, testing and teaching. They struggle with complex methodology and language, and make difficult decisions on our behalf. They may receive little recognition for their efforts. Like many others in the modern world, they have to contend with paperwork, deadlines and bureaucracy. In doing this committees build up a significant amount of knowledge, that which differs from that in society and in science. Much of it is tacit and ineffable and as such it is especially valuable. Some forms of this knowledge we may only know as intuition or as aesthetic but it may nevertheless be valuable.

Challenge 2—should we make more use of the knowledge AECs have?

The imagined aspects of Animal Ethics Committees

There is a proverb relevant to the activities of AECs: "whom the gods wish to destroy they send 40 years of success". The codes of ethical conduct legislation underpinning the use of animals in research, teaching

and testing have now been with us for nearly 20 years. It is suggested that it is time to begin thinking of the next 20 years to preclude the risk of divine destruction.

While AECs reflect the concerns of society regarding the use of animals in science, they inevitably also help shape the future development of society's relationship with animals. Leadership can be top-down (e.g., the Minister of Agriculture, the National Animal Ethics Advisory Committee and AECs) or it can be bottom-up suggesting that committees have an important leadership role.

There is a wealth of material available to help aspiring leaders work through their visions, missions, values, goals and objectives. However, a particularly insightful text is *Sacred cows make the best burgers* (Kreigel & Brandt 1996). A sacred cow (\'*kau*\ *n.)* is (1) a plodding bovine mammal of numerous stomachs and dubious intelligence regarded in some climes as holy in origin and therefore immune from ordinary treatment; (2) an outmoded belief, assumption, practice, policy, system or strategy, generally invisible, that inhibits change and prevents responsiveness to new opportunities. This work identifies some 14 types of cows which trample creativity and innovation. Three of these have been selected as worthy of consideration by AECs.

The expert cow relies on past expertise but experience can be an obstacle to change and innovation. To deal with this cow, AECs must think like beginners not as experts. They must also be smart and ask dumb questions. In my experience, some of the more insightful members of AECs have been the ones who asked the so-called "stupid" questions.

The no-mistakes cow makes people cautious at the expense of innovation, creativity and originality. To deal with this cow, AECs must not penalise mistakes but reward good tries. They must be aware that the biggest mistake is not learning from mistakes. Where is the evidence of our mistakes? How can we ensure that we don't make them again?

The customer cow ensures we listen to customers and satisfy them, but satisfaction should only be the beginning. To deal with this cow, it is suggested that you do not follow your customers but lead them, and don't satisfy them but surprise them. Remember that AECs' customers are society!

In meeting the challenge of the next 20 years, AECs (and their secretariat—the National Animal Ethics Advisory Committee and the Minister) should consider opportunities which encourage initiatives to address some or all of the following:

- openness and transparency;
- trust and honesty;
- exaggeration of the benefits and costs of science;
- what science, philosophy and common sense do not know;
- initiatives which go beyond legal requirements;
- impacts of underlying assumptions and paradigms; and
- the relevant concerns of proponents and opponents of the use of animals in science.

The fact that we have significant portions of society who are prepared to go to legitimate, and in some circumstances illegal, lengths to highlight the use of animas in science is testament to the failure to convincingly allay legitimate concerns. Proponents and opponents alike need to contribute to the middle ground (Davis & Croney 2004) as wisdom emerges from the exchange of views between people committed to true understanding and evaluation of each other's stances (Thompson 1999).

Challenge 3— should AECS play a greater role in shaping the relationship between people and animals?

Conclusions

The necessary, the real, and the imagined aspects of an AEC reveal a number of aspects regarding the use of animals in science. First, AECs represent society and all of its variants (something superbly portrayed by Wright of Derby. Second, it is important to examine the view through different windows, and as different people (don't be afraid to use science fiction to explore the social dimensions of science). Third, we should challenge sacred cows if and where they have become irrelevant. Finally, we need to remind ourselves of the significance and breadth of the challenge—the use of animals in science is contentious and continually needs to be addressed in creative and innovative ways.

References

Blum, D. 2003: Love at Goon Park. Harry Harlow and the science of affection. Wiley, Chichester.

Callahan, J. 1988: Ethical issues in professional life. Oxford University Press, New York.

Coglan, A. 2005: Ending MMR shots does not halt rise in autism. *New Scientist 5*: 16.

Cussler, C. 2001: Valhalla rising. Michael Joseph, London.

Daniels, S. 1999: Joseph Wright. Tate Gallery Publishing, London.

Davis, S. L.; Croney, C. C. 2004: Defining the middle ground for philosophers and production: bioethics. *Poultry Science 83*: 310–313.

Denney, I. 2000: We should lead animal welfare. *Australian Veterinary Journal 78*: 517.

Goldsmith, E. 1996: The way. An ecological world view. Themis Books, Totnes.

Hodges, J. 2003: Livestock, ethics, and quality of life. *Journal of Animal Science 81*: 2887–2894.

Kriegel, R.; Brandt, D. 1996: Sacred cows make the best burgers. Harper Business, Sydney.

Saul, J. R. 2001: On equilibrium. Penguin, Ringwood.

Thompson, P. B. 1999: From a philosopher's perspective, how should animal scientists meet the challenge of contentious issues? *Journal of Animal Science* 77: 372–377.

Turney, J. 1998: Frankenstein's footsteps. Science, genetics and popular culture. Yale University Press, New Haven.

Animal Ethics Committees: ethics committees or compliance bodies?

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Introduction

There are long-standing concerns about the use of animals in research. One important part of the attempt to meet these concerns has been the development of Animal Ethics Committees (AECs) and supporting regulation and legislation, designed to guard against unethical animal experimentation. Of course, there is scepticism about the effectiveness of such committees. Some of that scepticism—largely from outside the scientific community—flows from a more or less outright rejection of the possibility of legitimate animal experimentation. Other aspects—more often, though not inevitably, generated from within the scientific community—focus on the structure and functioning of AECs, suggesting, for instance, that the AEC system is biased toward scientists and veterinarians and that there should be greater opportunity for lay input and increased openness and accountability.[1]

It seems to me there is another difficulty with AECs; viz., that they do not in fact function as ethics committees at all. Rather, the standard way in which AECs are structured, and the standard background regulation and legislation in terms of which they operate, means that AECs are essentially "compliance bodies". Their role is to ensure that animal experimentation complies with antecedently set standards for legitimate use of animals in research, not to promote genuine ethical discussion or evaluation. This need not be a problem—if the antecedently set standards themselves required genuine ethical evaluation. But, typically, they do not. To be clear, it is not that I believe the standards and regulations that AECs administer, and which govern animal experimentation, are especially *unethical*. It is rather that they restrain the deliberation and function of AECs in ways which more or less exclude genuine ethical deliberation and evaluation.

One immediate worry, if this is correct, is that there is a widespread misconception—invited by the description of AECs as *ethics* committees—that these committees are engaged in genuine ethical deliberation and evaluation. At least some of those whose concerns about animal experimentation are met by the presence of AECs are likely to be surprised if I am right that they are neither designed nor function to provide genuine ethical oversight.

Further, it seems simply true that there are serious ethical concerns about the use of animals in research—even if we think those concerns can be met—and, if I am right about AECs, an obvious occasion and site for ethical evaluation of the use of animals in research is being overlooked. AECs, as ethics committees, are a good idea. If they do not function as ethics committees, however, there is an important need for ethical evaluation which is not being met, at least at the point of AEC evaluation.

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[1] See for instance Morris, M.; Weaver, S. 2003: Minimising harm in agricultural experiments in New Zealand. *Journal of Agricultural and Environmental Ethics 16*: 421–437.

Ethics committees and compliance bodies

Why might one think AECs were not genuine ethics committees? Consider some striking structural differences between the University of Auckland's Human Participants Ethics Committee (HPEC) and its Animal Ethics Committee (AEC).[2] Each is "called" an ethics committee. A cursory glance at the respective terms of reference of the two committees, however, suggests that the two committees fulfill very different functions within the institution.

The terms of reference of the HPEC specify that its membership shall include "one member with expertise in moral philosophy appointed by the University Council on the advice of the Head of Philosophy". The terms of reference of the AEC require no analogous "ethics" membership. Its 10 members are to include at least five members of the Faculties of Medicine and Science in addition to a Chair, who may or may not be from those Faculties, to be nominated by the University's Vice Chancellor, a lay person, a veterinarian, and an SPCA nominee. The committee may co-opt other members—but not an ethicist: "Co-opted members shall be chosen so as to provide *scientific* breadth and knowledge".[3]

The terms of reference of the HPEC specify that the Committee shall provide, *inter alia*, "careful and timely review of all proposed research and teaching projects which involve human participants … to ensure compliance with the highest ethical standards", and "advice and assistance to Council and the university community with respect to ethical standards and issues involving human participants". The terms of reference of the AEC, by contrast, call upon it to "ensure protocols for use of animals in research and teaching are in accordance with legislative requirements".

I do not think for a moment that one has to be an ethicist to be ethical, or that an ethics committee requires "ethics" expertise in order to make ethical decisions, though I have argued that moral philosophers do bring particular skills to ethics committees.[4] However, these differences in membership and responsibility are significant. The University of Auckland seems, at least, to perceive of these two committees in very different terms. The architects of the HPEC seem to have thought it required ethical expertise and charged it with ensuring compliance with "the highest ethical standards". The architects of the AEC saw no need for ethical expertise and were happy to limit the Committee to ensuring that the university's protocols were consistent with legislation. The terms of reference, and the legislation, appear to cast AECs in the role of compliance committees rather than committees charged with carrying out genuine ethical review.

An example

In a paper focused on agricultural animal research in New Zealand, Michael Morris and Sean Weaver remark that they base their "critique of animal experimentation on what the general public believe to be ethical (prescriptive ethics)". They go on to cite research showing that the general public thinks that animal experimentation is ethical "where there is a high chance of gain for human, animal or environmental health", and unethical where the aim is merely to increase agricultural productivity.[5]

Before coming to my main point about this example, let me make an "ethicist's aside" about the approach Morris and Weaver source from Rollin. Although, following Rollin, Morris and Weaver dub the approach

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[2] The New Zealand Animal Welfare Act 1999 requires individuals or organisations using animals for research, testing, or teaching to hold an approved Code of Ethical Conduct. Every code holder must have an AEC (s.98).

[3] The membership requirements of the University of Auckland AEC terms of reference are consistent with s.101 of the Animal Welfare Act 1999. The Act too is silent on "ethics" membership.

[4] See Dare, T. 1997: Challenges to applied ethics. Pp. 22–28 *in*: Encyclopedia of Applied Ethics. Academic Press; San Diego., reprinted. Pp. 23–35 *in*: Applied ethics: critical concepts in philosophy (Routledge 2002) R. Chadwick, R.; Schroeder , D. eds.

[5] Morris, M; Weaver, S. 2003: Minimising harm in agricultural experiments in New Zealand. *Journal of Agricultural and Environmental Ethics 16*: 421–437. They cite Rollin, B. E. 1981: Animal Rights and Human Morality (Prometheus, Buffalo, 1981) for the idea of "prescriptive ethics" and for the claim that it is a maxim of that ethic that animal experimentation is ethical where there is a high chance of gain for human, animal, or environmental health. They cite: Davies, B.: In depth survey of public attitude shows surprising degree of acceptance. *RDS News, April 2000*: 8–11 for the claim that the public "are not generally supportive" of experiments on agricultural production. The Morris and Weaver paper is available on line at http://homepages.ihug.co.nz/~nezumi1/minimise.html].

"prescriptive", it seems in fact to be "descriptive"—to *describe* what the relevant public thinks about ethical matters.[6] Within at least Western analytic moral theory, however, the idea that one might identify ethical norms by surveying public opinion is deeply controversial. The broadly descriptive, sociological task of describing the ethical norms held to be true by a given culture, or "public", might be important and engaging, perhaps allowing us to understand why a culture acted as it did. But often we will often want more than 'understanding' Ethics really is *prescriptive*; it seeks to establish norms capable of guiding action and evaluation, which are at least capable of giving us reason to think that the public is *wrong* about some moral issue. Often we want to say that while a particular culture or public believed it was morally right to keep slaves, or morally wrong for women to be treated as equals, they were wrong; that their moral judgments were mistaken. If we can do so, the truth or falsity of ethical propositions cannot lie simply in the belief of this or that group at this or that moment, and identifying ethical norms will involve more than public surveys.

This "meta-ethical" debate about the nature of ethics is complex, and I do not pretend any advance here. For the moment it will do to say that adequate ethical discourse seems necessarily to involve the development and presentation of arguments and reasons to think one course of conduct ought to be preferred over another. These reasons are likely to appeal, more or less directly, to the interests of those affected by human conduct.[7] Elsewhere, I have argued that "ethical expertise"—the sort of thing one might hope to find in an ethicist committee member, for instance—consists not in any privileged access to "the good", but instead in a more mundane familiarity with the common forms, strengths, weaknesses, and pitfalls of such arguments.[8]

So moral philosophers may well be interested to know that the public judge animal experimentation intended merely to increase productivity to be unethical, but most would not think that was *in itself* an argument for the truth or falsity of that moral claim. It is of the essence of ethical evaluation that some further argument is required, perhaps an appeal to the need to balance the harm suffered by the animal against the benefit to be produced, coupled with an argument for the lexical ordering of interests which prevented the fundamental interests of some entities being outweighed by more trivial, but perhaps more numerous (and so in aggregate more weighty), interests of another.[9]

Suppose for the moment, however, that the descriptive research relied upon by Morris and Weaver is both descriptively and methodologically sound; that the public do believe that animal experimentation aimed merely at increasing agricultural productivity is unethical, and that they are right when they do so.[10] On the face of it, there is a tension between that ethical judgement and s.80 of the New Zealand Animal Welfare Act 1999, which explicitly lists the "production and productivity of animals" as a legitimate purpose for the use of animals in research, testing, and teaching.

What is the significance of this for an AEC structured as the University of Auckland's AEC is structured? Insofar as the Committee is charged with ensuring "protocols for use of animals in research and teaching are in accordance with legislative requirements", it is presumably not open to the committee to reject research on a ground approved by the legislation. To what extent that places the committee in conflict with the view of ethics reported by Morris and Weaver is unclear, in part because just what the public thinks is itself unclear. Suppose, however, prescriptive ethical arguments could be given for an understanding of that view which coupled it with a strong lexical ordering of interests, an understanding which required *all* interests of certain kinds (interests in life, or in avoiding pain

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[6] I leave aside the highly problematic puzzle about how we attribute beliefs to a group. Although we use various procedural mechanisms (e.g., votes) to identify the "intentions" or beliefs of groups (as when we speak of the intent of the legislature in legal discussion), groups do not in any straightforward sense have intentions or believes at all.

[7] One immediate question for non-human animal ethics, is how the interests of animals are to be counted in such discourse.

[8] See T. Dare: Challenges to applied ethics, supra footnote 4.

[9] I describe a lexically ordered model in a little more detail below.

[10] Of course if the "prescriptive ethic" of Rollin is correct, there is no distinction here. If it's true that the public believe x is unethical, then x is unethical, for "x is unethical" simply means "the public believes x to be unethical"—but I hope the quick sketch of an argument in the previous paragraph suggests we may well be able to produce an argument to support that judgement.

perhaps) to be considered before *any* interests of other kinds (interests in maximising profit perhaps) could be taken into account and so which did not allow trade-offs between increased productivity and animal suffering. Under such a model, a research project that sacrificed the fundamental interests of research animals, simply to improve productivity, would be unethical, and there would be a clear conflict between the essentially legislative standards with which the AEC is to ensure compliance, and an arguable view of the requirements for ethical animal research. I suspect this is in fact the view of many opponents of animal experimentation aimed at increasing productivity. Those opponents can take no comfort from an ethics committee structured to act as a compliance committee in respect of a set of antecedent regulations that arguably exclude even consideration and evaluation of their position.

This example illustrates an overarching concern about the relation between AECs and the background regulation and legislation in terms of which they operate. For many, the trade-offs those regulations allow between the fundamental interest of animals and the comparatively trivial interests of humans and researchers—projects to increase productivity for increased profit are but one example—are deeply problematic. Part 6 of the New Zealand Animal Welfare Act 1999, which governs the use of animals in research, is shot-through with such trade-offs—research animals are to receive treatment to alleviate unreasonable or unnecessary pain or distress "where practicable"; where the nature of a research project means that the needs of animals cannot be fully met, or the alleviation of unreasonable or unnecessary pain or distress cannot be provided, pain or distress is to be reduced "to the minimum possible in the circumstances", and so on. AECs are comparatively powerless in the face of these authorised trade-offs: they can look at the maths, assess the costs and benefits, but—when cast in the role of compliance body—cannot cast doubt on the legitimacy of the trade-offs themselves.

Of course, one should not trivialise the ethical evaluation that can be carried out by AECs. For most of those concerned about animal experimentation the conflict between regulation and ethics is not as stark as it is sketched in the last two paragraphs. Although the legislation recognises increased productivity as a legitimate aim of animal experimentation, it goes on to require AECs to assess whether the benefit of the proposed projects outweighs the likely harm to research animals. Hence it might be open to AECs to regard increased productivity for economic gain as a relatively trivial goal that does not justify the imposition of very high degrees of suffering on research animals; the maths might not be ethically trivial. However, there seems to be some reason to think AECs do not readily take on this bolder role, even though it may be available to them under the current structures.[11] One might wonder whether they would be more likely to do so if those structures more closely echoed those of genuine ethics committees rather than compliance bodies.

[11] See Morris & Weaver, supra fn 5.

Session 4
Animals in research—the laboratory

Safeguarding the future of animal research in the United Kingdom

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There has been a long history of debate about animal experimentation in the United Kingdom (UK). As far back as 1875, there were active anti-vivisection groups, and the Queen expressed her concerns about animal experimentation in a letter to her surgeon that year. This led to the first Royal Commission in 1875. There was a further flurry of activity after the first infiltration in 1903, and the Research Defence Society (RDS) was founded in 1908 to put the case for research involving animals.

A century later, the UK still faces strong campaigns by abolitionist groups who seek to halt all animal research. However, in countering this threat, it is important to make a distinction between the activities of animal rights extremists, and the mainstream anti-vivisection organisations.

The extremists operate through direct action, which involves activities such as liberations, property damage, threats and intimidation. Over the past decade the extremists have developed sophisticated and coordinated campaigns against animal research institutes. These involve the novel tactics of secondary and tertiary targeting, often focusing on suppliers and contractors who may have only a distant relationship with the animal research institute. There is relatively little that research institutes can do about animal rights extremism apart from taking reactive measures such as enhanced site security. Animal rights extremism is really an issue for the police to deal with and this means that political commitment is important. RDS has been lobbying for many years for new legislation to tackle animal rights extremism, and for greater resourcing and powers of the police. We have had considerable success in recent years and we are hoping that extremism will decline as a serious problem in the UK over the next few years.

Anti-vivisection groups are formal, legitimate campaigning organisations who use peaceful means to get across their claim that animal experiments are "cruel and unnecessary". Whilst it is possible to engage in dialogue with these groups, their objectives are usually the complete abolition of any animal experiments, rather than any compromise. The anti-vivisection groups use traditional PR methods such as media work, lobbying and letter writing. They are very proactive and produce large volumes of literature opposing the use of animals in research. Over the long-term, we believe the anti-vivisectionists also pose a serious threat to medical research if their activities are not countered.

There has been concern expressed by the Government that the biomedical research community is not effectively making the case for animal research. They have a point. Most research institutes have been doing little more than keeping their heads down for the last three decades. In response, RDS has been undertaking concerted lobbying and communications work. Effective media work is highly important in terms of our message reaching the general public. RDS has been trying hard to get positive images of animal research in the media, e.g., through patients' testimonials and through film clips showing high animal welfare standards in laboratories. RDS has also provided media training and facilitated discussions within institutions conducting animal research about the best approach to the media.

More organisations have recently entered the debate, and are involved in a coalition to communicate the benefits of animal research. See, for example, http://www.medicalprogress.org/.

One of the accusations leveled against the research community is that it is too secretive. RDS has been encouraging institutions to become more open and transparent. RDS has encouraged institutions to mention animal research in annual reports, newsletters or other publications. In the meantime, a first step is to ensure all institutions have a statement on their website explaining why they carry out animal research. A few typical statements are below:

Royal Society: http://www.royalsoc.ac.uk/landing.asp?id=1222

Medical Research Council: http://www.mrc.ac.uk/index/current-research/funding-governance.htm#animals

Oxford University: http://www.admin.ox.ac.uk/biomed/facts.shtml or: http://www.admin.ox.ac.uk/biomed/faq.shtml

Home Office freedom of information pages on project licence abstracts: http://www.homeoffice.gov.uk/docs4/apc_statement.pdf

And the actual project licence abstracts http://www.homeoffice.gov.uk/comrace/animals/abstracts.html

In the long term, RDS believes that a proactive approach is necessary to explain to the public the benefits of animal research. So far there has been little networking of universities worldwide for the dissemination of information on animal-based research. This is going to be in development for 2006, and all collaboration will be welcome.

However, if the research community fails to engage with the public, the anti-vivisectionists certainly will do. In that situation, we would face a long-term decline in support for animal research. Currently we believe the situation in the UK is optimistic. We appear to have high levels of public support, as demonstrated by a number of opinion polls (http://www.mori.com/polls/2002/cmp.shtml), and the Government appears determined to crack down on animal rights extremism. RDS is determined to do whatever it can to assist this process, and is very willing to have a dialogue with like-minded organisations in any other country if this is of benefit.

Neurodegenerative disease modelling: why is it necessary?

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Abstract

Neurodegenerative diseases such as Stroke, Alzheimer's disease (AD) and Parkinson's disease (PD) are becoming more common within our aging population. Despite the prevalence and socio-economic impact of these disorders there are no effective treatments targeting acute or chronic neurodegeneration within the central nervous system. The identification and validation of new therapeutic strategies is dependent on a clear understanding of the pathophysiology of these disorders and the mechanisms underlying the disease processes. No single experimental technique can model all aspects of a disease. A number of approaches need to be investigated to significantly improve our understanding of the disease processes involved, including primary cell culture, tissue slice preparations and whole animal disease models. It is clear however, that the complex interplay at both cellular and molecular levels in the response to brain injury and recovery from it cannot be fully replicated *in vitro.* This presentation aims to highlight the importance of whole animal models in neurodegenerative disease research (with particular reference to Stroke) and why, despite their limitations they remain an essential preclinical research tool.

The problems of an aging population

Current statistics show that 12% of New Zealand's population are aged over 65. As life expectancy continues to increase, government figures predict that by 2051 a quarter of our population will be over 65 years of age. As our population ages, the prevalence of neurodegenerative diseases also increases; indeed, increasing age is the most significant risk factor for cerebrovascular disease and stroke. Many people over the age of 65 also show signs of cognitive impairment. Alzheimer's disease (AD) is the most common dementing disorder of later life and current estimates indicate up to 10% of the population over 65 and 50% over 80 are affected. The progression of these diseases is lengthy and there is no effective treatment. In short, the social and economic impact of these disorders is huge and set to increase.

Identifying new therapies

Identifying novel therapies for the treatment of neurodegenerative disease is dependent on a clear understanding of the pathophysiology of the disorder and the mechanisms underlying the disease process. Appropriate disease models play a pivotal role in identifying the mechanisms of cell death and in identifying new therapeutic targets. Disease models are also essential for establishing the effectiveness of any new therapeutic strategies and for providing proof of concept which is a prerequisite to clinical testing in human patients.

There are of course widely differing views on what constitutes a good model of human disease. *In vitro* models provide simple, isolated systems particularly suited to investigating biochemical events. *Ex vivo* systems such as organotypic slice culture are a step up from cell culture in terms of complexity. By maintaining some anatomical integrity these systems allow the study of both temporal and spatial events. However, whole animal models are required in order to truly replicate

the cellular and molecular intricacy of the brain's response to injury and recovery from it.

Animal models of neurodegeneration

A huge number of animal models have been developed to investigate common neurological disorders. These models attempt to replicate key features of the human disease, e.g., injection of the neurotoxin quinolinic acid mimics the selective loss of GABAergic medium spiny striatal projection neurons observed in Huntington's disease. Parkinson's disease models use systemic administration of MPTP or intracerebral administration of 6-OHDA to replicate the dopamine depletion observed in human patients. Generation of genetically modified animals whose nervous system is compromised by overexpression or ablation of proteins integral to cell death (conferring an increased or decreased susceptibility to brain injury) also provide useful experimental tools. One such genetically modified disease model includes the APPSWE(2576) mouse which expresses a transgene coding for an isoform of human β amyloid which was derived from a Swedish family with early onset Alzheimer's disease (Hsiao et al. 1996). These animals show memory deficits in behavioural tests which correlate with the development of amyloid plaques.

A degree of commonality exists in underlying factors across diseases particularly a role for glutamate-mediated excitotoxicity, generation of free radicals, and inflammation. Therefore, while many models seek to recreate the hallmarks of specific human diseases, newer animal models are also being developed to model general features associated with the progressive dysfunction and death of neurons such as generalised inflammation and caspase activation (Kerr et al. 2004).

It has been argued that only non-human primates are an appropriate species for investigating pathophysiology and evaluating new treatments in humans. In spite of this, the expense, logistics and ethical considerations of using higher species means initial preclinical investigations are generally carried out in rodents.

Cerebral ischaemia (Stroke)

Stroke is the third most common cause of death in the developed world. It is also a leading cause of disability and accounts for half of all neurological admissions. Over 1% of the entire population are living with a stroke-related deficit resulting in a world-wide healthcare cost of more than US$100 billion. Despite its prevalence and financial impact there is no widely available treatment for stroke.

Ischaemic stroke accounts for 83% of human strokes and occurs when a clot or blockage obstructs the vessels supplying blood to the brain. Since the majority of human strokes are occlusive in nature it makes sense that any measure which causes clot lysis and restores the circulation should limit the extent of brain injury. Tissue plasminogen activator (tPA) is the only specific therapy which has been shown to be effective in improving the outcome of stroke patients (Frey 2005). However, since administration must be within 3 hours of stroke onset, thrombolysis is only beneficial in around 5% of stroke patients. Therefore, while tPA provides some benefit the need for neuroprotectant compounds still exists.

Models of cerebral ischaemia

Although stroke models have been developed in many species, the most common species for modelling experimental stroke is the rat. The resulting ischaemia can be broadly classified as either global or focal. Focal models reduce blood flow to a single brain region. Global models reduce blood flow throughout the entire forebrain. Much criticism is levelled at the use of the global model, which mimics cardiac arrest rather than focal stroke; however, global models can provide a primary model in which to assess the efficacy of neuroprotective agents.

Occlusion of the middle cerebral artery (MCA) is the most common form of focal ischaemia in man and is the most common modelled experimentally. The vasculature of the MCA also has the advantage of being the most amenable for surgical intervention in experimental models. In addition, the cerebral anatomy of the rat shows good homology with man, and the size of the lesion in rats is proportionally similar to large infarcts in man (McAuley 1995).

Occlusion of the MCA has been achieved by a variety of means. Two principal mechanical techniques are the Tamura surgical model of exposure and ligation of the MCA (Tamura et al. 1981) and the monofilament model which involves insertion of a nylon suture via the cervical vessels into the Circle of Willis to occlude the origin of the MCA (Longa et al. 1989). The size of the resulting lesion is dependent on the time and

position of vessel occlusion and also the amount of collateral flow to watershed areas between vascular territories. Occlusion can be permanent or temporary allowing investigation of the effects of reperfusion. Alternative approaches include stereotaxic application of the vasoconstrictor endothelin-1 adjacent to the vessel (Sharkey & Butcher 1995) and placement of a blood clot at the origin of the MCA (Zhang et al. 1997). This embolic model is relevant to thromboembolic stroke in humans and is useful for documenting the safety and effectiveness of "clot-busting" agents. More importantly, as tPA is now the first line stroke therapy in humans we can investigate new therapies in combination with thrombolytic therapy.

Application of these many animal models has allowed us to understand the complex cascade of events which occur following interruption of blood flow and which ultimately lead to cell death. Many different classes of compounds such as NMDA receptor antagonists, calcium- and potassium channel blockers and nitric oxide synthase inhibitors have been shown to protect brain tissue in a variety of ischaemic models in a number of different species. Despite this preclinical success, none of these compounds targeting the early events in the cell death cascade has shown convincing clinical benefit (Richard Green et al. 2002).

Are animal models clinically relevant?

So why is there such a mismatch between the positive preclinical effects and the lack of efficacy in the human patients?

To some groups the obvious response is that animal models don't reflect human disease. Human stroke is varied in terms of the population affected, anatomical location and severity. The majority of stroke patients often have underlying health problems including hypertension and diabetes. This is in contrast to the healthy male animals with reproducible lesions in experimental studies. Despite these differences, animal models allow us to study aspects of the disease pathology in a physiologically controlled environment. Models that produce reliable, reproducible lesions allow careful dissection of potential mechanisms of both neuronal injury and protection. They also permit investigation of events in the seconds, minutes, hours and days after an ischaemic insult, aspects which would be impossible to determine or study in humans.

Animal models offer more than a controlled environment to investigate aspects of disease pathology. A number of physiological factors influencing ischaemic damage in animals have clinical correlates suggesting that animal models have some predictive relevance, e.g., hyperglycaemia has been shown to increase lesion size in experimental animals (Duverger & MacKenzie 1988). Hyperglycaemia in acute stroke patients also increases cerebral infarct size and worsens neurological outcome (Duvela et al. 2005). In addition, hyperthermia has been well documented to increase the amount of brain damage in animal models (Kim et al. 1996). In the same way, body temperature has a negative effect on stroke outcome in patients and the control and early treatment of hyperthermia is recommended (Dies-Tejedor & Fuentes 2004).

Aspects of clinical trial may also contribute to the failure of many compounds in patients (Del Zoppo 1998). Clinical trials have suffered from a lack of standardisation of critical factors such as inclusion criteria, dose and therapeutic time windows.

Administration of novel therapies in patients is a balancing act between delivering an effective dose and avoiding unwanted side-effects and many compounds which reached clinical trials were administered in sub-therapeutic doses. Administration of therapeutic compounds should also parallel the timecourse of biochemical changes which they target. It has been suggested that many compounds failed in the clinical setting because they were administered to patients too late to be effective. Selfotel, an NMDA receptor antagonist, is effective in rodent models of stroke when administered 60–90 minutes after the onset of ischaemia. However, it failed to show efficacy when administered 6 hours after stroke onset in patients (Sauer et al. 1993; Davis et al. 2000). Since the therapeutic time window for tPA is comparable in rats and humans this suggests that other classes of neuroprotectants may also need to be administered to patients in the same context that provides protection in animals. It is likely that the late administration of compounds in clinical trials is a feature of the late admission of many stroke patients to hospital. Developing compounds which target mechanisms beyond the very acute pathological events in the cell death cascade may provide effective therapies in the future.

Refining animal models

While there are aspects of clinical trial design which may have contributed to the lack of success of these compounds in patients, there are other factors to consider. Preclinical scientists are driven by legislation to adopt a reductionist attitude to experimental studies, not only to restrict the number of animals used, but to develop more refined, quantifiable endpoints to assess neuroprotective efficacy. The primary endpoint for most studies of stroke and the basis of most methods used to evaluate the effectiveness of potential neuroprotectants has been the assessment of the size and extent of the lesion *post mortem*. This approach has a number of limitations:

1. It assumes that tissue which appears histologically normal *post mortem* was functioning normally *pre mortem*.
2. Despite being used historically to demonstrate neuroprotective efficacy in rodent models, histology is not necessarily a useful predictor of clinical effectiveness (Del Zoppo 1998).

Clinical endpoints focus on functional improvement therefore demonstration of a preservation of function in addition to histological protection is required to increase the relevance of experimental studies. The question to ask is not "does this compound reduce the extent of brain damage" but rather "does this reduction in lesion size translate to functional recovery" in our animal models. So how do we determine if tissue which appears to be protected is functionally competent?

In the past, animal models of stroke have often been assessed using neurological scales of simple reflex and sensory motor functions similar to those used clinically. However, the major problem in developing a rodent counterpart to human functional assessment is that disturbances in simple reflexes and sensorimotor function often don't occur in animal models or spontaneously resolve in the hours and days after stroke. Neurological indices are therefore an unreliable means of assessing functional neuroprotection. Consequently specific, sensitive tasks assessing motor function and coordination have been developed.

Appropriate behavioural tasks must be relevant in terms of the anatomical areas which they serve. MCA occlusion produces a large motor deficit with a very minor cognitive impairment and animals show prolonged deficits in skilled motor tasks but no impairment in attentional processing (Montoya et al. 1991). Conversely, anterior cerebral artery occlusion produces marked cognitive deficits and animals show impaired performance in tasks evaluating memory and sustained attention but no deficit in motor tasks (Ward et al. 1998). Behavioural tests must also be reliable in terms of the size of the response and the stability of the deficit and it is essential that any improvement in performance is related to tissue salvage. A more ethological perspective has suggested that analysis of human symptoms in animal models must be based on functional similarity rather than equivalency. The critical factor is not whether an animal shows a particular behavioural impairment but rather how that behavioural impairment manifests in an animal (Branchi & Ricceri 2004).

Conclusion

Stroke is a disease of abnormal perfusion and its investigation requires intact vasculature. There is therefore an absolute requirement for whole animal models of cerebral ischaemia.

The rationale for implementing animal models is to improve understanding of the disease pathology and to identify potential therapies. While these models are essential to evaluate novel therapies it must be noted that they model aspects of disease pathology rather than an entire disease process. Experimental models are optimised to favour different aspects of disease pathology therefore selecting an appropriate model is critical to ensure predictive relevance in the clinic. These models need continuous refinement to enhance the scientific value of the data collected and to ultimately reduce the number of animals used. Additional value can be added by the use of end points that allow investigation of functional outcome. These paradigms are designed to investigate as wide a spectrum of function as possible and wherever possible parallel the clinical situation. Consequently, the data from one test are useful in answering a variety of questions as well as providing as clinically relevant information as is possible within the constraints of an animal model.

Pairing relevant disease models with more clinically relevant behavioural endpoints to investigate later events in stroke pathology should provide the best strategy to develop effective stroke treatments in the future.

References

Branchi, I.; Ricceri, L. 2004: Refining learning and memory assessment in laboratory rodents: An ethological perspective. *Annals of Ist Super Sanita 40*: 231–236.

Davis, S. M.; Lees, K. R.; Albers, G. W.; Diener, H. C.; Markabi, S.; Karlsson, G.; Norris, J. 2000: Selfotel in acute ischemic stroke: possible neurotoxic effects of an NMDA antagonist. *Stroke 31*: 347–354.

Del Zoppo, G. J. 1998: Clinical trials in acute stroke: why have they not been successful? *Neurology* S59–S61.

Dies-Tejedor, E.; Fuentes, B. 2004: Acute care in stroke: the importance of early intervention to achieve better brain protection. *Cerebrovascular Disease 17* Suppl. 1: 130–137.

Duverger, D.; MacKenzie, E. T. 1988: The quantification of cerebral infarction following focal ischaemia in the rat: influence of strain, arterial pressure, blood glucose and age. *Journal of Cerebral Blood Flow Metab*olism *4*: 449–461.

Frey, J. L. 2005: Recombinant tissue plasminogen activator (rtPA) for stroke. The perspective at 8 years. *Neurologist 11*: 123–133.

Health of older people in New Zealand 2002: A statistical reference. www.moh.govt.co.nz

Hsiao, K.; Chapman, P.; Nilsen, S.; Eckman, C.; Harigaya, Y.; Younkin, S.; Yang, F.; Cole, G. 1996: Correlative memory deficits, Abeta elevation and amyloid plaques in transgenic mice. *Science 274*: 99–102.

Juvela, S.; Siironen, J.; Kuhmonen, J. 2005: Hyperglycemia, excess weight, and history of hypertension as risk factors for poor outcome and cerebral infarction after aneurysmal subarachnoid hemorrhage. *Journal of Neurosurg*ery *102*: 998–1003.

Kerr, L. E.; McGregor, A. L.; Amet, L. E. A.; Asada, T.; Allsopp, T. E.; Carlson, G.; Logan, N.; Kelly, J. S.; Sharkey, J. 2004: Mice overexpressing human caspase 3 appear phenotypically normal but exhibit increased apoptosis and larger lesion volumes in response to transient focal cerebral ischaemia. *Cell Death Differential 11*: 1102–1111.

Kim, Y.; Busto, R.; Dietrich, W. D.; Kraydieh, S.; Ginsberg, M. D. 1996: Delayed postischemic hyperthermia in awake rats worsens the histopathological outcome of transient focal cerebral ischemia. *Stroke 27*: 2274–2280.

Longa, E. Z.; Weinstein, P. R.; Carlson, S.; Cummins, R. 1989: Reversible middle cerebral artery occlusion without craniectomy in rats. *Stroke 20*: 84–91.

McAuley, M. A. 1995: Rodent models of cerebral ischaemia. *Cerebrovascular Brain Metabolism Review 7*: 153–180.

Montoya, C. P.; Campbell-Hope, L. J.; Pemberton, K. D.; Dunnett, S. B. 1991: The "staircase test": a measure of independent forelimb reaching and grasping abilities in rats. *Journal of Neuroscience Methods 36*: 219–228.

Richard Green, A.; Odergren, T.; Ashwood, T. 2003: Animal models of stroke: do they have value for discovering neuroprotective agents? *Trends in Pharmacological Science 4*: 402–408.

Sauer, D.; Allegrini, P. R.; Cosenti, A.; Pataki, A.; Amacker, H.; Fagg, G. E. 1993: Characterization of the cerebroprotective efficacy of the competitive NMDA receptor antagonist CGP40116 in a rat model of focal cerebral ischemia: an in vivo magnetic resonance imaging study. *Journal of Cerebral Blood Flow Metabolism 13*: 595–602.

Sharkey, J.; Butcher, S. P. 1995: Characterisation of an experimental model of stroke produced by intracerebral microinjection of endothelin-1 adjacent to the rat middle cerebral artery. *Journal of Neuroscience Methods 60*: 125–131.

Tamura, A.; Graham, D. I.; McCulloch, J.; Teasdale, G. 1981: Focal cerebral ischaemia in the rat. 1. Description of technique and early neuropathological consequences following middle cerebral artery occlusion. *Journal of Cerebral Blood Flow Metabolism 1*: 53–60.

Ward, N. M.; Sharkey, J.; Marston, H. M.; Brown, V. J. 1988: Simple and choice reaction-time performance following occlusion of the anterior cerebral arteries in the rat. *Experimental Brain Research 123*: 269–281.

Zhang, Z.; Chopp, M.; Zhang, R. L.; Goussev, A. 1997: A mouse model of embolic focal cerebral ischemia. *Journal of Cerebral Blood Flow Metab*olism *17*:1081–1088.

Session 5
Alternatives and cost

Development of acceptable alternative methods

A review of methods, validation and ethical aspects associated with *in vitro* alternative methods

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Abstract

The process of validation is an important consideration when alternative assays are to be considered as acceptable replacements for the present animal-based methods. There is now a formal process whereby assays can be validated, and this is now being extended to new proposed animal *in vivo* tests. Validation is defined as demonstrating that an assay is reliable, relevant, has a prediction model and a Standard Operating Procedure. Human lethal blood levels are known for at least 75 chemicals that are regularly taken in overdose in Europe. This data can be used to check the reliability of *in vitro* assays designed to predict human toxicity. Since human toxicity is most commonly required, human cells preferably should be used. To obtain primary human tissue that retains "normal" function, ethical permission is required via the UK Hospitals Ethics Committees. There are ethical issues concerning the use of human tissue in particular with reference to patient medical records and identity of donors. In addition to the ethical issues that revolve around the use of human tissues, and human exposure records, there is also the ethical use of animals, in particular Primates. Are we ethically justified in using Primates at all, since they are social animals and endangered in the wild? How does this affect our attitude towards the use of other animal genera, since dogs, rats, mice, and even protozoa are routinely exposed.

Introduction and discussion

The Fund for the Replacement of Animals in Medical Experiments (FRAME, www.frame.org.uk) has over the past 30 years been directly involved in the development and formal validation of *in vitro* methods to replace, refine and/or reduce (Russell & Burch 1959) the use of animal experimentation.

The development of alternatives depends upon a number of key factors:

- a willingness to consider and evaluate alternative methods;
- a clearly defined endpoint by which the data *in vitro* can be associated with data obtained *in vivo* or be predictive for *in vivo* effects;
- an acceptance that the *in vitro* assay will represent one aspect of the organism's response, and that if this is a key/critical event then the model could be considered for formal validation;
- good "gold standard" *in vivo* data with which to assess the *in vitro* method. This is available but requires agreement as to its value (Purchase et al. 1987; Halle 2003).

Sadly, *in vitro* assays have suffered from early over-promotion of their applicability. The neutral red uptake assay endpoint and basic method has been employed with a range of chemicals and formulations. It is an acute cytotoxicity assay endpoint, and thus its applicability for predicting the Draize eye score (Borenfeund & Borrero 1984; Borenfeund & Peurner, 1985) and subsequently skin scores, has been questioned (e.g., Worth & Balls 2002a). In addition, the justification for the use of *in vitro* assay methods has been based on correlation coefficients, e.g., as in the Multicenter Evaluation of *In vitro* Cytotoxicity (MEIC) scheme. Data have been interpreted, by some, as rating one assay above another because the R^2 value was 0.82 for

human cells as opposed to 0.67 for animal cells (Ekwall et al. 1998). There is justification for this approach when large numbers of chemicals have been employed, and when evenly spread over the full range of toxicities but this approach can be criticised, particularly when relatively few chemicals are employed over a narrow range of *in vivo* toxicity.

High expectations have been set for *in vitro* methods, with low coefficients of variability used to define reproducibility and reliability. This tends to raise a major problem since the *in vivo* data do not meet such stringent criteria. In the EU/Home Office Eye Irritation Validation study of alternatives to the Draize eye method (Draize et al. 1944; Brantom et al. 1997), despite the choice of *in vivo* data from well controlled and acceptable studies, the Modified Maximal Average Scores (MMAS) had large variabilities for different chemicals. This was true even when the *in vivo* data were taken from the ECETOC (European Centre for Ecotoxicology and Toxicology of Chemicals) database (Technical report No 11).

To partially address the applicability of *in vitro* assays and their reliability, reproducibility and fitness for purpose, criteria have been set down for both the pre-validation (Curren et al. 1995) and the validation (Balls & Karcher 1995; Balls et al. 1995) process with *in vitro* alternative methods.

To address the techniques and documentation generated, the application of GLP to *in vitro* toxicology studies has been proposed (Cooper-Hannan et al. 1999). There are now a number of *in vitro* methods that have successfully completed the validation process, e.g., those related to embryotoxicity (see http://ecvam.jrc.it/index.htm). Such assays have confirmed reliability, reproducibility, transferability between laboratories, appropriate prediction models, and available *in vitro* and *in vivo* data sets (Worth & Balls 2002b).

The 3T3 NRU phototoxicity assay (Spielmann et al. 1998) successfully completed the validation process. The chemicals for this study were supplied coded to the nine participating laboratories, along with the method of analysis and prediction model for the potential to identify phototoxic chemicals. All the data were collected, predictions made, and externally checked before the codes were revealed to the participants.

The main problems identified in this study were the control of the selection of the solvent for the unknown chemicals and the precise interpretation of the methodology. Whilst culture medium or dimethylsulphoxide (at a specified maximal final concentration in the culture medium) were the solvents recommended, it became apparent, in the final analysis, that not all the laboratories had chosen the same solvents for the same chemicals.

Hence, in the present ICCVAM/ECVAM Validation study, the practical component of which is now complete, a solubility protocol was designed and is available as a suitable approach for selection of either medium, DMSO or ethanol (http://iccvam.niehs.nih.gov/methods/ivcytoval.htm).

There is a requirement to generate equivalent data to that obtained from animal studies, for regulatory purposes. The replacement of the rodent LD_{50} assays by *in vitro* alternatives has been the desired aim for many proposed basal cytotoxicity assays. The FRAME Alternatives Laboratory has been developing assay methods to predict human adverse reactions i.e. to predict risk phrases [R phrases that indicate particular rishs associated with chemicals, e.g., R36 means irritating to the eyes]. The use of human cells does raise ethical issues, particularly when primary cells are required. The UK is in the process of enacting a new Human Tissues Act (HTA), which will bring its legislation into line with that of the European Commission.

At present, obtaining primary human cells direct from donors requires patient permission. Before obtaining this, the experimental approach to be taken, the method of obtaining the tissue and the use to which the human data are to be employed, needs to be passed for scrutiny by the appropriate ethics committees. In the university and health sector there are ethics committees that evaluate and are able to decide if permission is to be granted. Hence, an experimenter in a university, or industry has to demonstrate competence and validity of the assay to be conducted to the in house ethics committee before seeking Health Authority ethical approval.

The new HTA will also encompass the human tissue banks and cadaver material. The Act received Royal assent on 15 November 2004, with the Chairman of the Human Tissue Authority Baroness Hayman being appointed in February 2005, charged with implementation of the Act by April 2006.

The Act covers:

1) The carrying-out of anatomic examinations.

2) The storage of anatomical specimens.
3) The storage and disposal of former anatomical specimens.
4) The definition of death for the purposes of this Act.
5) Communication with the family of the deceased in relation to the making of a post-mortem examination.
6) The making of post-mortem examinations.
7) Communication with the family of the deceased in relation to removal from the body for use for a scheduled purpose, of any relevant material of which the body consists, or which it contains.
8) The removal from a human body, for use for a scheduled purpose, of any relevant material of which the body consists or which it contains.
9) The import and the export of the body or relevant material from a deceased person, for use for a scheduled purpose.
10) The disposal of relevant material which has been removed from a human body for use for a scheduled purpose, or has come from a human body and is an existing holding.

Thus this covers tissues and body fluids. It does not cover embryos outside the human body, or hair and nail from the body of a living person. Neither does it cover "Surplus Tissue", which is defined as:

1. "any material which consists of or includes human cells and which has come form a person's body in the course of receiving medical treatment, diagnostic testing, or participating in research, or
2. applies to any relevant material which has come from a human body and ceases to be used, or stored for use, for a purpose specified that is covered by the Act."

Hence, those who work with human skin, cornea, or placenta, would appear to be under no further restriction under the new Act. Those working on other tissues, e.g., liver and body fluid will be.

For the studies conducted in the FRAME Alternatives Laboratory (FAL), which have centred on epithelial barrier systems and developmental differentiation, limited changes will be required to the ethical permission already sought.

FAL has focused on two main areas of model development. The epithelial models illustrate more clearly method development, validation and ethical aspects. The other area employs the use of the D3 stem cells (L'Huillier et al. 2002) and chick micromass systems for identification of teratogens.

Developments with the human skin and corneal epithelial models

Human keratinocytes can be readily grown *in vitro* in defined media, following their initial culture by Rheinwald & Green (1975). The same defined medium was then employed for growing human corneal epithelial cells which had been immortalised by transfection (Kahn & Walker 1994) but using elevated calcium ion concentrations, 1m*M*, to stimulate differentiation (Ward et al. 1997a). The requirement to keep the calcium ion concentration below 0.09m*M* is vital to prevent primary human keratinocytes from differentiating and progressing through programmed cell death as a result of activation of transglutaminases (Ward et al. 1997b; Gray et al. 2004).

There are transfected human skin keratinocytes, e.g., the HaCaT cell line isolated by N. Fusenig, but these do not express all the features associated with the primary keratinocytes. Indeed the primary keratinocytes begin to lose enzyme functions as they are passaged, even with robust enzymes such as the cutaneous esterase (Barker & Clothier 1997).

Care is required in the culture of human keratinocytes or corneal epithelial cells, and in particular with respect to the calcium ion concentration they are exposed to. The FAL has experienced batches of medium that contain calcium in excess of the 0.09m*M* stated, which has resulted in stimulation of differentiation and thus the loss of the entire cultures. Hence, it now routinely employs calcium-free medium such that the calcium concentration can be ensured and the precise culture conditions defined (e.g., http://iccvam.niehs.nih.gov/methods/ivcytoval.htm).

Emanating from the ECVAM reports on phototoxicity (Spielmann et al. 1994; 2000), the FAL were part of the validation study and decided to include evaluation of human keratinocytes, alongside the 3T3 cells, as the target cells. The FAL results, with the human keratinocytes, were employed to refine the prediction model employed (Holzhutter 1997).

Concern was raised that different human donors may respond in unpredictable ways in the *in vitro* phototoxicity study. To check for this, different donors were employed in the replicate runs required for each

of the coded chemicals (Clothier et al. 1999).

The results obtained with the human keratinocytes revealed that all except bithionol (Clothier et al. 1999) gave results as for the 3T3 NRU phototoxicity study (Spielmann et al. 1998). This raised the question as to the cause of this difference. Was it a human/mouse difference, or an epithelial/keratinocytes difference? Subsequent experiments with human corneal transfected cells (Araki Sasaki et al. 1995) and human keratinocytes showed that the corneal cells were susceptible to phototoxic insult from bithionol but not amiodarone whereas the human keratinocytes were susceptible to amiodarone but not bithionol (Combes et al. 1999).

Thus this raised the possibility that the human keratinocytes could be employed as part of a second level test, to help evaluate the mechanisms of phototoxicity in human skin cells (Reid et al. 2001).

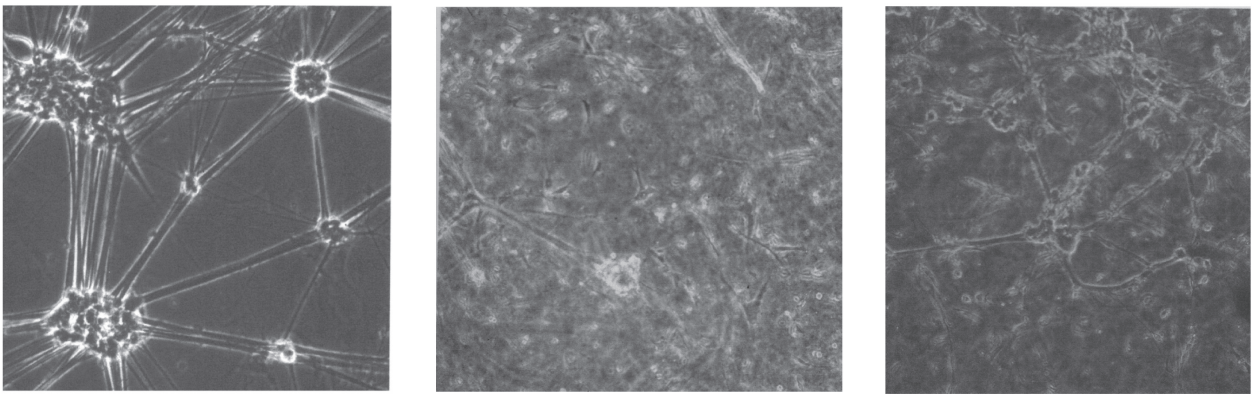
While both the skin and corneal models employed (Clothier et al. 1999; Combes et al. 1999) retain the calcium-mediated differentiation and could be measured *in vitro* with a standardised protocol to measure squamous differentiation (Gray et al. 2004), it was possible that key factors were not being released via the FAL skin model. As part of a collaborative project the interaction of the human parasite *Schistosoma mansoni* cercariae was employed to examine interaction with the human skin or corneal epithelial cells, (Khammo et al. 2002; Whitfield et al. 2003a; 2003b). These experiments demonstrated that the human models were producing the appropriate factors required by this parasite to identify human skin or eye and penetrate into them.

Further development of the skin model is being addressed to examine the effects of interaction between sensory neurones and tissue repair. The corneal model illustrates this approach since the innervation of the corneal epithelium is known to be significant *in vivo*. The problems with developing innervated models *in vitro* are the inability to culture nerve cells, the need to identify appropriate neurones, and the ability to show plural functionality and cell-cell interaction. Moore et al. (2005) reported the use of a hybridoma neuronal cell line with sensory characteristics, the ND7/23 cells, whereas an alternative approach using embryonic dorsal root ganglia was taken by the Griffiths team (Suuronen et al. 2004). Suuronen et al. (2004) have demonstrated neurite penetration into the corneal epithelial model, which to date Moore et al. (2005) have not.

This illustrates a clear difference of approach. The FAL have used the ND7/23 cell line since it is readily available via tissue culture collections. In addition the method, whereby the nerve cells and corneal epithelial cells can be readily distinguished and their interaction monitored before, following exposure and during subsequent recovery from chemical insult in the same model, can be undertaken using non-toxic marker dyes. A number of approaches have been taken but, to date, none of the non-cytotoxic dyes for labelling living cells for periods of days to weeks has proved successful in remaining solely within the ND7/23 or keratinocyte/corneal cell line (Moore 2005).

Since injury and subsequent recovery is all part of the Draize eye score (Draize et al. 1944), the development of such innervated models is relevant, not only to eye irritation models but also potentially

Fig. 1 Dorsal root ganglion cells seeded at 6.10^5 on collagen coated plastic (a), collagens with no human fibroblasts (b), or human dermal fibroblast containing collagen gels (c), x150.



1a **1b** **1c**

to skin irritation models.

The FAL has taken the approach of using dorsal root ganglia cells with the skin model (Figure 1; Ogilvie, Khammo, Parker and Clothier unpubl. results) as well as the ND7/23 cell approach. Also it is possible to demonstrate retention of specific sensory receptors in dorsal root ganglia cultures over time (Mellor et al. 2004) as well as activity of the ND7/23 cells in keratinocyte medium (Moore et al. 2005).

Recently, the Nuffield Foundation (www.nuffieldbioethics.org) has published a report into the ethics of research involving animals, that among other conclusions indicates more research is required into the Three Rs—reduction, refinement and replacement (Russell & Burch 1959)

Conclusion

As a result of development and rigorous validation, *in vitro* methods are becoming accepted. Companies now employ them routinely often still as pre-screens, but increasingly in the cosmetic industry as indicators of no effect levels with which to start human exposure trails. The prospects for further well-thought-out, mechanistically based and valid *in vitro* assays is evident.

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References

Araki-Sasaki, K.; Ohashi, Y.; Sasake, T.; Hayashi, K.; Watanabe, H.; Tano, Y. K.; Handa, H. 1995: An SV40 immortalised human corneal epithelial cell line and its characterisation. *Investigations in Ophthalmology and Visual Science 36*: 614–621.

Balls, M.; Karcher, W. 1995: The validation of alternative test methods. *ATLA 23*: 211–217.

Balls, M.; Goldberg, A. M.; Fentemk, J. H.; Broadhead, C. L.; Burch, R. L.; Festing, M. F. W.; Frazier, J. M.; Hendriksen, C. F. M.; Jennings, M.; van der Kamp, M. D. O.; Morton, D. B.; Rowan, A. N.; Russell, C.; Russell, W. M. S.; Spielmann, H.; Stephens, M. L.; Stokes, W. S.; Straughan, D. W.; Yager, J. D.; Zurlo, J.; van Zutphen, B. F. M. 1995: The Three Rs: the way forward. *ATLA 23*: 838–866.

Barker, C.; Clothier, R. H. 1997: Human keratinocyte cultures as models of cutaneous esterase activity. *Toxicology in Vitro 11*: 637–640.

Borenfeund, E.; Borrero, O. 1984: *In vitro* cytotoxicity assays: potential alternatives to the Draize ocular irritancy test. *Cell Biology and Toxicology 1*: 55–65.

Borenfeund, E.; Peurner, P. 1985: Toxicity determined *in vitro* by morphological alterations and neutral red absorption. *Toxicology Letters 24*: 119–124.

Brantom, P. G.; Bruner, L. H.; Chamberlain, M.; de.Silva, O.; Dupuis, J.; Earl, L. K.; Lovell, D. P.; Pape, W. J. W.; Uttley, M.; Bagley, D.M.; Baker, F.W.; Bracher, M.; Courtellemont, P.; Declercq, L.; Freeman, S.; Steiling, W.; Walker, A. P.; Carr, G. J.; Dami, N.; Thomas, G.; Harbell, J.; Jones, P. A.; Pfannenbecker, U.; Southee, J. A.; Tcheng, M.; Argembeaux, H.; Castelli, D.; Clothier, R.; Esdaile, D. J.; Itigaki, H.; Jung, K.; Kasai, Y.; Kojima, H.; Kristen, U.; Larnicol, M.; Lewis, R. W.; Marenus, K.; Moreno, O.; Peterson, A.; Rasmussen, E. S.; Robles, C.; Stern, M. 1997: A summary report of the COLIPA International Validation Study on alternatives to the Draize Rabbit Eye Irritation Test. *Toxicology in Vitro 11*: 144–179.

Clothier, R. H.; Willshaw, A.; Cox, H.; Garle, M.; Bowler, H.; Combes, R. 1999: The use of human keratinocytes in the EU/COLIPA international *in vitro* phototoxicity test validation trial and the ECVAM/COLIPA study on UV filter chemicals. *ATLA 27*: 247–259.

Combes, R.; Manner, J.; Boavida, P.; Owen, M.; Clothier, R. 1999: The effects of UVA on human corneal and keratinocyte cell lines. Pp. 152–155 *in*: Alternatives to animal testing II, Clark, D., Lisansky, S.; Macmillian, R. *eds*. CPL Press, Newbury.

Cooper-Hannan,R.; Horbell, J.W.; Coeke, S.; Balls, M.; Bowe, G.; Cervinka, M.; Clothier, R.; Hermann, F.; Klahm, L. K.; de Lange, J.; Liebsch, M.; Vanparys, P. 1999: The principles of good laboratory practice: application to *in vitro* Toxicology studies. *ATLA 27*: 539–577.

Curren, R. D.; Southee, J. A.; Spielmann, H.; Liebsch, M.; Fentem, J. H.; Balls, M. 1995: The role of prevalidation in the development, validation and acceptance of alternative methods. *ATLA 23*: 211–217.

Draize, J. H.; Woodward, G.; Galvery, H. O. 1944: Methods for the study of irritation and toxicity of substances applied topically to the skin and mucus membranes. *Journal of Pharmacology and Experimental Therapeutics 82*: 377–390.

Ekwall, B.; Barile, F. A.; Castano, A.; Clemedson, C.; Clothier, R. H.; Dierickz, P.; Ekwall, B.; Ferro, M.; Fiskesjo, G.;, Garza-Ocanas, L.; Gomes-Lechon, M. G.; Gulden, M.; Hall, T.; Isomaa, B.; Kahru, A.; Kerszman, G.; Kristen, U.; Kunimoto, M.; Karenlampi, S.; Lewan, L.; Loukianov, A.; Ohno, T.; Persoone G., Romert, L., Sawyer, T. W.; Shrivastava, R.; Segner, H.; Stammati, A.; Tanaka, N.; Valentino, M., Walum, E.; Zucco, F. 1998: MEIC evaluation of acute systemic toxicity Part VI. The prediction of human toxicity by rodent LD_{50} values and results from 61 *in vitro* methods. *ATLA 26*: 617–658.

Gray, A.; Malton, J.; Clothier, R. H. 2004: The development of a standardised protocol to measure squamous differentiation in stratified epithelia, by using the Fluorescein Cadaverine incorporation technique. *ATLA 32*: 91–100.

Halle, W. 2003: The registry of cytotoxicity : Toxicity testing in cell cultures to predict acute toxicity (LD_{50}) and reduce testing in animals. *ATLA 31*: 89–198.

Holzhutter, H. G. 1997: A general measure of *in vitro* phototoxicity derived from pairs of dose-response curves and its use for predicting *in vivo* phototoxicity of chemicals. *ATLA 25*: 445–462.

Kahn, C. R.; Walker, T. 1994: Human corneal epithetial primary cultures and cell lines with extended lifespan can be used to study mechanisms of corneal injury and subsequent repair. *In Vitro Toxicology 7*: 124.

Khammo, N.; Bartlett, A.; Clothier, R. H.; Whitfield, P. J. 2002: The attachment of Schistosoma mansoni cercarie to human skin cells. *Parasitology 124*: 25–30.

L'Huillier, N.; Pratten, M.; Clothier, R. H. 2002: The relative embryotoxicity of 1, 3-dichloro-2-propanol on primary chick embryonic cells. *Toxicology in Vitro 16*: 433–442.

Mellor, I. R.; Ogilvie, J.; Pluteanu, F.; Clothier, R. H.; Parker, T.; Rosini, M.; Minarine, A.; Tumiatti, V.; Melchione, C. 2004: Methoctramine analogues inhibit responses to capsaicin and protons in rat dorsal root ganglion neurons. *European Journal of Pharmacology 505*: 37–50.

Moore, P.; Ogilvie, J.; Horridge, E.; Mellor, I. R.; Clothier, R. H. 2005: The development of an innervated epithelial barrier model using a human corneal cell line and ND7/23 sensory neurones. *European Journal of Cell Biology 84*: 581–592.

Moore, P. 2005: Development of an innervated 3-dimensional *in vitro* human corneal epithelial model . PhD Thesis University of Nottingham, NG7 2RD.

Purchase, I. F. H., Farrar, D. G., Whitaker, I. A. 1987: Toxicological summaries on substances used in the FRAME cytotoxicity research project. *ATLA 14*: 184–243.

Reid, L.; Clothier, R. H.; Khammo, N. 2001: Hydrogen peroxide induced stress in human keratinocytes and its effect on bithionol toxicity. *Toxicology in Vitro 15*: 441–445.

Rheinwald, J. G.; Green, H. 1975: Serial cultivation of stains of human epidermal keratinocytes: The formation of keratinizing colonies from single cells. *Cell 6*: 331–344.

Russell, W. M. S.; Burch, R. L. 1959: The principles of human experimental technique. London, UK: Methuen.

Spielmann, H.; Lovell, W. W.; Holzle, E.; Johnson, B. E.; Maurer, T.; Miranda M. A.; Pape, W. J. W.; Sapora, O.; Sladowski, D. 1994: *In vitro* Phototoxicity testing. ECVAM workshop report 2. *ATLA 22*: 314–348.

Spielmann, H.; Balls, M.; Dupuis, J.; Pape, W. J.; Pechovitch, G.; de Silva, O.; Holzhutter, H. G.; Clothier, R.; Desolle, P.; Gerbercik, F.; Liebsch, M.; Lovell, W. W.; Maurer, T.; Pfannenbecker, U.; Potthast, J. M.; Csato, M.; Sladowski, D.; Sterling, W., Brantom, P. 1998: The International EU/COLIPA *in vitro* Phototoxicity Validation Study: results of phase II (blind trial). Part I: The 3T3 NRU phototoxicity test. *Toxicology in Vitro 12*: 305–327.

Spielmann H.; Muller, L.; Averbeck, D.; Balls, M.; BrendlerSchwaab, S.; Castell, J. V., Curren, R.; deSilva, O.; Gibbs, N. K.; Liebsche, M.; Lovell, W. W.; Merk, H. F.; Nash, J. F.; Neumann, N. J.; Pape, W. J. W.; Ulrich, P.; Vohr, H. W. 2000: The Second ECVAM Workshop on Phototoxicity Testing. *ATLA 28*: 777–814.

Suuronen, E. J.; McLaughlin, C. R.; Stys, P. K.; Nakamura, M.; Munger, R.; Griffith, M. 2004: Functional innervation in tissue engineered models for *in vitro* and testing purposes. *Toxicological Sciences 82*: 525–533.

Ward, S. L.; Walker, T. L.; Dimitryevich, S. D. 1997a: Evaluation of chemically induced toxicity using an *in vitro* model of human corneal epithelium. Toxicology in vitro model of human corneal epithelium. *Toxicology in Vitro 11*: 121–139.

Ward, R. K.; Clothier, R. H.; Combes, R. 1997b: *In vitro* pathophysiological models of squamous differentiation. *TEN 4*: 38–45.

Whitfield, P.; Bartlett, A.; Khammo, N.; Brain, A. P. R.; Brown, M. B.; Marriott, C.; Clothier, R. 2003a: Delayed tail loss during the invasion of human skin by Schistosome Cercaria. *Parasitology 126*: 135–140.

Whitfield, P. J.; Bartlett, A.; Khammo, N.; Brain, A. P.; Brown, M. B.; Marriott C.; Clothier R. 2003b: Age-dependent survival and infectivity of *Schistosoma mansoni* cercariae. *Parisitology 127*: 29–35.

Worth, A.; Balls, M. 2002a: Alternative (non-animal) methods for chemical testing: current status and future prospects. *ATLA 30, S1*: 27–43.

Worth, A.; Balls, M. 2002b: Alternatives (non animal) methods for chemicals testing: current status and future prospects. A report prepared by ECVAM and the ECVAM working group on chemicals. *ATLA 30, S1*: 115–125.

Public accountability of animal use for scientific purposes in Australia—auditing of Animal Ethics Committees and national data

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Introduction

As there is no national animal welfare legislation regulating the use of animals for research and teaching in Australia, each of the eight States and Territories has its own legislation and system of animal ethics committees (AECs). The *Australian Code of Practice for the Care and Use of Animals for Scientific Purposes* is published by the National Health and Medical Research Council (NHMRC) and compliance with this Code is a legal requirement in all jurisdictions. The 7th edition was published in 2004 and included for the first time a requirement for regular external review of the operation of institutions and their AECs. This defined the required scope and outcomes of the reviews and how they should be conducted. While such reviews are already undertaken in some states, this is a new requirement in many jurisdictions.

Differences in legislation and administration between the eight jurisdictions have made the collection, collation and interpretation of national data on animal use in research and teaching very difficult. While the need for such data has been recognised since 1989, they are not yet available from all jurisdictions, but it is anticipated that a complete set of data will be provided for 2004. This paper provides the Australian data for five of the eight jurisdictions for 2003, together with some interpretations and comments. Data collated from 2002 will also be discussed.

This paper outlines how reviews of AECs may be undertaken in the different jurisdictions; provides the first national animal use data together with interpretation and explanation; and concludes with some general comments on public accountability of AECs in Australia.

Animal welfare legislation and the Code of Practice in Australia

Each of the Australian States and Territories has enacted legislation, known as the *Animal Welfare Act* (Tasmania, Western Australia, Northern Territory, Australian Capital Territory (ACT)); the *Prevention of Cruelty to Animals Act* (Victoria, South Australia, New South Wales (NSW)); or the *Animal Care and Protection Act* (Queensland). In all jurisdictions except NSW this legislation includes provisions covering the use of animals in research and teaching and the establishment and operation of AECs. NSW has enacted separate legislation, the *Animal Research Act 1985*, to cover this area. Responsibility for animal welfare legislation lies with different jurisdictions in the States and Territories. It lies with Departments of Primary Industries in NSW, Queensland, Victoria, Tasmania and the Northern Territory, but with the Departments of Environment in South Australia and ACT, and Local Government in Western Australia. Resources provided to animal welfare vary considerably between jurisdictions, which makes coordination of data collection difficult and policy implementation at the national level complex.

The *Australian Code of Practice for the Care and Use of Animals for Scientific Purposes* was first published in 1969 by the National Health and Medical Research Council (NHMRC) and is now in its 7th edition (NHMRC 2004). It has power of law in all

jurisdictions and provides an excellent guide to the ethical and humane care and use of animals used for scientific purposes for researchers, institutions and AEC committees and members. The latest edition for the first time requires a triennial external review of the operation of all AECs in each State and Territory. The Code specifies the composition, terms of reference and responsibilities of AECs, which must comprise at least four persons, including a separate person appointed to each of Categories A, B, C and D. The average membership of an AEC is 8–10, including the Chairperson.

A Category A member is a person with a qualification in veterinary science and relevant experience. A Category B member is a person, usually with a higher degree in research, who has substantial recent experience in the use of animals in research or teaching. A Category C member is a person with commitment to and experience in animal welfare, who is not employed by the AEC's institution, nor is involved in the care and use of animals for scientific purposes. A Category D member is a person who has never been involved in the use of animals for scientific purposes and who is not associated with the institution. Both Category C and D persons are lay members. In addition, the Code recommends the inclusion on an AEC of a person responsible for the routine care of animals within the institution. This person is sometimes described as a Category E member (e.g., in the SA legislation). The Code recommends that the Chairperson hold a senior position within the organisation or if external, that he/she obtains commitment from the institution, and that this person is an additional appointment to the Category A to D members.

External reviews of Animal Ethics Committees

While it is often stated that the system of AECs in Australia has an important element of transparency with its lay members, and is working relatively well, this cannot be demonstrated in most jurisdictions because of the lack of formal auditing or review. The only States with formal mechanisms in place before 2005 have been NSW, through the Animal Research Review Panel of the NSW Department of Primary Industries; Victoria, through the Bureau of Animal Welfare of the Victorian Department of Primary Industries, which contracts a former senior staff member to conduct these reviews; and Tasmania, whose Department of Primary Industries, Water and Environment conducts annual inspections of licensed establishments.

The lack of formal auditing in most jurisdictions led to criticism from Animals Australia, an animal rights group representing a large number of organisations across Australia, that the AEC system lacked transparency. The new requirement in the Code of Practice for external review of the operation of institutions and their AECs addresses this concern and will provide evidence from all eight jurisdictions that, subject to a satisfactory review, all scientific and teaching activities involving the use of animals are adequately justified, that the welfare of those animals used is given due consideration and that the AEC is effective.

How the reviews will be done—differences between jurisdictions

New South Wales

The system of AEC review and of animal use statistics collection is long established and was referred to above. The NSW Animal Research Review Panel publishes an Annual Report (NSW Agriculture 2004), which provides the only publicly available information in Australia on the activities of AECs, including site inspections to monitor compliance with legislation and statistics on animal use for scientific purposes in NSW. Inspections are conducted jointly by the Panel and the Animal Welfare Office of the Department of Primary Industries, which covers the costs. The definition of an animal in the NSW *Animal Research Act* is non-human vertebrates including fish.

Western Australia

Western Australia is considering how its AEC audits will be done. Institutions will have to cover the costs. Under the Western Australia *Animal Welfare Act 2002* an animal is defined as a live vertebrate, or a live vertebrate of a prescribed kind, other than a human or a fish. There are no prescribed invertebrates. Animal use statistics from Western Australia for 2004 will be included in the national statistics.

Northern Territory

There are no animal use statistics available from the one large and several smaller AECs in the Northern Territory and there are as yet no plans to audit AECs.

Tasmania

The Animal Research Inspectorate conducts annual inspections of licensed institutions with regard to compliance with the approved Code and any other licence condition. A pro-forma is being developed for this activity to make documentation easier and more meaningful. The "inspection" currently includes attendance at AEC meetings on an ad hoc basis and site inspections. Investigations of complaints are also conducted as required.

The external review (as opposed to the annual inspection) of licensed institutions' AECs as required by the Code must be initiated by the institution. Institutions may use the Animal Research Inspectorate of the Department of Primary Industries, Water and Environment or, in the case of the Department's AEC, the Tasmanian Audit Office, or other suitably qualified organisation for this review. Audit costs have not been set. Licensed institutions will have to pay a separate fee for the audit as current licensing fees only cover costs associated with licensing (annual inspections, administration and ethical awareness sessions). An audit procedures manual is being developed.

The *Animal Welfare Act 1993* defines animals as "any live vertebrates other than a human being" or "any other creature prescribed for the purposes of any or all of the provisions of the Act". It does not cover cephalopods and this definition has been interpreted also to include larval or other juvenile forms of animal, e.g., tadpoles.

South Australia

The Animal Welfare Office of the Department of Environment and Heritage will commence tri-ennial reviews of the 12 AECs in South Australia in 2005. Four reviews will be performed each year and each will be led by a person from interstate with substantial AEC experience, together with two staff from the Animal Welfare Office. Reports will be sent to the Chief Executive of the AEC's institution, with a copy to the AEC Chairperson. This will be the first time AECs have been reviewed in South Australia. Institutions will have to cover the review costs.

Under the South Australian *Prevention of Cruelty to Animals Act 1985,* the definition of an animal includes non-human vertebrates except fish. While the definition of an animal in the Code of Practice is broader and includes all live non-human vertebrates and higher-order invertebrates, the Act is deemed by law to over-ride the Code. This is unsatisfactory, as it removes fish and higher-order invertebrates from AEC consideration. Hence the animal use data from South Australia do not include these species.

Queensland

The Queensland Department of Primary Industries and Fisheries' Animal Welfare Unit will implement a monitoring programme for users of animals for scientific purposes and their AECs in 2005, which is based on similar models in NSW, Victoria and New Zealand and will satisfy the criteria for external review in the Code of Practice. Audits will be carried out on all users and their AECs (approximately 210 registered users and 40 AECs) over the next three years. The monitoring programme is based on triennial audits of registrants and their AECs. The Department employs specially trained Authorised Officers to carry out audits of registrants and their AECs. Independent external AEC members with an interest in animal welfare assist the Authorised Officers in the audits.

Registrants will be given adequate notice of audits. However, there is provision for audits with 48 hours' notice in certain circumstances. Corrective action is required for non-compliance with Code requirements and if necessary recommendations will be made for improvements in standards. The results of the audits are confidential with only the names of registrants and dates of audits disclosed to the public. The results of the audit will be taken into account when assessing whether a registrant should be re-registered for a further three-year period and conditions may be placed on re-registration based on the audit. There is no charge for the audits or follow-up visits.

Under the Queensland *Animal Care and Protection Act 2001* an animal is defined as any live non-human vertebrate, including amphibians, birds, fish, mammals and reptiles. Also included are live pre-natal or pre-hatched animals in the last half of gestation, e.g., a

mammalian or reptilian foetus, pre-hatched avian, mammalian or reptilian young and live marsupial young. To bring the Queensland animal definition in line with the Code of Practice, cephalopod invertebrates such as octopus, squid, cuttlefish and nautilus are also to be included as animals by Regulation. At this point, prawns and crabs are not included in the definition of an animal.

Victoria

The Victorian Department of Primary Industries has been conducting reviews of AECs and institutional animal use since 1986. Before July 2004, the costs of reviews were carried by the Department, but are now incorporated into the licence fee with a 50% public benefit. These reviews have historically fulfilled the requirements now outlined in the Code. In 2005, the Department aims to expand to a panel of approved contractors to carry out these reviews and use the animal use data to further focus these reviews.

Animal use statistics have also been collected since 1986. Recent amendments to the legislation (2004) have simplified the requirements for these data and aligned the relevant criteria with the nationally agreed categories. The legislation, which over-rides the Code, has also been amended to incorporate fish and wildlife as animals used in scientific procedures for the purpose of compliance with the Code and annual statistics. There remains a discrepancy concerning higher order cephalopods and crustacea. While the latest annual statistics (2003) have recently been made freely available on the web (and a full report is available on request), the names of institutions and AECs reviewed are retained in line with confidentiality requirements.

Australian Capital Territory

While the ACT Animal Welfare Office has received animal usage statistics from only one licensed institution for the past three years, all institutions will be requested to lodge their past statistical information when renewal applications are issued. The ACT has not finalised how triennial reviews of AEC will be implemented.

The definition of an animal in ACT legislation is a live member of a vertebrate species, including amphibians, birds, fish, mammals (other than humans), reptiles and cephalopods, and crustaceans intended for human consumption.

National data on animal use in research, testing and teaching

Animal use for scientific purposes in Australia is contentious and is frequently the subject of media interest. As this paper was being prepared, the Melbourne "Age" newspaper featured on the front page of its Saturday edition the headline "Sacrificed for Science", which discussed the 2003 animal use statistics from Victoria as part of a "Special investigation inside the secret world of animal experiments" (*The Age* 25 June 2005). The complexity of these data, together with jurisdictional discrepancies and inadequacies of national data add credence to the suggestions of secrecy and lack of transparency which are often made by opponents of animal-based research.

The need for data to be collated and publicly available nationally has been recognised for many years. The Australian Senate Select Committee on Animal Welfare (1989) in its Report on Animal Experimentation recommended that:

"the Commonwealth, State and Territory Governments publish annually accurate and comprehensive information on the extent and forms of animal experimentation conducted within their respective jurisdictions. In addition, government authorities should provide some analysis of the statistics to make them meaningful to the public, and to reduce the potential for misinterpretation." (Recommendation 2.30).

While such data have been published annually by NSW in the Annual Reports of the Animal Research Review Panel, and have been collated annually and made available on request, until recently they have not been published by Victoria, and the other six jurisdictions have neither collated nor published these data. The first step was to develop and adopt a standard method for collecting and reporting data from organisations licensed to conduct animal-based research and teaching. This was facilitated by a grant from the National Health and Medical Research Council (NHMRC) to the South Australia Department of Environment and Heritage in 1997 to develop a software program, which was provided to State and Territory agencies responsible for animal welfare some years ago. It was not utilised by most jurisdictions and was revised in 2000.

The Animal Health Committee, which comprises the Chief Veterinary Officers of the State, Territory and Australian Governments, agreed in 2002 to assume

responsibility for collating, interpreting and publishing national data. This was referred to the Animal Welfare Working Group for implementation. Short-term responsibility for collating but not publishing, data was accepted by Victoria, pending a decision on which agency would assume formal responsibility for this task.

Despite all jurisdictions having agreed to provide uniform data for 2002, this did not occur. Three jurisdictions did not provide data and one other set of data was incomplete. There were also differences in the type of data collected between jurisdictions. Kelly (2004) provided a detailed description of the difficulties experienced in developing an acceptable database for collection of data and obtaining agreement from all eight jurisdictions to implement it.

It has recently been agreed that the Australian data from 2005 will be collated and interpreted by the Animal Welfare Office of the Australian Department of Agriculture, Food and Fisheries and published on its website. This should occur in 2006. However, it will be some years before any trends in these data will emerge and variations from one year to another will need to be interpreted cautiously, because of differences in the method of data collection between jurisdictions and fluctuations in usage, for example of fish and poultry and in wildlife studies.

Analysis of the national statistics

Data from 2002 and 2003 are shown in Tables 1–6 at the end of this paper. The number of animals used for scientific purposes in 2002 (four jurisdictions) was 3,535,741 and in 2003 (five jurisdictions) was 3,674,073 (Table 5). The figures (Table 6) from New Zealand for 2002 and 2003 are 263,684 and 320,911 (NAEAC 2003, 2004). For a description of the collection and interpretation of New Zealand statistics, see Hellstrom (2003).

Table 1 describes the Australian data for 2003 by the type of animal and project purpose, and Table 2 by the type of animal and the category of procedure. For a detailed description of the method of presentation of data, see Kelly (2004). More than half of all animal usage, 769,624 plus 1,468,475 animals, or 61.5% of the total, was for achievement of educational objectives and for environmental studies respectively. A further 543,888 animals were used in studies relating to improvement of animal production. The remaining 892,086 animals were used in studies of human or animal biology or in the maintenance and improvement of human or animal health and welfare. Table 2 shows that the procedures involved 2,378,319 observational studies with minor interference and 582,563 animals with minor conscious intervention not requiring anaesthesia (64.7%). Of the remainder, 288,886 animals were unconscious without recovery, 40,034 had surgery with recovery, 92,164 had minor operative procedures with recovery, 117,616 had minor physiological challenge, 92,817 had major physiological challenge and 81,674 had death as an endpoint.

Discrepancies and differences between jurisdictions

Discrepancies between jurisdictions are evident from examination of the data in Tables 3 and 4. Large numbers of fish were used in studies in NSW, but were not included from some other jurisdictions. Fish were not included in Western Australia, South Australia, or Victoria because fish are, or were not, defined as an animal in legislation. Queensland included fish and ante-natal organisms in the second half of development or gestation (using the arbitrary "capable of independent feeding" cut off for larval fish) and did not differentiate between ages of animals or stages of development. Fingerlings are immature fish and should be counted, although the most practical method is yet to be determined.

Regarding animal definition and stage of development, both NSW and now Victoria (for 2004 statistics) included foetuses and forms equivalent to half gestation, half incubation or capable of independent feeding onwards, which conforms with generally accepted concepts of sentience (and the Code of Practice). Western Australia, South Australia, Queensland and Tasmania also are in line with this age definition. However, the guidelines for interpretation of data advise not to count foetal or larval forms. The age definition therefore needs to be more specific and agreement reached on its implementation.

Regarding category of procedures, under the heading of observational studies with minor interference, Victoria did not include pure observational studies (with no interference to the animals) nor captured all wildlife use regardless of category, due to legislative exemptions. Some states (NSW and Queensland) included data from observational (non-invasive) studies of wildlife. The high figure for environmental study in Queensland is most likely due to the fact

that Queensland has a large number of environmental consultants who carry out fauna surveys and also has a very active Parks and Wildlife Service. A lot of fish are used under this category. For example, of the 654,967 animals used for environmental studies in 2003, 236,236 were fish. This category applies to a large proportion of the research carried out in Queensland, such as feeding trials, breeding studies and teaching activities. It also includes a lot of minimal impact wildlife observational studies.

There are very large differences in the numbers of animals used for achievement of educational objectives between NSW and Victoria (717,077 compared with 19,390 in 2002; 634,083 compared with 12,699 in 2004). Such discrepancies must be addressed if the data are to be meaningful and useful in the future. Queensland and SA counted the use of animals in schools (most of which is observational), but Victoria did not and this is uncertain in other jurisdictions.

A clearer definition of "death as an endpoint" is required. This is intended only to include animals whose death is a deliberate and justifiably necessary part of an experiment rather than those which died subsequently, for example as a result of culling. An investigation into reporting of this category for 2003 in Victoria revealed confusion and over-representation in the application of this category.

Some other issues of public accountability of concern to Animal Ethics Committees

Private funding of research and resulting intellectual property

Without the availability of specific records, it is not possible to determine the proportion of animal-based research which is publicly or privately funded. This is often linked to confidentiality clauses relating to potential intellectual property arising from the research. However, the proportion of research funded from private sources is possibly quite large, as a result of decreasing funding from public grant-giving bodies. Such research is often undertaken by public institutions on a contractual basis for private companies and industry bodies and proposals are considered by their AEC, which may be attached to a university, public hospital, medical research institution or government agency.

The dilemma for the AEC is that the results of such research may not be published and are therefore not available to the scientific or wider community.

Implementing the Three Rs of Replacement, Reduction and Refinement

The Code of Practice states clearly that investigators and teachers who use animals for scientific purposes must consider these very important principles. The effectiveness of AECs in assisting researchers and teachers to implement the principles of replacement, reduction and refinement is difficult to assess as there is no mechanism to measure it. However, regular audits of AEC operations will highlight the importance of this and auditors will be looking at the commitment of institutions and their AECs to their implementation.

Method of selection, appointment and training of Animal Ethics Committee members

There does not appear to be any common mechanism for recruiting new AEC members, with most being found by word of mouth rather than by public advertisements. Some institutions and State agencies (e.g., in Queensland, NSW, SA and Victoria) convene annual training days for AEC members, researchers and students. These are very worthwhile and assist in raising the standard of operation of AECs and of animal use in research and teaching. Both the NHMRC and ANZCCART have held training days with a particular focus on the needs of Category C and D members.

How to audit Animal Ethics Committees and still retain confidentiality

Most jurisdictions have not done enough audits yet to see if this will be a real rather than a perceived problem and it will need to be discussed during the AEC reviews. It may not be a problem, provided the members of the audit team are bound by a confidentiality agreement. Audit information and reports, including corrective action, must be kept confidential by the responsible government agency and should not be divulged to any third parties.

Personal safety and Freedom of Information legislation

A major future challenge to the effective functioning of AECs in Australia is to balance the personal safety and security of investigators and AEC members against the need for public accountability and transparency

of AEC operations and animal use. Membership of AECs is not publicised and is not likely to be provided by State or Territory jurisdictions under a Freedom of Information request, as it would not be deemed to be in the public interest.

Personal safety of AEC members has not been an issue in Australia to date. While there is concern within Australian animal rights groups about the operation of AECs, the opportunity exists for their members to contribute actively to animal welfare through AEC membership, usually as Category C or D members, but few have done so. One reason may be the need for AECs to reach decisions by consensus, which is difficult if any member holds abolitionist or strong views against the use of animals for scientific purposes. This is not the case with members of the RSPCA, an animal welfare organisation which is well represented on AECs in Australia and whose members contribute very well as Category C members.

The militant opposition to animal research by animal rights groups which has been such a feature in the UK in recent years (see Festing, this Proceedings), and to a lesser extent in New Zealand, has not occurred in Australia. For example, while there were no protesters at ANZCCART's 2002 conference on the Gold Coast and a few, passive, protesters outside ANZCCART's 2004 conference in Sydney, recent ANZCCART conferences in New Zealand (2001, 2003 and 2005) have been the subject of noisy and persistent protests by very angry demonstrators. This has required police and security staff to guard the conference venue and protect conference delegates entering and leaving the conference.

ANZCCART's approach in Australia has been to avoid polarisation of this debate as far as possible by inviting differing views to be presented and discussed. This has included formal presentations by the Executive Director of *Animals Australia* at ANZCCART conferences, seminars and workshops. ANZCCART also works closely with the RSPCA in Australia and New Zealand. The need to "lift the veil and find common ground" was the topic of the ANZCCART conference held in New Zealand in 2003.

If Australia and New Zealand are to avoid the physical intimidation and violence from opponents of animal use in research and teaching which occurs in the UK, finding common ground between researchers and teachers who use animals and animal rights advocates must occur. This will depend to a large extent on establishing and maintaining good personal communication between these groups. Organisations such as ANZCCART, whose motto is "humane science", have an increasingly important role in meeting this challenge.

Conclusion

Many of the discrepancies and complexities associated with review of institutions and AECs, and reporting of national statistics, arise as a result of variations in jurisdictional legislation. The revision and mandatory adoption of the *Australian Code of Practice for the Care and Use of Animals for Scientific Purposes* assists in aligning the States and Territories with a common framework of principles and requirements.

However, frustration persists for investigators and institutions intending to use animals for scientific and teaching purposes in more than one jurisdiction; for interested groups and members of the public who call for transparency and accountability; and for those trying to achieve and report complete, meaningful national statistics.

These reasons, as well as the need to strengthen accountability and transparency with a common approach, provide a strong argument for a more nationally directed legislative approach by the eight State and Territory jurisdictions, in accordance with the 7th edition of the *Australian Code of Practice for the Care and Use of Animals for Scientific Purposes.*

References

Hellström, K. 2003: Animal use statistics: the New Zealand experience and perspective. Pp. 18–25 *in*: Animal welfare and animal ethics committees: where are the goalposts now? *Proceedings of the 2002 ANZCCART Conference.* ANZCCART New Zealand.

Kelly, D. 2004: Animal research and teaching statistics—the Australian experience. Pp. 56–60 *in*: Lifting the veil: finding common ground. *Proceedings of the 2003 ANZCCART Conference.* ANZCCART New Zealand.

National Animal Ethics Advisory Committee (NAEAC) 2003 and 2004: Annual Reports for 2002 and 2003. New Zealand Ministry of Agriculture and Forestry, Wellington.

National Health and Medical Research Council 2004: Australian Code of Practice for the Care and Use of Animals for Scientific Purposes. Seventh edition. Australian Government, Canberra.

NSW Agriculture 2004: Animal Research Review Panel. Annual Report for 2002–03. Sydney.

Senate Select Committee on Animal Welfare 1989: Animal Experimentation. Report by the Senate Select Committee on Animal Welfare. Australian Government Publishing Service, Canberra.

Australian data for 2003

Table 1 Type of animal and project purpose 2003.

Types of animals		Understanding of human or animal biology	Maintenance and improvement of human or animal health and welfare	Improvement of animal management or production	Achievement of educational objectives	Environmental study	Totals
Reptiles	Lizards	4,821	0	136	269	9,467	14,693
	Snakes	2,152	87	203	31	334	2,807
	Tortoises	629	60	0	266	6,219	7,174
	Other Reptiles	218	311	0	22	835	1,386
Aquatic Animals	Amphibians	11,010	1,733	1,163	9,046	16,953	39,905
		2,452	0	20	0	0	2,472
	Crustaceans	58	0	0	204	0	262
	Fish	84,279	26,464	307,691	11,433	1,072,541	1,502,408
	Other aquatic animals	3,154	65	546	11,150	89	15,004
Laboratory Mammals	Ferrets	31	839	4	87	0	961
	Guinea pigs	1,807	12,329	1,262	4,408	16	19,822
	Hamsters	0	0	0	0	0	0
	Mice	250,935	214,590	23,962	7,455	240	497,182
	Rabbits	2,310	2,857	6,763	390	1	12,321
	Rats	54,832	27,486	615	6,091	617	89,641
	Other Lab Mammals	325	1,437	0	242	293	2,297
Domestic Animals	Dogs	777	2,051	240	1,092	1	4,161
	Cats	202	350	44	290	0	886
	Other domestic animals	1	24	0	0	0	25
Native Mammals	Dasyurids	833	0	57	1,123	5,685	7,698
	Koalas	114	90	135	18	226	583
	Macropods	939	130	2	363	4,241	5,675
	Native rats and mice	571	0	35	2,033	9,029	11,668
	Possums and gliders	144	381	103	422	4,050	5,100
	Wombats	8	0	70	9	232	319
	Other native mammals	878	67	678	369	19,418	21,410
Stock Animals	Cattle	5,193	15,672	42,662	28,425	0	91,952
	Deer	80	0	60	61	225	426
	Goats	158	1,551	860	2,894	0	5,463
	Horses	478	9,035	395	2,000	43	11,951
	Pigs	10,301	4,784	1,505	6,537	0	23,127
	Poultry	24,579	20,742	50,347	610,267	170	706,105
	Sheep	3,674	55,608	98,097	56,426	30	213,835
	Other stock animals	0	7	28	103	37	175
Primates	Baboons	0	0	4	0	0	4
	Macaques	8	32	5	0	0	45
	Marmosets	63	162	161	0	0	386
	Other primates	0	18	11	0	10	39

Table 1 *Continued*

Types of animals		Understanding of human or animal biology	Maintenance and improvement of human or animal health and welfare	Improvement of animal management or production	Achievement of educational objectives	Environmental study	Totals
Exotic Feral Animals	Camels	0	2	0	2	0	4
	Cats	0	0	0	0	96	96
	Cattle	0	0	0	52	9	61
	Goats	0	10	175	0	163	348
	Hares	0	0	0	0	13	13
	Horses	6	25	14	0	7	52
	Mice	429	380	1,475	8	930	3,222
	Pigs	55	0	85	1	63	204
	Rabbits	47	0	0	65	170	282
	Rats	962	0	372	29	879	2,242
	Other exotic feral animals	311	298	3,330	600	1,872	6,411
Birds	Exotic captive	146	20	0	174	0	340
	Exotic wild	18	0	4	81	1,032	1,135
	Native captive	105	3	19	1,094	18	1,239
	Native non-endemic	27	843	0	2,595	2,505	5,970
	Native wild	12,656	2,753	545	552	309,716	326,222
	Other birds	5,296	495	2	785	0	6,578
Zoo Animals	Other zoo animals	222	1	3	60	0	286
	Totals	488,294	403,792	543,888	769,624	1,468,475	3,674,073

Table 2 Type of animal and category of procedure 2003.

Types of animals		Observational studies involving minor interference	Animal unconscious without recovery	Minor conscious intervention, no anaesthesia	Minor operative procedures with recovery	Surgery with recovery	Minor physiological challenge	Major physiological challenge	Death as an end point	Totals
Reptiles	Lizards	9,710	203	4,644	0	0	0	0	136	14,693
	Snakes	1,935	25	593	37	62	0	0	155	2,807
	Tortoises	631	1	542	6,000	0	0	0	0	7,174
	Other Reptiles	301	51	440	594	0	0	0	0	1,386
Aquatic Animals	Amphibians	11,103	8,975	18,634	255	120	0	0	818	39,905
	Cephalopods	0	520	1,870	82	0	0	0	0	2,472
	Crustaceans	211	0	51	0	0	0	0	0	262
	Fish	1,090,604	108,188	263,818	3,624	1,347	6,965	3,926	23,936	1,502,408
	Other aquatic animals	13,166	37	937	695	0	4	0	165	15,004
Lab Mammals	Ferrets	100	0	857	0	4	0	0	0	961
	Guinea pigs	285	2,104	6,469	277	202	4,068	1,639	4,778	19,822
	Hamsters	0	0	0	0	0	0	0	0	0
	Mice	33,622	89,962	104,939	36,488	20,685	81,813	82,255	47,418	497,182
	Rabbits	6,374	919	3,484	398	746	152	200	48	12,321
	Rats	8,630	38,159	9,729	12,145	11,672	4,091	2,832	2,383	89,641
	Other Lab Mammals	264	240	357	253	0	24	1,159	0	2,297
Domestic Animals	Dogs	1,543	1,241	877	188	191	121	0	0	4,161
	Cats	355	201	228	69	7	13	5	8	886
	Other domestic animals	25	0	0	0	0	0	0	0	25
Native Mammals	Dasyurids	2,571	115	5,004	5	0	0	0	3	7,698
	Koalas	151	30	292	110	0	0	0	0	583
	Macropods	4,573	249	765	58	30	0	0	0	5,675
	Native rats and mice	5,997	92	5,253	4	0	321	0	1	11,668
	Possums and gliders	4,021	346	658	31	29	9	6	0	5,100
	Wombats	293	0	8	14	4	0	0	0	319
	Other native mammals	8,875	73	11,919	348	119	75	0	1	21,410
Stock Animals	Cattle	52,889	258	28,551	5,015	864	4,349	24	2	91,952
	Deer	219	120	27	0	0	0	0	60	426
	Goats	2,791	24	2,490	25	7	126	0	0	5,463
	Horses	2,891	71	8,536	259	0	194	0	0	11,951
	Pigs	7,621	791	5,754	8,027	283	524	123	4	23,127
	Poultry	657,150	29,355	14,986	1,277	0	2,742	451	144	706,105
	Sheep	127,597	3,245	55,887	14,399	3,368	9,066	62	211	213,835
	Other stock animals	65	25	2	18	0	5	0	60	175
Primates	Baboons	4	0	0	0	0	0	0	0	4
	Macaques	5	3	0	0	8	29	0	0	45
	Marmosets	32	22	0	0	28	304	0	0	386
	Other primates	11	0	18	10	0	0	0	0	39

Table 2 *Continued*

Types of animals		Observational studies involving minor interference	Animal unconscious without recovery	Minor conscious intervention, no anaesthesia	Minor operative procedures with recovery	Surgery with recovery	Minor physiological challenge	Major physiological challenge	Death as an end point	Totals
Exotic Feral Animals	Camels	0	0	0	0	2	2	0	0	4
	Cats	30	2	13	51	0	0	0	0	96
	Cattle	61	0	0	0	0	0	0	0	61
	Goats	163	166	19	0	0	0	0	0	348
	Hares	13	0	0	0	0	0	0	0	13
	Horses	33	0	2	9	0	0	0	8	52
	Mice	1,845	512	864	0	0	0	0	1	3,222
	Pigs	62	100	0	2	0	0	0	40	204
	Rabbits	169	110	3	0	0	0	0	0	282
	Rats	74	1,303	835	0	0	0	0	30	2,242
	Other exotic feral animals	1,007	405	3,649	65	239	46	0	1,000	6,411
Birds	Exotic captive	69	209	12	50	0	0	0	0	340
	Exotic wild	1,012	20	65	20	0	18	0	0	1,135
	Native captive	1,072	74	24	30	17	22	0	0	1,239
	Native non-endemic	2,600	27	847	0	0	2,496	0	0	5,970
Birds	Native wild	312,957	90	11,986	1,102	0	0	87	0	326,222
	Other birds	390	223	5,589	37	0	27	48	264	6,578
Zoo Animals	Other zoo animals	147	0	36	93	0	10	0	0	286
	Totals	2,378,319	288,886	582,563	92,164	40,034	117,616	92,817	81,674	3,674,073

Table 3 Animals used by purpose 2003*.

STATE	Understanding of human or animal biology	Maintenance and improvement of human or animal health and welfare	Improvement of animal management or production	Achievement of educational objectives	Environmental study	Totals
WA	0	0	0	0	0	0
VIC	183,978	196,391	86,827	12,699	8,913	488,808
TAS	39,586	5,119	7,972	1,824	619	55,120
SA	22,724	5,424	1,058	26,377	16,360	71,943
QLD	97,360	81,341	110,682	94,641	270,943	654,967
NT	0	0	0	0	0	0
ACT	0	0	0	0	0	0
NSW	144,646	115,517	337,349	634,083	1,171,640	2,403,235
Total	488,294	403,792	543,888	769,624	1,468,475	3,674,073

* No data available for SA, WA, NT and ACT for 2002, or WA, NT and ACT for 2003.

Table 4 Animals used by procedure 2003*.

STATE	Observational studies involving minor interference	Animal unconscious without recovery	Minor conscious intervention, no anaesthesia	Minor operative procedures with recovery	Surgery with recovery	Minor physiological challenge	Major physiological challenge	Death as an end point	Totals
WA	0	0	0	0	0	0	0	0	0
VIC	69,029	83,156	123,459	31,146	18,409	70,146	58,675	34,788	488,808
TAS	9,167	8,051	32,687	1,024	128	994	3,069	0	55,120
SA	39,030	9,070	16,230	2,004	1,646	1,579	1,406	978	71,943
QLD	357,070	87,938	151,094	27,036	4,781	11,381	14,397	1,270	654,967
NT	0	0	0	0	0	0	0	0	0
ACT	0	0	0	0	0	0	0	0	0
NSW	1,904,023	100,671	259,093	30,954	15,070	33,516	15,270	44,638	2,403,235
Total	2,378,319	288,886	582,563	92,164	40,034	117,616	92,817	81,674	3,674,073

* No data available for SA, WA, NT and ACT for 2002, or WA, NT and ACT for 2003.

Table 5 Animal use for scientific purposes in Australia 2002 and 2003*.

State	2002	2003
Victoria	**439133**	**488808**
Tasmania	**69418**	**55120**
South Australia	**No data**	**71943**
Queensland	**679191**	**654967**
New South Wales	**2,336,521**	**2,403,235**
Total	**3,535,741**	**3,674,073**

* No data available for SA, WA, NT and ACT for 2002, or WA, NT and ACT for 2003.

Table 6 Australian and New Zealand data 2002 and 2003*.

Jurisdiction	2002	2003
Australia	3,535,741	3,674,073
New Zealand (NAEAC, 2003/4)	263,684	320,911

* See footnote to Tables 3, 4 and 5 above re Australian data.

Session 6
Out of the lab and into the wild

Vertebrate pest control research—managing ethical issues

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Abstract

New Zealand has a range of introduced vertebrate pests that have negative impacts on conservation, animal health, and production values. Species such as possums, ferrets, stoats, feral cats, rats, mice, pigs, goats, deer, and tahr all receive some form of lethal control in order to minimise their impacts. This significant control effort is underpinned by a range of research projects that, by necessity, use a considerable number of experimental animals. This paper highlights some specific challenges that research on wild animals pose for researchers and Animal Ethics Committee members using Landcare Research's animal use as an example. To minimise suffering experienced by experimental animals it is imperative that there is continual improvement in research design, testing protocols, and technology, and the adoption of these improvements is a responsibility of both the researchers and AEC members. Given the ongoing need for vertebrate pest control in New Zealand and the support this control needs from research, research on wild animals will be required for the foreseeable future. The significant benefits that have been gained from past research and the continuing refinement of experimental methods and technologies should ensure that manipulations of experimental animals remain justifiable, with the recognition that the goals of vertebrate pest control research contrast to the usual goals of contemporary animal-based research such as conservation, livestock production and pharmaceutical development.

Introduction

New Zealand has a number of introduced vertebrate pests that have had, and continue to have a significant negative impact on a range of conservation, animal health, and production values (King 1990). Management of the impacts often requires expensive, large-scale control operations that by necessity kill large numbers of individuals. For possums alone, more than $80 million is spent annually on their control using poisons (1080, cyanide, anticoagulants, and cholecalciferol), traps and shooting. This control kills large numbers of individuals: for example, a typical aerial 1080 operation against possums over an area of 5,000 ha may kill as many as 50,000 individual possums. Consequently, to avoid ethically unjustifiable killing of animals, we believe (O'Connor et al. 2005) it is imperative that all stages of a control programme are managed to ensure:

- operational goals are well defined and measurable;
- the selected control strategies are likely to achieve the goals;
- the control methods chosen achieve an acceptable balance between effectiveness and imposed suffering;
- effectiveness of the control operation is monitored.

The effective implementation of each of these stages is underpinned and supported by a rigorous research programme that, by necessity, requires the use of animals in research. Landcare Research, one of nine Crown Research Institutes in New Zealand, carries out a range of vertebrate pest-related research under the approval of its Animal Ethics Committee (AEC)

and a MAF-approved Code of Animal Welfare. Because much of this research is focused on killing wild animals, both the researchers and AEC members need to balance suffering experienced by experimental animals with the experimental aims that necessitate the suffering. This paper provides some examples of the challenges this presents, how these challenges are being addressed, and some of the positive benefits that have accrued from the research. The data used in this paper relate solely to animal use by Landcare Research.

Statutory reporting

Landcare Research has a statutory obligation to report annually to the Ministry of Agriculture and Forestry on the species used, and for each manipulation grade the number of individual animals used. Landcare Research also chooses to report on its animal use in its annual report as part of its triple-bottom-line reporting system (Landcare Research 2004). That is, not only does this research organisation report its financial performance, it also reports its environmental and social performance. Animal use is one component of this environmental reporting.

The species and numbers of animals used varies annually depending on the research priorities of funding agencies, but in all years possums dominated animal usage (Table 1). Of these animals 33.5% are used in captive experiments (i.e. cage or pen trials), the remainder being used in field trials.

Captive animal use

Research with captive pest animals is undertaken for several reasons, and often involves the killing of animals. The deliberate killing of animals, although unusual in animal-based research, is considered ethical in this context since society, through legislation (e.g. Animal Welfare Act 1999), has determined that some introduced animals are pests, and where their damage is judged to be sufficient, lethal control is required. A clear majority (88%) of the general public surveyed, however,

Table 1 Annual usage of animals in AEC-approved research at Landcare Research.

	2000		2001		2002		2003	
	Used	Killed	Used	Killed	Used	Killed	Used	Killed
Possum	2460	1527	4620	1439	1416	1321	3297	1747
Ferret	288	38	251	90	173	153	266	117
Stoat	16	5	20	0	75	75	186	50
Feral cat	77	0			30	30	6	6
Rabbit	89	83					559	559
Hedgehog	190	0					31	12
Guinea pig							10	10
Rat	22	20	363	363	602	424	1526	1504
Mouse	364	363	100	100	2314	976	193	140
Wallaby			56	25				
Deer			15	6				
Cattle							4	0
Sheep	50	46					18	1
Pig	17	17					28	28
Dog							6	6
Duck							10	10
Chicken			38	38			94	81
Intro. Birds	22	0						
Weka							3	0
Skink					534	10	22	5
Adelie penguin					2136	0		
Eel	386	361						
Other fish			5	5			30	30
Frog	21	5						
Totals	4002	2465	5468	2066	7280	2989	6289	4306

felt that control methods should conform to some minimum standard of humaneness (Fraser 2001). Thus, to develop new or improved lethal control methods, studies are conducted initially with samples of captive animals large enough to provide a reliable assessment of both effectiveness and humaneness. Clearly, it is necessary to use death of animals as an experimental end-point to enable such assessment, and time until death and symptoms of toxicosis are key parameters in assessing the relative humaneness of vertebrate poisons (Littin & O'Connor 2002). Furthermore, in assessing the risks for human health and the environment, additional animals are used in regulatory toxicology studies that are required to permit the use of chemicals in a broader sense. Collectively, such studies provide a basis for product registration that ensures that pest control can be achieved effectively, humanely and with low environmental risk (Eason et al. 1997). In the longer term, non-lethal methods of controlling populations of pests may become available, and to this end research has been continuing with captive animals for about 15 years on the development of methods of reproductive control of possums and other pests. Social research has shown that such methods are clearly favoured by the general public (Fitzgerald et al. 1996), but conventional, lethal control and associated underpinning research will be required until new technologies are proven.

Wild animal use

Research on wild animals is conducted, first, to better understand their impacts, and therefore may focus on the pest species themselves (e.g., browsing damage of possums) or the native species (e.g., kiwi, kokako) or entire ecosystems that are affected. Typically there is a greater "ethical cost" in studying pests in the wild as the research may require animals to be killed, either for sampling purposes (e.g., for studying digesta in dietary studies, or assessing disease status), or for field trials of control effectiveness.

Many of the possums that are killed in field trials are killed as part of population monitoring, usually by the use of leg-hold traps which themselves have a welfare impact (i.e. suffering in the trap). Because this type of monitoring is used routinely by pest management agencies, it is excluded (under the Animal Welfare Act) from the definition of "manipulation" and is therefore not included in MAF's annual reporting of nationwide animal usage in research and teaching. Nevertheless, Landcare Research independently presents this information in its annual report, and provides training in humane euthanasia of trapped animals in the field that follows a Standard Operating Procedure approved by the AEC.

Animal deaths that result from research into the development of control technologies must be reported annually to MAF, unlike the deaths that occur as a result of routine control using a proven method. However, this presents a difficulty for researchers, as many individual pests may be killed, but not accounted for, because monitoring control effectiveness often relies on an index of population reduction not an estimate of actual numbers killed. Additionally, some control methods (e.g., anticoagulant poison) do not enable dead animals to be recovered. How many animals fall into this category is unknown, and depends on the density of pest populations (which is difficult to assess accurately), the size of the area control is applied to, and the effectiveness of the control treatment applied (which is not known until the study is completed). Consequently, researchers conducting these types of field experiments have to estimate the numbers of animals "manipulated" when submitting animal use data to MAF.

Another challenge that researchers face is that their experimental animals are released back into the wild and may or may not be able to be re-captured. Often this does not pose a welfare problem, but there are two areas where special care must be taken. The first is with fitting collars or harnesses to attach, for example, radio-transmitters. To obtain an unbiased estimate of animal behaviour, or measure the efficiency of poisons, all age cohorts of a target population should be sampled. Consequently, collars must occasionally be placed on immature animals that will grow and potentially fill the collar. Additionally, collars have a relatively short transmission life (usually less than 18 months) and when they cease to operate the collar no longer provides useful information from that animal, but the animal still has to tolerate the collar's presence. In these instances collars must be attached sufficiently loosely that young animals can grow without suffering any constriction from the collar. Recent advances in timed self-releasing collars (R. Calder, Sirtrack, pers. comm.) reduce the potential welfare risk of these devices. The second concern arises from the possibility of released animals having some capture trauma that cannot be identified or treated.

The Landcare Research AEC has taken a strong interest in these problems, and requires unproven techniques to be assessed first in small pilot studies. Furthermore, field staff are required to be adequately trained in fitting devices and in assessing captured animals for potential injuries.

Severity of manipulation grades

Because much of the research related to managing vertebrate pests examines the efficacy of poisons and traps, manipulation grades can be high, sometimes in the two highest grades. It is noteworthy that in its definition of "animal", legislation does not differentiate between pest and non-pest animals, and therefore the same ethical considerations must be applied to both despite evidence, for example, that the public value possums less than kiwi or takahe (Hickling 1994). While Landcare Research is committed to affording pest animals used in research the same degree of duty of care as non-pest animals, the reporting of animal usage does not distinguish pests from non-pest animals, and therefore does not reflect public attitudes. That is, although care must be taken at all times to minimise pain and distress, we suggest that having experimental animals in the more severe grades may be generally perceived as more ethically acceptable because of the public acceptance that some animals are pests and need to be controlled.

There are five specified grades of manipulation (Table 2), and as an example, possum research projects have had animals in all grades with most being graded as A and B (86% in 1999–2003), but very few in category X (0.3% in 1999–2003).

Three processes have been developed to address concerns that some experiments have grades of C and less frequently X. First, experiments with the higher severe grades are reviewed particularly rigorously by AEC members, to ensure that the planned animal usage is outweighed by the expected benefit (outcome) of the experiment. Second, stopping rules have been developed where appropriate. For example, testing of kill traps is done following the test requirements of the National Animal Welfare Advisory Committee Guidelines (NAWAC 2000). These guidelines prescribe a given success rate for a trap to pass the test, and if during the test the number of allowable failures is exceeded the test is stopped. As an example, if a sample of 10 test animals is selected to assess the killing performance of a kill trap, all 10 animals much be rendered irreversibly unconscious within 3 minutes. Thus, if the first animal is not rendered irreversibly unconscious within 3 minutes then no further testing is done because the 10 required successes cannot be achieved. Third, refined humane end-points have been developed for assessing poison efficacy, based on results from research aimed at determining animal welfare impacts of poisons.

Non-target captures

A consequence of carrying out research on wild animals in the field is that there is a range of potential non-target species that are unintentionally manipulated as a "bycatch". Most field-based wild-animal experiments have consequences for non-target species and Landcare Research reports this bycatch along with animal use statistics (Table 3). Both introduced and native species are caught as bycatch. In the 2003 reporting year, 79–98% of captured indigenous animals and 32–48% of introduced animals were released (Landcare Research 2004). Landcare Research has developed a decision chart to assist field staff to decide what should be done if a non-target species is captured. There are also

Table 2 Grades of manipulation on experimental animals.

Grading of manipulations	Grade
Manipulations that are expected to cause little or no stress or discomfort. No suffering.	O
Manipulations that involve minor stress or pain, any pain is of short duration. Little suffering	A
Manipulations that can involve significant but unavoidable stress. If significant pain occurs it will be alleviated. Suffering may occur.	B
Manipulations that cause severe stress or pain which cannot be alleviated because of needs to achieve purpose of experiment. Suffering is probable.	C
Manipulations that cause severe unrelieved stress or pain of short or long duration. High levels of suffering likely.	X

legislative requirements constraining what can be done if introduced wildlife or wild animals (as defined by the Wildlife Act 1953, and the Wild Animal Control Act 1977) are unintentionally caught. Basically these Acts prohibit release of these animals, so even if they are uninjured the Acts require field staff to euthanase these animals.

Although non-target species are routinely captured, these animals are not reported as part of official animal use statistics.

Benefits accruing from wild animal research

Clearly there are welfare costs to animals used in research. However, there are also significant benefits accruing from improvements in the humaneness of control methods used, along with benefits to the environment and livestock health.

Warburton & O'Connor (2004) classified these benefits into three categories:

1. Primary benefits—benefits accruing to the target animals through improvement in control tools reducing welfare compromises.
2. Intra-specific benefits—benefits accruing to the target population through more effective control minimising the number of animals subjected to control over time.
3. Inter-specific benefits—benefits to other species resulting from control of the target species.

Primary benefits

An example of primary benefit is improvement in the efficacy of poisons and traps. Morgan (1982) found that possums survive poison operations primarily because animals either encounter sub-lethal baits, or they only eat a sublethal quantity of bait because of neophobia (including taste or olfactory aversion). When a significant proportion of a population is sublethally poisoned (c. 15%, Morgan 1982) there are significant welfare as well as efficacy concerns as animals may suffer a toxicosis lasting perhaps several days before recovering. Several studies have been carried out to minimise the incidence of sub-lethal poisoning. For example, Batcheler (1982) examined the quality of carrot bait used for rabbits and possums, and showed that bait quality was often very poor with less than 2.8% of baits exceeding the optimal 2 g weight. However, with the implementation of bait screening, 46–62% of bait exceeded the nominal 2 g and significantly improved the probability of a high kill. A secondary impact of poor bait quality is the risk such bait poses to native birds. Powlesland et al. (1999) found that 55% of New Zealand robins were killed during a possum-control operation when carrot baits were unscreened, but only about 9% when screened.

Similarly, Henderson & Frampton (1999) showed that baits with low palatability resulted in greater than 35% of possums being sublethally poisoned, and others that ate only small bait fragments having protracted times to death. However, research showed that if baits had 0.15% 1080, cinnamon as a poison mask, and prefeeding was used, significant improvement in kills could be obtained. Additionally, Frampton et al. (1999) after analysing data from a series of possum-control operations, concluded that the percentage of animals sub-lethally dosed by one bait ranged from 23% to 77%. In contrast, when bait specifications were modified to exclude baits smaller than 4 g, the percentage of sub-lethally dosed possums reduced to 19–66%. Further modification (i.e., baits greater than 4 g and using 1080 concentrations of 0.15%) resulted in the percentage of sub-lethally dosed possums reducing to 0–8%. Clearly significant welfare benefits can be gained by integrating high quality assurance (QA) standards into control operations.

Benefits to the target pest animals can also be achieved if the most humane vertebrate pesticides are used. Pesticides such as sodium and potassium cyanide are favoured because of their rapid action and minimal

Table 3 Bycatch recorded as a consequence of field-based wild-animal research. Note total numbers of animals captured in any one year depends on the number of field-based projects carried out.

	1999	2000	2001	2002	2003
Number of target animals captured	10424	9122	10307	8631	11845
Number of non-target animals captured	1459	1383	1944	673	619
Non-targets as a percentage of total captures	12%	13%	16%	7%	5%

welfare compromise (O'Connor 2000). Studies have assessed the welfare impacts of the vertebrate pesticides used in New Zealand (Gregory et al. 1998, Littin et al. 2002), and a recommended protocol for assessing the relative humaneness of vertebrate pesticides has been developed (Littin & O'Connor 2002).

A research programme focusing on traps has also been carried out in New Zealand to assess the welfare performance of both restraining traps, such as leg-hold traps, and kill traps (Warburton 1982; Warburton 1992; Warburton & Orchard 1996). This research, using testing procedures developed as part of an ISO trap standard (Jotham & Phillips 1994; Warburton 1995), has enabled leg-hold traps used for trapping possums to be ranked on the basis of the frequency and extent of injuries caused to the target species. This research underpins the planned prohibition in New Zealand of a range of leg-hold traps including all long-spring and double-coil spring traps larger than No1s (e.g., Lane-Ace gin traps and Victor No1½ traps), except those with Soft Catch modifications (e.g., Victor No1½ Soft Catch traps). Recent trials assessing the effect that adding chain-springs to traps has on injuries suggests injuries can be significantly reduced by this simple modification (Figure 1) (Warburton & Poutu 2002).

Intra-specific benefits

Most vertebrate pest management in New Zealand is based on a strategy of initially achieving a significant reduction in population numbers and then attempting to maintain the population below some threshold at which the impact of the pest is mitigated (Parkes 1993; Choquenot & Parkes 2001). The frequency at which such "maintenance" control is applied depends on how low the required threshold is and the potential growth rate of the population once control pressure is removed. For many managed pest populations in New Zealand, maintenance control is carried out annually. However, if the frequency of application can be reduced, there are potentially significant benefits to be gained in terms of a reduction in the number of animals subjected to vertebrate pesticides and traps.

One option for reducing the frequency of control is to slow the breeding rate of pest populations. Research is being carried out to develop non-lethal methods for managing vertebrate pest populations with a major focus on fertility control (Cowan 1996, 2000). Although such methods are not operational as yet, computer modelling, supported by field trials of surgically sterilised possums, suggests that the frequency of maintenance control could be reduced from intervals

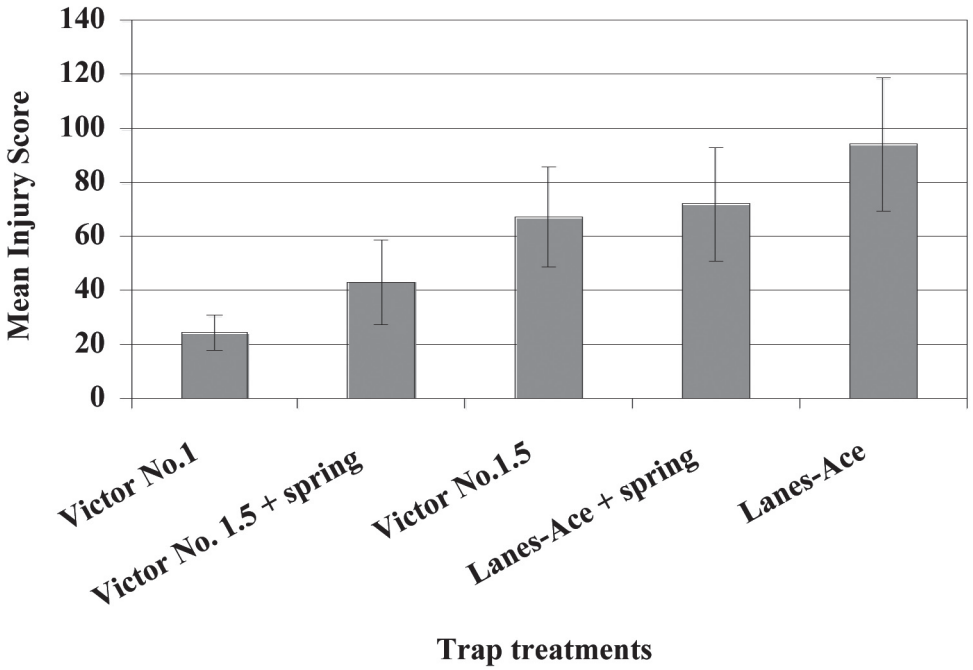

Fig. 1 Mean injury scores of possum limbs captured in leg-hold traps with and without chain springs. Chain springs significantly reduced injuries in both the Lanes-Ace and Victor 1½ traps. (From Warburton & Poutu 2002).

of 1–2 years to as much as 30 years if 80% of females are sterilised and immigration is limited (Ramsey 2000, 2005). If such an approach were applied, even with only 50% sterility, to a typical control area of 10,000 ha, the number of possums having to be killed over a 20-yr period would reduce ten-fold from about 200,000 to 20,000.

Inter-specific benefits

In New Zealand, vertebrate pests are often killed because of their impact as predators on endangered bird species. Consequently, animal-based research that increases the effectiveness of control operations can have a significant benefit for the animal species whose protection is the goal of the control operation. For example, aerial application of 1080 poison baits is often used to control populations of possums and rats (*Rattus rattus*), so that bird species such as the New Zealand robin (*Petroica australis*) may benefit. Powlesland et al. (1999) reported that fledgling success for robins in an area before control was 0.4 fledglings per pair, but increased to 3.8 per pair following control, and the number of birds present increased by 132%.

Similarly, for kukupa (*Hemiphaga novaeseelandiae*, a large native pigeon) at one site nesting success increased from 0% before possum and rat control was carried out to 100% after two years of control (Prime et al. 1999), and at another island site kukupa numbers increased sixfold after possum control (Veltman 2000). Benefits of possum control have also been recorded for kokako (*Callaeas cinerea wilsoni*), which is a rare endemic wattle-bird that has been declining in numbers over recent years on mainland New Zealand. Intensive rat and possum control increased the percentage of adult pairs that successfully fledged chicks from about 25% to 92%. Adult territorial birds in the same area increased from about 50 to more than 80 over a six-year period (Innes et al. 1999).

Mohua (*Mohua ochrocephala*) is another endangered hole-nesting bird that suffers periodic population crashes due to stoat predation. Trapping of stoats during the breeding season can significantly improve the nesting success of this species, with the number of nests successfully fledging young increasing from 36% in untrapped areas to 80% in trapped areas (O'Donnell et al. 1996).

Discussion

Research on wild animals, especially vertebrate pests, poses some special challenges to AEC members and researchers. Researchers involved in field-based projects are not always able to predict the number of animals that might be affected, what non-target species and their numbers might inadvertently be captured or killed, and that experimental animals are not always able to be recovered when required. Additionally, because the commonly used management approach for mitigating pest impacts is to kill the pests, research must by necessity, use these lethal methods to test and evaluate them. Consequently, some wild-animal-based projects have animal-use statistics in the more severe manipulation grades.

Although researchers are aware of the need to apply the principles of the Three Rs (replacement, reduction and refinement), there is very little, if any, opportunity for replacement because of the requirements of needing to specifically treat or observe the target species in its wild habitat. Thus, most improvements in animal welfare need to be made by focussing on reduction and refinement.

Researchers need to ensure their experiments provide sufficient statistical power to enable robust conclusions to be drawn from the results. Recommendations such as those made by Festing et al. (2002) for reducing the use of animals through better experimental design must be more rigorously adhered to, and better understood by researchers, statisticians and AEC members. A point that must not be overlooked is that too few animals, although initially minimising the number of animals being experimented on, may not provide a worthwhile result, wasting both animals and resources. In New Zealand with an increasing amount of research being commercially funded, researchers are pressured to reduce the sample sizes of animals, not because of welfare concerns but in an attempt to be more commercially competitive. Such behaviour increases the chance that experiments will provide inconclusive results and as a consequence animals will be manipulated wastefully. It is critically important that small sample sizes are scrutinised carefully by a statistician to estimate the likely statistical power of the experiment.

Continual improvement in research design (Festing et al. 2002), protocols (NAWAC 2000), and technology (e.g., improved anaesthetics or husbandry techniques) ensure experimental manipulations become increasingly refined. However, there needs to be a concomitant effort in educating researchers on the potential refinements to ensure each project maximises the possible benefits to the experimental animals. Griffin & Gauthier (2004) outline six key principles that AECs and researchers

should adhere to. These are embodied in the New Zealand Animal Welfare Act.

Ensure that:

- the project has merit through having well defined goals;
- all researchers involved have the necessary training and experience;
- all animals in the study are treated in such a manner that their physical and psychological needs are met;
- adequate resources and personnel are available for the duration of the study;
- pain and distress, concomitant with the study, is minimised;
- any animal experiencing unrelievable pain or distress can be recognised and euthanased appropriately.

Given the ongoing need for vertebrate pest control in New Zealand and the support this needs from research, research on wild animals will be required for the foreseeable future. The significant benefits that have been gained from past research and the continual refinements in experimental methods and control technologies should ensure that manipulations of experimental animals continues to be justified, with the recognition that vertebrate pest control research has a focus on humane killing of animals. Pest control by its very nature must accept that killing is required and as Singer (1997) pointed out: "that in a bad situation, [we] therefore seek the least bad way out".

References

Batcheler, C. L. 1982: Quantifying 'bait quality' from the number of random encounters required to kill a pest. *New Zealand Journal of Ecology 5*: 129–139.

Choquenot, D.; Parkes, J. 2001: Setting thresholds for pest control: how does pest density affect resource viability? *Biological Conservation 99*: 29–46.

Cowan, P. E. 1996: Possum biocontrol: prospects for fertility regulation. *Reproduction, Fertility and Development 8*: 655–660.

Cowan, P. E. 2000: Biological control of possums: prospects for the future. Pp. 262–270 *in*: The brushtail possum—biology, impact and management of an introduced marsupial, Montague, T. L. *ed*.

Eason, C. T.; Wickstrom, M.; Gregory, N. 1997: Product stewartship, animal welfare and regulatory toxicology constraints on vertebrate pesticides. Pp. 206–213 *in*: *Proceedings of the 50th Plant Protection Conference.*

Festing, M. F. W.; Overend, P.; Das, R. G.; Borja, M. C.; Berdoy, M. 2002: The design of animal experiments—educing the use of animals in research through better experimental design. Laboratory animal handbooks No. 14. Laboratory Animals Ltd. 112 p.

Fitzgerald, G.; Saunders, L.; Wilkinson, R. 1996: Public perceptions and issues in the present and future management of possums. *MAF Policy Technical Paper 96/4.* 36 p.

Frampton, C. M.: Warburton, B.: Henderson, R. J.: Morgan, D. R. 1999: Optimising bait size and 1080 (sodium monofluoroacetate) concentration for the control of brushtail possums (*Trichosurus vulpecula*). *Wildlife Research 26*: 53–59.

Fraser, W. 2001: Introduced wildlife in New Zealand: a survey of general public views. Landcare Research Science Series No. 23. Mannaki Whenua Press, Lincoln. 45 p.

Gregory, N. G.; Milne, L. M.; Rhodes, A. T.; Littin, K. E.; Wickstrom, M., Eason, C. T. 1998: Effect of potassium cyanide on behaviour and time to death in possums. *New Zealand Veterinary Journal 46*: 60–64.

Griffin, G.; Gauthier, C. 2004: Incorporation of the principles of the three Rs in wildlife research. Pp. 215–219 *in:* Proceedings of the fourth world congress on alternatives and animal use in the life sciences, Balls, M.; Firmani, D.; Rowan, A. N. *eds*. New Orleans, USA.

Henderson, R. J.; Frampton, C. M. 1999: Avoiding bait shyness by improved bait standards. *Landcare Research Contract Report: LC9899/60*. 54 p.

Hickling, G. J. 1994: Animal welfare and vertebrate pest management: compromise or conflict? Pp. 119–123 *in*: Animal welfare in the twenty-first century: ethical, educational and scientific challenges, Baker, R. M.; Mellor, D. J.; Nicol, A. M. *eds*. Proceedings of the conference held at the School of Medicine, Christchurch, New Zealand.

Innes, J.; Hay, R.; Flux, I.; Bradfield, P.; Speed, H.; Jansen, P. 1999: Successful recovery of North Island kokako *Callaeas cinerea wilsoni* populations, by adaptive management. *Biological Conservation 87*: 201–214.

Jotham, N.; Phillips, R. L. 1994: Developing international trap standards—a progress report. Pp. 308–310 *in*: *Proceedings of the16th Vertebrate Pest Conference*.

King, C. M. 1990: The handbook of New Zealand mammals. Oxford University Press, Auckland. 600 p.

Landcare Research 2004: Landcare Research New Zealand Ltd, Annual Report. 72 p. http://www.landcareresearch.co.nz/publications/annualreport_0304/

Littin, K. E.; O'Connor, C. E. 2002: Guidelines for assessing the welfare impacts of vertebrate poisons. Landcare Research Contract Report LC0203/006 (unpublished). 24 p.

Littin, K. E.; O'Connor, C. E., Gregory, N. G.; Mellor, D. J.; Eason, C. T. 2002: Behaviour, coagulopathy and pathology of brushtail possums (*Trichosurus vulpecula*) poisoned with brodifacoum. *Wildlife Research* 29: 259–267.

Morgan, D. R. 1982: Field acceptance of non-toxic and toxic baits by populations of the brushtail possums (*Trichosurus vulpecula* Kerr). *New Zealand Journal of Ecology 5*: 36–43.

NAWAC 2000: Guidelines for assessing the welfare impacts of mammalian restraining and killing traps. NAWAC Document 95/00. Ministry of Agriculture and Forestry, Wellington

O'Connor, C. E. 2000: Animal welfare and behavioural constraints on the use of control technologies. NSSC workshop on possum and bovine Tb management in 2010. Foundation of Research Science and Technology, Wellington.

O'Connor, C.; Warburton, B.; Fisher. M. 2005: Ethics and the killing of wild sentient animals. Pp. 203–207 *in*: *Proceeding of the 13th Australian Vertebrate Pest Conference*, Te Papa, Wellington.

O'Donnell, C. F. J.; Dilks, P. J.; Elliott, G. P. 1996: Control of a stoat (*Mustela erminea*) population irruption to enhance mohua (yellowhead) (*Mohua ochrocephala*) breeding success in New Zealand. *New Zealand Journal of Zoology 23*: 279–286.

Parkes J. P. 1993: The ecological dynamics of pest-resource-people systems. *New Zealand Journal of Zoology 20*: 223–230.

Powlesland, R. G.; Knegtmans, J. W.; Marshall, I. S. J. 1999: Costs and benefits of aerial 1080 possum control operations using carrot baits to North Island robins (*Petroica australis longipes*), Pureora Forest Park. *New Zealand Journal of Ecology 23*: 149–159.

Prime, K.; Nugent, G.; Innes, J. 1999: Pigeons versus Possums: 7–0 at Motatau. *He Korero Paihama—Possum Research News 11*: 1–2.

Ramsey, D. S. L. 2000: The effect of fertility control on the population dynamics and behaviour of brushtail possums (*Trichosurus vulpecula*) in New Zealand. Pp. 212–216 *in*: *Proceedings of the 19th Vertebrate Pest Conference*, Davis.

Ramsey, D. S. L. 2005: Population dynamics of brushtail possums subject to fertility control. *Journal of Applied Ecology 42*: 348–360.

Singer, P. 1997: Neither human nor natural: ethics and feral animals. *Reproduction, Fertility, and Development 9*: 157–162.

Veltman, C. 2000: Do native wildlife benefit from possum control? Pp. 241–250 *in*: The brushtail possum—biology, impact and management of an introduced marsupial, Montague T. L. *ed.*

Warburton, B. 1982: Evaluation of seven trap models as humane and catch-efficient possums traps. *New Zealand Journal of Zoology 9*: 409–418.

Warburton, B. 1992: Victor foot-hold traps for catching Australian brushtail possums in New Zealand: Capture efficiency and injuries. *Wildlife Society Bulletin 20*: 67–73.

Warburton, B. 1995: Setting standards for trapping wildlife. Pp. 283–287 *in*: Proceedings of the 10th Australian Vertebrate Pest Control Conference. Hobart, Australia..

Warburton, B., Orchard, I. 1996: Evaluation of five kill traps for effective capture and killing of Australian brushtail possums (*Trichosurus vulpecula*). *New Zealand Journal of Zoology 23*: 307–314.

Warburton, B.; O'Connor, C. 2004: Research on vertebrate pesticides and traps: do wild animals benefit? Pp. 229–234 *in*: *Proceedings of the Fourth World Congress on Alternatives and Animal Use in the Life Sciences*, Balls, M.; Firmani, D.; Rowan, A. N. *eds* New Orleans, USA.

Warburton, B.; Poutu, N. 2002: Effectiveness of chain-springs on leghold traps for reducing injuries to captured possums. *Landcare Research Contract Report LC0203/031*. 10 p.

Animal welfare at home: considerations and perspectives

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Introduction

New Zealanders, like many Westerners, make their home in a variety of places—from high-rise urban apartment buildings, to the traditional bungalow or villa on the quarter-acre section, to country houses on extensive farms. But no matter where they make their home, they will in all likelihood encounter, and interact with, a variety of animals there.

Typical categories of animals found at home include companion animals, wildlife, and insects and spiders. The nature of interaction with these animals will be influenced by four factors: the individual's make-up and circumstances; the animal's make-up and circumstances; the physical environment; and applicable laws and regulations.

Interactions between humans and animals have the potential to both enhance and compromise the welfare of both.

For the majority of Westerners, their interaction with animals at home represents most, if not all, of their interaction with species other than their own. It is not then surprising that they struggle to comprehend animals—and animal welfare—in other contexts, such as in farming or research.

With technological advances occurring at an exponential rate, it may be that the future will see greater use of technology, such as mobile communications and the internet, as vehicles for facilitating interaction with animals at home.

What is home?

When New Zealanders think of home, many will picture the traditional quarter-acre section complete with its familiar bungalow or villa. While the quarter acre has somewhat shrunk today with the advent of infill housing, it still holds true that the majority of New Zealanders live in a free-standing house.

A more recent development, however, has been the surge in inner-city apartment living. While the market for apartments may fluctuate in the short term, the long-term prospect is that growth in apartment living will more than match growth of our major cities and, for an increasing number of New Zealanders, an apartment will be their home. While some apartments include private rooftop gardens these are the exception, and for many apartment dwellers there is no access to a private outdoor space at home.

At the other end of the spectrum, country houses continue to provide a home for those working the land. However, as with infill city housing, the rural landscape is also changing, as evidenced by the proliferation of lifestyle blocks to meet the needs of city dwellers looking to escape the pressures of urban living.

It is true, also, that many people in thinking of home will also think of their immediate community as being part of their home. This will particularly be the situation the smaller the physical home boundaries; hence, apartment dwellers may have a tendency to include the whole building and immediate neighbourhood in what they think of as home.

Animals found at home

No matter where New Zealanders choose to call home they will in all likelihood encounter a variety of animals there, some of which they will interact with, whether at

their own instigation or that of the animals. The greater the land area associated with the home, generally the greater the number and variety of animals that may be encountered. Hence, rural New Zealanders probably have the most opportunity to interact with a wide variety of animals, while inner-city urban dwellers potentially have the least.

There are three main categories of animals that all New Zealanders will commonly find at home: companion animals; wildlife; and insects, spiders, centipedes and millipedes.

Companion animals

Companion animals are perhaps the most obvious animals to be found at home, in that we provide them with the security of our home in return for their companionship.

New Zealand is reputed to have one of the world's highest percentage of companion animal ownership, and, with regard to cats, the world's highest percentage. Surveys conducted in recent years suggest that just over 50% of households in New Zealand have a cat, with approximately 30% of New Zealand households having a dog (Kerridge pers.comm.).

Interactions with companion animals will, by their very nature, usually be positive for both humans and animals. Humans and companion animals often form lifelong bonds based on strong emotional attachment and trust.

Wildlife

As soon as we walk out of our houses we will encounter wildlife. Birds, both native and introduced, will come and go from our properties. Nocturnal mammals such as hedgehogs and possums may make their way through our properties after dark. Other wildlife, such as rats and mice, may invade our homes. Some of us will find pleasure in, and will seek to interact with, the wildlife around our homes.

Insects, spiders, centipedes and millipedes

Insects, spiders, centipedes and millipedes may frequent our properties in large numbers, which we may or may not be aware of, with a significant number living inside our houses. Most of us instinctively avoid encounters with these animals where we have a choice.

Factors influencing interaction with animals at home

There are four main factors that influence the nature of our interaction with animals at home: the individual's make-up and circumstances; the animal's make-up and circumstances; the physical environment; and applicable laws and regulations. Depending on the combined influence of these factors, our interactions with animals have the potential to both enhance and compromise the welfare of both the animals and ourselves.

Individual's make-up and circumstances

An individual's make-up and circumstances will have a major influence on the way he or she chooses to interact with animals, and the way he or she reacts when approached by animals. Such things as an individual's family, cultural and religious background, education and societal influences, and one-off life experiences will all affect his or her make-up, while his or her work situation, economic means and health will affect his or her current circumstances.

Family, cultural and religious background

An individual's personality is a by-product first and foremost of his or her family upbringing, including any cultural and religious beliefs held by the family.

An unhappy childhood may result in a personality that seeks the unconditional acceptance of animals at home as a substitute for attempts to form relationships with other humans. A classic example of this may be the recluse who feeds hundreds of pigeons around a neighbourhood or who becomes a collector of companion animals far beyond his or her means to care for those animals. At the other extreme is the well-documented link between child abuse and animal abuse (Ascione & Arkow 1999). An abused child may seek to harm animals at home to gain attention or to exert control, or may witness abuse of animals as a means of psychological punishment.

An individual's cultural background may influence how he or she both views and interacts with animals. For example, as Bernard Rollin notes, "Our society considers dogs members of the family; other societies consider them unclean, still others eat them. We ever-increasingly consider horses companions; some

Europeans eat them" (Rollin 2004).

Similarly, an individual's religious background can also influence his or her view of animals. For example, Christianity, Judaism and Islam promote respect for animals while accepting their slaughter as a source of food. On the other hand, Hinduism, Jainism and Buddhism promote a strong vegetarian ethic. In fact, Jains go further, with doctrines advocating non-injury to animals that are taken to the extreme (Masri 1989).

Education and societal influences

If an individual's personality is a by-product, first and foremost, of his or her family upbringing, it is second, a product of the education he or she receives and the societal influences he or she absorbs.

The education system is a powerful influencer of the children who pass through it, and it should therefore be no surprise that just one teacher expressing a strong view towards animals and their welfare can have a marked effect on students for the rest of their lives. No doubt the same can be said for the school which includes in its curriculum the teaching of respect for animals, perhaps with some interaction with live animals.

The importance of education in influencing attitudes towards animals has long been recognised by animal welfare societies worldwide. The Royal New Zealand SPCA's policy on education includes the statement that "The SPCA strongly advocates the inclusion of animal welfare in the school curriculum as a compulsory subject", with the explanation that "The SPCA believes that all students are entitled to receive animal welfare education. If children are taught at an early age to consider the welfare of animals, they are far more likely to grow into young adults who have a respect not only for animals but also for their fellow human beings" (SPCA 2004).

Societal influences may also have a strong impact on the way people live their lives, including the way they interact with animals. Peer pressure is particularly important to young adults, as evidenced by young males who may avoid showing outward affection for animals on the basis that they will appear less "manly" in the eyes of their friends. In SPCA shelters, teenage girls are more likely to volunteer to help with the animals than teenage boys.

One-off life experiences

One-off life experiences have the potential to influence an individual's personality and outlook, particularly if they have occurred at a young age. For example, a youth might find approaching a large dog traumatic if he was badly bitten by a dog as a young child. A woman who witnessed the birth of kittens as a young girl may have a strong desire for her own children to experience the same.

Work situation, economic means and health

An individual's circumstances can also influence the way he or she interacts with animals. In today's society many of us work long hours and many families require two incomes to make ends meet, leaving little time for interaction with animals at home.

Whether or not the household chooses to adopt companion animals, the type of companion animals they adopt, the diet those animals are fed and the veterinary treatment they receive all have the potential to be influenced by the economic means of the household.

An individual's health can also affect, and be affected by, his or her interactions with animals. An individual who is convalescing from an illness may have more time at home to interact with animals, but less energy to sustain any interaction. The therapeutic influence of animal interactions on human health has been well documented. A nationwide survey of Australian households concluded that "those who own pets, especially dogs, have better physical and mental health than non-owners. Pet owners go to the doctor less often. Fewer of them take medication for high blood pressure, sleeping difficulties, high cholesterol or a heart problem" (McHarg et al. 1995).

Similarly, those in society who are physically challenged may also choose to interact with animals at home differently from those who are not. Consider how a blind or deaf person may interact with animals, particularly a guide or hearing dog, or how someone with impaired mobility may interact with companion animals.

Animal's make-up and circumstances

Just as an individual's make-up and circumstances will have an influence on the way he or she interacts with animals, so will an animal's make-up and circumstances

influence the way it interacts with humans, and the way it reacts to approaches by humans.

Such things as an animal's species, breed, size and age will affect an animal's make-up, while such things as health, socialisation and other animals at home will determine circumstances.

Species, breed, size and age

Various species of animal will have varying capacities for interaction with humans. Companion animals have the potential to form close bonds with humans, as compared with wildlife or insects and spiders whose first instinct is likely to be that of taking flight to ensure self-preservation. Within companion animals, a dog for instance generally has the ability to bond more closely with its owner than, say, a budgie or rabbit.

An animal's breed can also influence the way it interacts. Burmese cats are renowned for their affectionate nature towards humans, whereas poodles are a highly intelligent breed of dog capable of quite complex interaction.

The size and age of an animal may both limit and enhance its interaction with humans. For example, large dogs will require more space to exercise than, say, small house dogs, and young animals will be more active and may be more desiring of interaction than elderly animals.

Health, socialisation and other animals at home

In the same way that interaction with animals has the potential to positively influence a person's health, so can interaction with humans positively influence a companion animal's health. Animals in poor health will generally have less energy for interaction, and will require a gentler form of interaction. Animals that are physically challenged or have impaired mobility may interact differently from other animals in the household.

Companion animals require socialisation with other animals, including humans, at a young age. Consider how an unsocialised dog might react to the arrival of new members in the household, both animal and human, as compared with a dog that has been well socialised as a puppy.

Other animals at home can also influence how particular animals in the household interact with humans. An animal that feels insecure in the household's animal hierarchy may withdraw from interaction, as compared with one that is secure in its place in the household. A cat living in a home where there is an abundance of small prey outside may prefer to hunt in preference to seeking interaction with human members of the household.

Physical environment

The physical environment may influence interactions with animals by either allowing or limiting the opportunity for positive interactions to take place. In the worst-case scenario, the well-being of the animal can be negatively affected by the physical environment. The physical environment includes available space, the elements contained within that space and exposure of the space to weather.

Available space

The amount of indoor and outdoor space available to an animal may influence its interactions with humans. For example, consider the situation of a large dog living in an apartment, requiring to be taken from the building by its owner on a regular basis for meaningful exercise, as opposed to the same dog living on a lifestyle block or farm with plenty of room for self-exercise. Consider also the caged budgie, providing opportunities for interaction but at a cost to the budgie's freedom and well-being, as opposed to wild birds outside the house.

Elements within the space

While physical space affects animal interactions, so do the elements that are contained within that space. A large backyard section devoid of any trees or bush will not attract the number of wild birds, insects and spiders that a section full of trees and bush will.

Exposure to weather

The current weather, and seasonal changes, may influence our interactions with animals. For example, if it is raining we may choose to forgo exercising the dog, and during summer we may find more young wildlife coming onto our properties. How much impact the weather has will be determined by the amount of outdoor space relative to the home and its exposure to the elements.

Applicable laws and regulations

Most, if not all, Western societies have laws which to varying degrees protect the welfare of companion

animals and perhaps also native wildlife. Other wildlife, and insects and spiders, are generally not considered worthy of protection.

In New Zealand a variety of legislation protects the welfare of animals at home.

Animal Welfare Act 1999

This primary legislation provides that companion animals must have their physical, health and behavioural needs met in accordance with good practice and scientific knowledge (Animal Welfare Act 1999, section 10). Physical, health and behavioural needs are defined in relation to an animal as including proper and sufficient food and water; adequate shelter; opportunity to display normal patterns of behaviour; physical handling in a manner which minimises the likelihood of unreasonable or unnecessary pain or distress; and protection from, and rapid diagnosis of, any significant injury or disease; being a need which, in each case, is appropriate to the species, environment and circumstances of the animal (Animal Welfare Act 1999, section 4).

Dog Control Act 1996

Specific to dogs, this primary legislation requires dog owners to ensure that their dogs are registered; kept under control at all times; receive proper care and attention and are supplied with proper and sufficient food, water and shelter; receive adequate exercise; do not cause a nuisance to any other person, whether by persistent and loud barking or howling or by any other means; do not injure, endanger, intimidate or otherwise cause distress to any person; do not injure, endanger or cause distress to any stock, poultry, domestic animal or protected wildlife; and do not damage or endanger any property belonging to any other person (Dog Control Act 1996, section 5).

Codes of welfare

Codes of welfare are secondary legislation (regulations) under the Animal Welfare Act 1999. Codes for cats and dogs are due to be gazetted within the next 12 months, providing detailed minimum standards and recommended best practices relating to those animals at home.

Local by-laws

Territorial authorities (local councils) may pass by-laws relating to animals at home. This is particularly so in terms of adopting a policy in respect of dogs, as is required of them by the Dog Control Act (Dog Control Act 1996, section 10). Examples are by-laws limiting the number of animals per household, or providing for off-leash public exercise areas for dogs, or prohibiting the slaughtering of animals, such as pigs, at home for human consumption.

Wildlife Act 1953

Native wildlife found at home may be protected by this primary legislation, which provides that no person may, without lawful authority, hunt or kill any absolutely protected or partially protected wildlife or any game; buy, sell or otherwise dispose of, or have in their possession, any absolutely protected or partially protected wildlife or any game or any skin, feathers or other portion, or any egg, of any absolutely protected or partially protected wildlife or of any game; rob, disturb or destroy, or have in their possession, the nest of any absolutely protected or partially protected wildlife or of any game (Wildlife Act 1953, section 63).

Potential for animal welfare to be affected

Interactions between humans and animals have the potential to both enhance and compromise the welfare of both, and may cover the full spectrum from reciprocated trust to deliberate abuse.

Companion animals are reliant on us to meet all their needs, and therefore, if we fail to do so, there is scope for their welfare to be affected. Perhaps the ideal situation is that of a harmonious relationship between a family and their animal, resulting in positive benefits to both family members and animal. At the other end of the scale is neglect—or, worse, wilful ill-treatment—of the animal, with the result that the animal's welfare is compromised.

Our interactions with wildlife will vary greatly from individual to individual. Some people will ignore the presence of wildlife and not seek interaction, while others will positively seek to invite wildlife to their property and to interact with it. Perhaps the most obvious example is that of providing food for wild birds, whether it be by way of stale bread thrown out onto the lawn or commercial birdseed provided in strategically placed bird feeders.

It is my observation that humans have a tendency to be both fascinated and repelled by insects and spiders. Depending on where we encounter these animals the

experience may or may not be positive for us. While we may watch in wonderment as a spider builds a perfectly symmetrical web in our garden, our reaction to finding such a web within our home may be quite different. Individuals who find insects and spiders within the house will sometimes capture and remove them to their gardens outside, while others will go to some effort to attempt to exterminate them.

Of the four factors influencing interactions with animals at home, an individual's make-up and circumstances is the key factor. This is because this factor has the potential to influence the other three factors to varying degrees. For example, whether a companion animal is properly socialised, and the physical environment in which it lives, will be determined by the make-up and circumstances of its owner. Also, the current laws and regulations relating to animals at home are inevitably influenced by the collective make-up of those individuals empowered to make such laws and regulations. Further, an individual's make-up may determine that he or she chooses to ignore those laws and regulations that are in place, to the detriment of the animals with which he or she interacts.

Comprehending animals and animal welfare in other contexts

When considering interactions with production animals, a further factor needs to be added to the four factors influencing interactions with animals at home. This is economics, and the need for a profit to result from interactions with production animals. Similarly, when considering factors influencing interactions with research animals, while economics will also play a part in influencing these, a much more important additional factor is the research objective.

In both situations these additional factors—economics and the research objective—will strongly influence the nature of the interactions with animals, including the make-up and circumstances of the animals and also their physical environment.

Today, for the majority of Westerners, their interaction with animals at home represents most, if not all, of their interaction with species other than their own. The question, then, is whether the public may increasingly struggle to comprehend animals—and animal welfare—in other contexts, such as in farming or research. This will be important to the farming community, in that the public is a major consumer of product from farms and is a major influencer of animal welfare laws relating to production animals. Similarly, for the research community, the public is often a major consumer of the research outcomes and a major influencer of animal welfare laws relating to research animals. Of most importance will be whether or not the public receives balanced factual information in the future on which to form their opinions.

Future directions

There can be little doubt that technological advances worldwide will continue to occur at an exponential rate in the future, particularly in the area of mobile communications and the internet. Current technology in these areas allows viewing of, and potential interaction with, animals in the home, albeit at a prohibitive cost for the majority of homeowners. However, as technology advances this cost will fall, making it likely that technology will be used as a vehicle for facilitating interaction with animals at home in the future.

Another major area of social change in recent years has been the specific targeting of advertising, and the culture it engenders, at children. As a result, today children become aware of fashion and cultural trends at an early age. The shaping of our future society may therefore increasingly be in the hands of the major conglomerates specifically targeting messages at our children. If some of these messages begin to address the issue of animal welfare, and animals at home, it is likely that there will be a significant impact on future trends in interactions with animals at home.

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References

Ascione, F. R.; Arkow, P. *eds* 1999: Child abuse, domestic violence, and animal abuse—linking the circles of compassion for prevention and intervention. Purdue University Press, West Lafayette, Indiana.

Masri, A. B. A. 1989: Pp. 47–61 *in*: Animals in Islam. The Athene Trust, Petersfield, England.

McHarg, M.; Baldock, C.; Headey, B. W.; Robinson, A. 1995: National People and Pets Survey, Sydney, Urban Animal Management Coalition.

Rollin, B. E. 2004: An ethicist's commentary on cultural bias in animal use. *Canadian Veterinary Journal 45*: 555.

SPCA 2004: Royal New Zealand SPCA National Animal Welfare Policy: Animals in education.

Conference recommendations

Conference recommendations

2003 ANZCCART Conference recommendations and follow-up

A number of recommendations arose from the 2003 ANZCCART Conference. It should be stressed here that these recommendations were essentially action points that were extracted from discussions during the conference break-out session. The action points were subsequently discussed by representatives of three New Zealand bodies: ANZCCART (NZ), the Ministry of Agriculture and Forestry (MAF), and the National Animal Ethics Advisory Committee (NAEAC).

1. Lay Summaries

Aim:
That AECs and all organisations that use animals and report animal use statistics to MAF should provide lay summaries (without Institutional affiliations) to MAF for loading on the internet.

Issue	Responsibility
1. Lay Summaries	ANZCCART
2. Annual Statistics	NAEAC, MAF
3. Degrees of Suffering	NAEAC, MAF
4. Noxious procedures	NAEAC
5. Independent Chairs	
6. Rigour of AEC process	NAEAC, MAF
7. Public Views	MAF
8. Need for Balanced Information	ANZCCART

Action:
ANZCCART (NZ) discussed this at great length during 2004 and it was considered important to take regard of issues surrounding the commercial sensitivity of some work involving the use of animals in research, testing and teaching, and to ensure that lay summaries contain no overt Institutional affiliations. Lay summaries should also be submitted at the conclusion to the project, as opposed to the time at which AEC approval is given.

In terms of providing some direction, it was noted that the UK Home Office, which deals with issuing personal and project licenses to those undertaking animal-based research under the Animals (Scientific Procedures) Act 1986, now publishes abstracts of all new project licenses granted on applications made from early 2005. The abstracts are written by the project license holders, and they own the copyright to the abstracts. The information includes: the specified permissible purposes of the research; the fact that there are no non-animal alternatives; that the expected benefits must outweigh the likely adverse effects on the animals concerned; and that the number of animals and their suffering must be minimised.

In view of the above, it was considered important that the lay summaries should address the following objectives:

- Provide the context of the study by way of a brief background.
- Describe the aim of the study.
- State the necessity of using animals for the study with a consideration of alternatives.
- Describe the outcomes of the study.

ANZCCART (NZ) will send a letter to all New Zealand AECs and organisations reporting animal use statistics to MAF, in order to seek their input on the terms of reference and the format of lay summaries. This letter will be sent in the last quarter of 2005. It is likely that MAF could host the web site of lay summaries.

2. Annual Statistics

***Aim*:**
That more detail be provided in annual statistics.

***Action*:**
More explanatory comments have been provided in the 2003 and 2004 NAEAC Annual Reports. For the statistics collected for the 2005 year, new categories have been provided for: testing; the production of biological agents; and the development of alternatives.

3. Degrees of Suffering

***Aim*:**
Consideration should be given to examining the degrees of suffering with a view to providing better guidance and examples of each category.

***Action*:**
MAF has commissioned an operational research project to review the severity scale. This work is under way.

4. Noxious Procedures

***Aim*:**
That noxious procedures be replaced.

***Action*:**
NAEAC will, through its annual report and NAEAC News, continue to publicise alternatives to noxious procedures

5. Appointment of external/independent chairs of AECs

***Aim*:**
That AECs are chaired in an independent manner.

***Outcome*:**
There was no support for the appointment of independent chairs. The role of chair requires accessible person-to-person interaction with staff of an Institution with a Code of Ethical Conduct, and knowledge of the use of animals in research, testing and teaching. This recommendation was not advanced further.

6. Rigour of AEC Process

***Aim*:**
That AECs should be given the opportunity to exchange ideas regarding best practice in terms of ethics deliberations and issues that recognise and address welfare concerns.

***Action*:**
NAEAC will develop a strategy for allowing AECs to submit their application forms to NAEAC for review and a "big tick". NAEAC is currently working on a mechanism to allow AECs to share information/forms with each other, and a New Zealand workshop for AECs was held in September 2005. MAF was also actively engaged in this workshop.

7. Public Views

***Aim*:**
That it is desirable to achieve evidence of the NZ public's view of the use of animals in research, teaching and testing.

***Action*:**
MAF commissioned some attitudinal research on New Zealanders' attitudes to the use of animals in research, testing and teaching. This research was carried out in June/July 2005 and the outcomes of this research will be published soon.

8. Need for Balanced Information

***Aim*:**
That greater dissemination of unbiased information is required at all levels to convey the facts.

***Action*:**
ANZCCART (NZ) is examining the means by which information on animal-based research could be presented to school students. The NZ Board is still considering the target audience. Importantly, Australia is addressing educational material for primary school students.

2005 ANZCCART Conference recommendations

1. That closer collaboration occur between New Zealand and Australia with regard to information-sharing and striving for best practice in using animals for research, testing and teaching.
2. That ethics should be put back into Animal Ethics Committees. The Australian perspective here is that a lot of ethics occurs within Australian AECs and many have an "ethicist" or "philosopher" on their AEC. This is not the case in New Zealand.