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Transgenesis and animals in research — an overview of animal welfare considerations

Currently, biological sciences are greatly influenced by the emergence of the techniques of molecular genetics. The use of these techniques may raise unique ethical and animal welfare issues, particularly in relation to the manipulation of the genome. The production of transgenic animals is one such manipulation and points to consider in any discussion of the welfare implications of using transgenic animals are summarized here.

What are transgenic animals?

It is possible to transfer a specific sequence of DNA into the genome of an animal. When the DNA encodes a specific gene, the manipulation is one of gene transfer. The transfer of a functional gene into the germline of subsequent generations may change the physiology of those animals in ways that are not always predictable. A number of strategies are being developed to enhance gene transfer, by carrying the DNA with various vectors such as modified retroviruses, adenoviruses or by DNA trapped in liposomes. The DNA is either injected into a dividing oocyte or incorporated into embryonic stem cells *in vitro,* which are subsequently fused with a normal early embryo.

The DNA sequence of a particular gene can be prepared so that the base sequence has been changed in a precise manner. Conditions can be created in which there is a reasonable probability that the new sequence will be inserted into the genome of an animal replacing the normal sequence and thus inactivating that gene. An animal with such an inactivated gene is referred to as a gene knockout animal.

It cannot be assumed that a single copy of a transgene resides in cells of the recipient animal. Subsequent breeding programmes to establish homozygous animals or defined genetic strains may have unique welfare implications as the generation of novel genetic strains requires increased vigilance in detecting unexpected phenotypes.

Since the 1960s, the use, or the ways of avoiding the potential misuse of molecular techniques have been viewed with some mistrust by the public and by certain sectors of the scientific community. It has been suggested that biotechnology may be opening Pandora's box with undesirable consequences. Transgenesis has been viewed in this way but perhaps not from an informed perspective. A number of points for discussion are summarised in the following sections.

Is transgenesis unacceptable because it is unnatural?

Normal breeding procedures include the generation of breeding lines from naturally occurring variants by the selection of preferred phenotypes. After the transfer of a transgene, there may be no obvious phenotype to use as a selective trait and in generating a strain, the important strategy may be to avoid unwanted traits. The co-selection of cryptic variants can occur in both natural breeding and transgenic programmes. It is worth considering the natural progression in which tissue and gene transfer has developed over the last 40 years (Table 1).

The seven categories in Table I illustrate the progressive refinement of the means by which physiological processes can be perturbed . The examples are of obvious clinical relevance and the refinement essentially covers attempts to increase the precision of the modification as the organs are replaced by tissues, then by cells and finally, by specific DNA. Similarly, any augmented function by the transplanted material changes from being under the control of the DNA of the donor cells to being under the control of the DNA of the recipient, with obvious advantages in circumventing the immune rejection of transplanted cells. The reason for describing this progression is to emphasize that transgenesis is not a unique process presenting unique ethical issues, but a step in a continuum of methods, used to influ-

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This issue contains the facts sheet on Occupational Health and Safety in the Animal House and Associated Laboratory Facilities. The facts sheet is also available as an offprint.

ence biological functions. The transfer of genetic material is a basic biological process and the transfer of DNA can be regarded as one of a range of situations whereby this is achieved (Table 2).

With the exception of cloning, these methods present few controversial ethical issues. The creation of transgenic animals emerges as a stage in a natural progression of gene transfer techniques and whether some of these techniques are unnatural or simply progressively refined methods for achieving the same results is debatable.

Transgenesis disturbs the integrity of the genome

The mammalian genome comprises about 105 genes which are arranged in a balanced and cooperative way. Sandoe *et al.*, (1997) have discussed the question of respecting the integrity of the genome. Briefly, it is maintained that transgenesis may cause changes that are too radical to be natural and therefore unacceptable. The diversion of an animal into one with an unnatural genotype could be seen as undesirable but the definition of "natural" needs clarification. It is difficult to accept that evolution has terminated in the sense that there is a normal natural state. Changing a breed, by natural selective breeding or by gene manipulation could be very similar, and have similar implications for, animal welfare. The importance of maintaining genetic integrity is not easy to use as a reason for restricting transgenesis and the retention of an advantageous equilibrium between dominant and recessive genes is not unique to one genetic method. The maintenance of genetic diversity would be a function of how the variants are used, rather than how they were generated, and generating an inbred line of mice would be clearly different from improving a breed of farm animals.

Transgenesis may create unexpected phenotypes

It has been argued by some that the perceived precision of inserting a discrete piece of DNA into the genome is illusory. Genes can be engineered to be expressed in specific tissues only, for example, as modified mammary secretions or in subsets of immune cells and they can be switched on or off in various ways. Gene regulation is a function of an interacting network, rather than a series of independent units. Thus, the insertion of a new gene at the wrong site can inactivate other genes.

The effects of inserting growth hormone genes is the standard example of genetic modifications that may cause multiple effects of doubtful benefit to the transgenic animal. It is generally accepted, in rodents particularly, that "bizarre" forms of animals hardly ever survive an effective ontogenic screen, consisting of the maintenance of viability *in utero*, competition with litter mates or even maternal cannibalism of the unfit offspring. There are, however, mutant forms with late onset traits. Screening for such traits that should be culled raises additional long-term welfare considerations.

Developing transgenic animals may have unfortunate consequences for humans

The intentional modification of the genome in humans so that change is carried into the next generation is unacceptable to Human Ethics Committees. Gene therapy protocols are required to specifically exclude the possibility of germline modification. It has been argued that increasing the efficiency of germline modification in animals increases the likelihood that the technology will be misused in humans. This point of view should be balanced by the potential benefits that additional knowledge from animal work will have on coping with human disorders.

Table 1

Successive refinement of methods to alter physiological processes in animals

Process	*Example*
Blood transfusion	
Organ transplantation	kidney, heart, liver etc.
Bone-marrow transplantation	
Tissue transplantation	skin grafts, pancreatic islets
Cell transplantation	myoblasts, hepatocytes, dopamine cells
Gene transfer *ex vivo*	modified embryonic stem cells
Gene transfer *in vivo*	nucleic acid with or without vectors

Welfare implications in the construction of transgenic animals

It is the expression of genes rather than the construction of transgenic animals that has the potential for affecting well-being. In most cases, the possession of transgenes leads to no perceptible changes, but it is possible that well-being can be reduced or enhanced. Not only is the magnitude of effects important but there is a temporal factor. The effect of a novel gene may be restricted to a narrow window of time in the lifetime of an animal.

Ideally, it should be possible to have a list of indicators with which the well-being of an animal can be measured. An excellent example of this approach is illustrated by Morton (1998) who has listed markers for health and well-being. Broom (1997) has also attempted to list a series of welfare indicators. They would be species-specific and require a detailed knowledge of the normal states of behaviour and physiology throughout the lifespan of the animal. There are difficulties in establishing the normal baseline, particularly with commercially bred animals. Orthodox breeding may diminish well-being, as has been found in

Table 2

The range of situations whereby gene transfers are achieved

1. Normal fertilisation
2. Artificial insemination
3. *In vitro* fertilisation
4. Intrafallopian transfer of gametes
5. Nuclear transfer (cloning)
6. Use of embryonic stem cells
7. *In vivo* gene transfer

some meat-producing animals. The usual minimal observations on feeding, reproductive ability and excretion are becoming inadequate and various aspects of appearance, behavioural characteristics and response to social challenges will be necessary to use before precise attempts to score well-being replaces subjective assessments.

Transgenic animals as models of human disease

A number of disorders can be attributed to one or more dysfunctional genes. However, many gene systems are redundant so that a mutant gene may not be detectable by a function. In terms of metabolic networks, alternative pathways may be available. 'Immunodeficiency' is an example of a phenotype that can be acquired by the acquisition of one of a range of different genetic variants. It follows that the characteristics of an aspect of that disorder may only be reproduced in one of a number of transgenic or gene knock-out strains. The production of numerous lines of transgenic animals from which to select an appropriate model, does not seem to be consistent with the general aims of reducing the number of animals used but, nevertheless, may be essential to achieve the aims of attaining an informative model.

The consideration of protocols by animal ethics committees in New Zealand

The general philosophy behind the acceptance of protocols is well established. Provided that the outcomes of the experiment match any negative effects on animal welfare (the ethical cost) the protocol should reflect attempts to reduce, refine and replace the use of animals. The production of transgenic animals is a manipulation that requires ethical approval. It is perhaps ironic that the less refined approach using traditional breeding approaches, to achieve similar ends, would not require specific approval provided minimal standards of animal husbandry are met.

When does ethical approval cease and the requirements of standard husbandry become the sole criterion? It would be reasonable to insist on the protocol extending into a substantial portion of the lifetime of the animal and into, at least, the next generation so that late onset traits can be monitored for their effects on animal well-being. What would be normal breeding practice to produce animals that are homozygous at the introduced, or deleted, locus could be seen as a manipulation requiring special monitoring procedures, to make sure that the emerging homozygotes have no special welfare requirements.

In Europe, there are moves to consider the animal welfare aspects of biotechnology and collect the disparate findings that are emerging. The regulatory body in New Zealand is the Environmental Risk Management Authority (ERMA) and the containment of approved novel genetically-modified organisms is controlled by this authority. As these activities develop, it is clear that interactions between regulatory bodies and ethics committees will increase to the benefit of animal welfare. The points summarised here merely touch on some of the discussion points in considering transgenesis with the hope that persons concerned are encouraged to consider points that are omitted, overemphasized or thought irrelevant.

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Regulation of animal use in research, testing and teaching in New Zealand — the black, the white and the grey

The law in New Zealand requires those who manipulate live vertebrate animals for the purposes of research, experimentation, testing, teaching or the production of biological agents, to do so in accordance with an approved code of ethical conduct. Deciding which activities are encompassed by this requirement and which are not is not always straightforward. This article examines some activities that clearly require coverage by a code (the "black"), some that clearly do not (the "white") and some issues surrounding borderline activities (the "grey").

The Animals Protection (Codes of Ethical Conduct) Regulations 1987 require that any organisation or individual which, or who, manipulates live animals for the purposes of research, experimentation, diagnostic, toxicity or potency testing or teaching do so in accordance with the Code of ethical conduct approved by the Minister of Agriculture. Since mid-1988, the manipulation of animals for the purposes of producing antisera or other biological agents has also required coverage by the Code.

Issues

The identification of those affected by regulations, i.e., manipulators, is an ongoing task as there are always new players who may be unaware of their legal obligations. Having identified the potential manipulator, it must be decided whether their activities fall within the purview of the regulations. In the majority of instances, the answer is readily apparent but there are some activities that are less clear-cut. In trying to determine whether an activity constitutes a manipulation for the purposes of the regulations, it is useful to use a three-step test:

1 Is the activity being performed on a live animal (as defined in the law)?

2 Does the activity constitute a manipulation (as defined in the law)?

3 Does the reason that the activity is being performed fall into the category of research, experimentation, diagnostic, toxicity or potency testing, work for the purposes of producing biological agents, or teaching?

If the answers to all three questions are yes, then the activity must be performed in accordance with an approved code. If the answer to any of the questions is no, then a code is not necessary.

The black and the white

Some examples of activities that clearly require a code of ethical conduct are:

- basic biological, biomedical, veterinary and agricultural research using live animals;
- non-recovery surgery carried out by veterinary students as part of their training;
- testing animal vaccines on laboratory rodents;
- regular blood harvesting from animals to produce antiserum; and
- the manipulation of animals for teaching purposes.

Although it may not be the first legal issue that springs to mind when considering rabbit calicivirus disease (RCD), the spreading of the RCD virus by injecting caged rabbits with the virus mixture for the production of additional virus material and releasing them into the wild is also an activity that falls within the regulations. The decision making process for this example is as follows.

Captured wild rabbits fall within the definition of animal (i.e., they are in a state of captivity). Injecting them with a viral mixture exposes them to a micro-organism, and is therefore a manipulation, while the purpose of the activity is the production of biological agents.

Note, however, that harvesting dead rabbits for the same purpose does not require a code.

There are other activities that definitely do not require a code of ethical conduct. For example, keeping animals in kindergartens or classrooms as pets or for purely observational purposes does not involve a manipulation and thus does not require a code.

Contrary to an apparently common belief, dissections on carcase material do not require ethical approval either. The regulations are specifically restricted to live animals. The Animals Protection Act provides an exemption for the humane killing of animals. Killing an animal humanely is therefore not covered by the regulations, regardless of what is done to the body subsequently.

For the same reason, farming practices that involve surgical procedures (such as tailing or castration) when done in the context of routine farm management are not manipulations, because they are not being performed for the purposes of research, testing and teaching. However, it is worth noting that the same procedures do require ethical approval in some circumstances. One example would be where the procedures were being carried out as part of a research programme to compare different methods of castration.

The grey

There are a number of activities that fall within a grey area, i.e., where the answer to one or more of the questions in the three step test is not immediately clear or is a matter of judgement.

One such grey area is the use of foetuses. The law does not define the point at which a conceptus becomes an animal (e.g., only when it has been born, or at conception, or at some point in between). This is a matter that could be determined only by the courts. However, foetuses are used in research, testing and the production of biological agents, so the question arises as to whether the procedures

need to be covered by a code of ethical conduct.

In a similar vein, the National Animal Ethics Advisory Committee (NAEAC) has considered the harvesting of foetuses at slaughter premises for the purpose of producing biological agents. In this instance, the foetuses were not merely an occasional by-product of the routine culling of ewes, but rather the ewes were to be slaughtered primarily so that foetal tissue could be harvested. These issues raise some technical points of law, which are currently under discussion.

Bird banding is another issue that NAEAC has been considering recently. Bird banding (a term that encompasses ringing, tagging and other marking) is an activity that has been performed in New Zealand as part of official schemes administered by various agencies (currently the Department of Conservation) for about 50 years. It was considered that the activity was exempt from the provisions of the *Animals Protection Act*, which state that nothing in the Act *shall render unlawful ... the earmarking or branding of any animal*... or the ... *capturing of any animal in a wild state.*

However, it has recently been suggested that bird banding is carried out for the purposes of research in a broad sense and that it constitutes, broadly speaking, a manipulation. On the other hand, it is argued that the National Banding Scheme already regulates the practice of bird banding through a permit system that controls personnel, species, method of capture and method of identification. To impose a further approval system from an AEC is regarded as an unnecessary burden.

NAEAC has not yet made a decision on whether bird banding is, or should be, classed as a manipulation. As some bird banding techniques could be categorised as invasive (e.g., when tags are applied through the skin or the suturing of transmitter base plates to birds), NAEAC is seeking further information on these techniques.

Another grey area relates to what might be termed "incidental" manipulations. Wild animals (e.g., possums) required for research projects must be captured. To ensure sufficient numbers to meet any age or sex ratio requirements, more animals are captured than are needed for the project. Some surplus animals are euthanased, while others may die before being assigned to a specific research project. Should these animals be regarded as having been manipulated? NAEAC concluded that capturing wild animals is exempted by the Act, as is killing them. Thus possums that are not actually used in a research project are not manipulated.

Further debate arises regarding training courses. There are a number of courses at the senior secondary school, pre-employment or polytechnic level that teach animal handling or husbandry skills. The animals involved are generally livestock, but companion animals would be involved in veterinary nursing courses, for example. Two of the criteria are clearly met - the animals fall within the definition, and the activity is for teaching purposes.

The question to resolve is, is it a manipulation? Docking tails certainly interferes with the anatomical integrity of an animal. One may decide that teaching people to dock dairy cattle tails during a training course is a manipulation. The ramifications of this are possible perceptions of "bureaucracy gone mad", not to mention an argument for saying that every farmer who teaches a new farmhand some animal handling skills needs a code of ethical conduct.

On the other hand, bringing the family pet into a veterinary nursing course so that students can practise injection techniques may be an activity that more readily suggests the need for ethical approval.

The rule of thumb developed to cover these types of situations is that if the procedure that is performed in a teaching situation would be performed anyway (e.g., the trainees are learning how to drench sheep that were due to be drenched) then coverage by a code is not necessary. However, if the procedure is one that would not have been carried out at the time, or if the procedure is repeated a number of times, then a code of ethical conduct is advisable.

Similarly, farmers and veterinarians conduct on-farm trials to improve stock health, growth rates, fertility and productivity. Trials may involve sporidesmin challenge testing, selection for parasite resistance, artificial breeding or libido testing.

Such procedures may, strictly speaking, require a code of ethical conduct even though this appears not to have been intended in the original regulations. However, a very recent amendment to the Animals Protection (Codes of Ethical Conduct) Regulations exempts animal evaluations carried out by a veterinary surgeon on any animals in his or her immediate care - with certain provisos.

Conclusion

The Animals Protection (Codes of Ethical Conduct) Regulations have been operating now for 10 years and more than 80 organisations or individuals are operating under a code of ethical conduct that has been approved by the Minister of Agriculture. Such codes ensure that the welfare and humane treatment of live animals used for research, testing, teaching and the production of biological agents is fully considered by an AEC (which includes at least three members from outside the organisation) prior to any manipulations being performed.

If anyone is unclear whether particular activities should be covered by a code of ethical conduct, they are advised to contact MAF's Animal Welfare and Environment Section.

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Animal groups put the Australian research community 'on notice' over AEC performance

Animals Australia (ANZFAS) has real concerns about the performance of the Animal Ethics Committee (AECs) system. The federation represents some 40 of the most prominent animal welfare organisations in Australia (and in New Zealand), and those groups either individually or through Animals Australia provide Category C members (persons with a demonstrable commitment to animal welfare) to AECs. At the 1998 Annual General Meeting in Perth on 25 July, delegates from those groups participated in a special workshop to discuss the question 'Should we stay?'. The 'full and frank' debate at the workshop led to a resolution (below) that calls for significant reform as a condition of future participation.

Pressure has built over recent years for the Animals Australia management to recommend against its members continuing to support the AEC system. Some active animal welfare campaigners repeatedly expressed their concern that our participation lends unjustifiable credibility to the work of AECs. Certainly the recent withdrawal of RSPCA NSW nominees brought the criticism to a head.

Animals Australia and its member organisations have provided nominees to institutional AECs for more than a decade, and since the early 1990s have provided those people with support, training, a lay members manual, and (for a time) a dedicated newsletter. In addition, Animals Australia people have participated in the *Code of Practice* reviews and State/Territory legislative reviews, and since 1992 publicly articulated the flaws and problems in the effectiveness of AECs, and of course called for greater accountability of this 'self-regulatory' model.

While Animals Australia has arguably 'played the game', it seems that the 3Rs (replacement, reduction and refinement) are still not being taken seriously. There is a prevailing and widespread misapprehension in the research community that all research is more important than the lives of animals. The group dynamics of an AEC, the failure of most researchers to even attempt to provide the Committee with literature reviews or other independent evidence of the importance of the work, or to explore alternatives to animals, leads to a mere 'housekeeper' role for the AEC. Ethics is much more than this. Application of the Australian Code of Practice is woeful.

The Workshop, in assessing future support for the AEC system by Animals Australia, debated the following questions:

- Are improvements at some institutions, such as better housing, lower animal numbers (particularly in teaching) and some refinements (e.g., more highly trained handlers and better analgesia), enough to justify the time, energy and stress of serving on an AEC?
- Are animal welfare / rights members on AECs being 'used' by government and research interests to legitimise the use of animals in research, and thus give credibility to a biased system?
- What impact would the withdrawal of our Category C members from AECs have on the way decisions are made for animals in research?
- What changes are needed to make the AEC system work to protect animals from unnecessary research and from unnecessary suffering?
- What role could Animals Australia and its member societies play in introducing any changes?

The following resolutions were strongly supported by the plenary session of the Animals Australia/ANZFAS Annual Meeting:

Animals Australia (ANZFAS) is aware that large numbers of Animal Ethics Committees (AECs) currently fail in their duty to properly replace animals in research, reduce numbers used, and refine research methods to prevent animal suffering.

Therefore, Animals Australia (ANZFAS) seriously questions the value of the AEC system, particularly as in many States/Territories there is little effective assessment of AEC performance.

Animals Australia (ANZFAS) hereby puts the research community 'on notice' that unless prompt redress of this situation occurs, it will recommend to its member societies and supporters that they withdraw their services as Category 'C' (animal welfare) members of AECs.

Animals Australia (ANZFAS) therefore recommends that each State/Territory:

- *Establishes an independent audit system (which includes animal welfare representation) to report to each State / Territory Animal Welfare Advisory Committee (or similar) within one year (i.e. July 1999);*
- *Establishes a professional inspectorate to oversee animal research, and which will provide a report to Parliament each year of their activities and findings; and*
- *Conducts compulsory training modules for all AEC members to undertake before, or within six months of joining an AEC, and every two years thereafter.*

In passing the above resolutions, particularly the recommendations regarding State and Territory governments, delegates were well aware of the very different regimes that currently exist across Australia. In some jurisdictions, or even within more progressive institutions, some of the suggestions may already be in place. However, we are not aware of any example where all these practices occur, and in the vast majority few, if any, checks and balances are operating. Animals are capable of suffering wherever they are and deserve a uniform and effective protection mechanism.

A sense of frustration and anger was evident during the Workshop, understandable when it is realised that several million animals are used, and most lose their lives each year for research in Australia. With the

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Occupational Health and Safety in the Animal House and Associated Laboratory Facilities

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1. The Occupational Health and Safety Laws in Australia

All States and Territories of Australia have in place occupational health and safety (OHS) legislation which contain a statutory *duties of care*, defining the responsibilities of employers and employees and other people who are associated with the workplace (1). Specifically, the aims of the OHS Acts are the promotion of safety and health of employees by reducing or eliminating hazards, protecting people in the workplace from hazards, securing a safe and hygienic work environment, fostering co-operation, participation and consultation by and/or between all parties involved in the workplace on matters concerning OHS and to promote education and community awareness on matters relating to OHS (1).

The employer must ensure that *as far as is practicable* the workplace is free of hazards, work practices are safe, workplace and employees are supervised, employees are informed, instructed and trained and that the employer consults and co-operates with employees and OHS representatives on matters concerning OHS (1).

The employee must take reasonable care to protect him/herself and others in the workplace. This means that an employee must co-operate with the employer on matters concerning OHS, must follow safe work practices and must use protective equipment (1).

2. The difference between hazards and risks

Hazards are not the same as risks. The animal house has many hazards, but with proper management, risks to the laboratory animal technician should be minimal. A hazard in the workplace is the actual or potential danger which poses a potential threat to the wellbeing of a staff member, whereas a risk is the probability that the hazardous situation will cause damage to the staff member (2).

A safer workplace requires management and employees to consult about work practices and safety measures. One way to achieve this is by the preparation of a 'WorkSafe Plan' (3) and the conduct of a safety audit (4, 5, 6, 7). Hazards can be identified by conducting a *Hazard and Operability* (HAZOP) study (4). A HAZOP study identifies potential hazards affecting OHS and recommends control or mitigating measures to reduce or eliminate the hazards. An important part of a HAZOP study is the assessment of the risk for the hazards identified in any given situation (Tables 1 and 2). (4). Once the risk is estimated, management can proceed with the allocation of resources in order to reduce or eliminate the hazards (5, 8). Resources should be allocated to the highest risk situations or to situations that give a rapid and obvious result. The latter can often be beneficial in situations where a tangible commitment by management to the work place environment will have positive effects on staff morale and ensure that later more difficult remedies are able to be implemented with a degree of employee good will (5, 9, 10).

To identify the hazards in the animal house and to prepare a HAZOP study a list of key words is constructed. The construction of the list can be carried out in many ways including literature searches and staff consultation (4, 5, 11).

The following keyword list is an attempt to provide the minimum number of identifiable hazards around which management might construct a HAZOP study.

3. Keywords to be used in a HAZOP study

3.1. Allergic rhinitis, occupational asthma and allergic dermatitis

Allergic rhinitis is the most common outcome of occupational exposure to laboratory animals (12, 13, 14, 15), accounting for at least 90% of all symptoms associated with laboratory animal allergy (LAA) (14). In its most severe form, LAA could be classed as an occupational asthma. Despite the higher incidence of allergic rhinitis (16, 17), most studies have concentrated on allergic reactions affecting the lower respiratory tract (18, 19, 20, 21, 22). Allergic reactions of the lower respiratory tract are generically described as asthma and characterised by the narrowing of bronchioles with associated respiratory symptoms such as coughing, shortness of breath, wheezing and chest tightness (23). Asthma is an IgE-mediated immediate (Type I) respiratory allergic disease (13, 24). Occupational asthma is defined as an asthmatic syndrome caused by hypersensitivity to a specific agent (sensitising agent) in the work environment in a previously non-asthmatic person (23). LAA is the most common form of occupational asthma experienced by laboratory animal tech-

Table 1. Risk Scoring Table

To prepare a risk matrix an operation / procedure requires a frequency score and a consequence score to be assigned.

Frequency	Index	Consequence	Index
Continuous (100 times/day)	0	None (No injury potential)	0
Intermittent (10 times/day)	1	Minor (Injury produces no long term effects and hospitalisation unlikely)	1
Brief (1 times/day)	2	Significant (Injury produces no long term effects but hospitalisation likely)	2
Occasional (once/week)	3	Major (Severe injury requiring hospitalisation and produces long term effects)	3

The risk of an operation/procedure is calculated by the equation: **R = C – F**, where R = risk, C = consequence and F = frequency. The operation/procedure can be ranked between –3 and +3, with a +3 ranked task representing a very high risk level, a 0 ranked task representing an intermediate risk and a –3 ranked task representing a very low risk

Table 2. Risk Matrix Table

To identify the operations /procedures which present the highest risk a risk matrix is prepared.

	Frequency			
Consequence	**Occasional**	**Brief**	**Intermittent**	**Continuous**
Major	0	+1	+2	+3
Significant	-1	0	+1	+2
Minor	-2	-1	0	+1
None	-3	-2	-1	0

A risk of +3 indicates a need to commit resources and/or undertake major changes to reduce the risk, whereas management would not be expected to commit major expenditure or changes to mitigate hazards with a low risk of –3. A low risk does not mean that no resource allocation is required. Some spending may be required to achieve good engineering and OHS standards as required by *Good Laboratory Practices.*

(Reference: ERM Hong Kong (1997). Safety of work procedures at the Chinese University of Hong Kong Animal House. Report prepared for the Chinese University of Hong Kong Animal House by ERM-Hong Kong Ltd. 6/F Hecny St., 9 Chatham Rd., Tsim Sha Tsui, Kowloon Hong Kong.)

nicians (22, 24), but it is by no means the only cause of occupational asthma (25). A person working in a laboratory animal house can be sensitised to any airborne allergen in the work environment. Those found in an animal facility include mould spores (17), organic dust especially cereal from animal diets (17, 25), and wood products from animal bedding (17, 23), latex particles attached to powder used to lubricate gloves (25, 26), and storage mites of feed (17, 23, 27).

Allergens implicated in LAA are animal proteins derived from serum and urine which have contaminated skin or fur of laboratory animals, or which have contaminated bedding or faecal dust (13, 24). Earlier work inaccurately described allergens as being fur, hair and dander and this was supported by non-specific allergen tests of the time, such as the human skin prick test (12, 13, 24). However, with better immunological technology it has been shown that the main animal allergens are protein molecules of low molecular weight which belong to the family of proteins called lipocalins (15, 28). The other important group of allergens is the serum proteins, particularly albumin (13, 15, 24, 28). Inhalation of aerosols of rodent urine containing allergenic proteins has been shown to be the most important source for allergens (14, 15, 18). However, the role of fur, dander, saliva, faeces, epithelium and serum (particularly aerosols created during surgical intervention (29)) can not be under-estimated (13, 24). Studies have reported a prevalence of LAA ranging from 7% to 44% of people exposed to laboratory animals (13, 14, 30, 24). However, it is possible that this is an underestimate of the extent of the problem, as the more severely affected workers may seek alternative employment (12, 13, 14, 24). The annual incidence has been reported as ranging from 13% to 37% (22, 24, 31), although a lower incidence ranging from 2% to 10% has been reported following the introduction of protective measures (22, 31).

A typical profile for an employee with LAA is as follows: a scientific or technical worker, 23-32 years old, male or female, family and/or personal history of atopy, and who develops LAA within two to three years of initiating close contact with laboratory animals. Typically the patient shows a Type 1 (immediate) allergic reaction within minutes of contact with animals, where the most frequent symptoms are rhinitis, coughing and asthma (12, 13, 14, 24). The above profile is valuable in assessing the consequences of LAA because individuals who develop LAA are generally young, who have developed LAA only relatively recently, suggesting a body of employees not continuing with work involving laboratory animals (12). Anecdotal evidence suggests that LAA creates greater hardship for technical staff working with laboratory animals than for researchers. Researchers who become allergic to laboratory animals can be expected to remain in research and accommodate their allergy by changing research protocols to avoid contact with laboratory animals. A technical staff member is usually not able to modify his/her work environment to the same extent as a researcher and so is more likely to seek alternative employment. This is often in a totally unrelated field, resulting in the individual having to stop working with laboratory animals at an early to mid-point in their career (12, 14, 24).

Allergic dermatitis is not just a skin manifestation of LAA, as there are many allergens other than animal proteins which can cause allergic dermatitis (5, 32, 33, 34). Some of the other allergens found in an animal house include: latex, formaldehyde, industrial enzymes (eg. detergents), proteins from wheat flour and storage mites (32). Individuals who handle animals as a significant part of their employment are amongst the groups of employees which most commonly report occupational allergic dermatitis and/or contact urticaria (32) and, despite the large number of potential allergens, animal proteins are the most common allergens involved in allergic dermatitis.

3.2. Manual handling

A HAZOP survey of a major university laboratory animal unit found that manual handling of animals, goods and equipment posed the greatest hazard within the unit, and because of poor work practices, provided the most risk (4). When manual handling tasks of employees were identified, the tasks that posed the greatest risk were bedding preparation and tray/cage changing, feeding and watering, lifting and carrying large size faeces collection trays, lifting and carrying feed, bedding and rubbish bags in excess of 25kg; and the risk of repetitive strain injury resulted from emptying, scraping and washing animal trays and cages.

The manual task of changing cages during the cleaning process was further studied (35) in order to identify the various factors that can be modified to reduce the risk of musculoskeletal disorders associated with manual handling. Factors that affect muscle loading during manual tasks include the size of the object, height or position at which the objects to be lifted are placed, weight of objects, duration of the lift and frequency of the lifting task (35). More specifically, the risk of musculoskeletal disorders from any manual task is increased with awkward or static postures (e.g. working with hands above shoulder height or using a twisting motion of the torso), heavy weights, direct load bearing by muscles, repetitive arm movements (36, 37) and lack of rest. Risk factors associated with muculoskeletal disorders associated with manual handling can be therefore attributed to two key causes: poor human posture and poor work station design (35, 38, 39). The study specifically looked at work station design and used a five-row rodent rack that is commonly used in laboratory animal facilities as the standard design. Racks used in this study were either manufactured by Techniplast, (Italy) or NKP, (United Kingdom). The study looked at weight of boxes being lifted and cleaned as well as the height of the cage within the rack. Weights reflected the minimum, mode and maximum weight of cages that had previously been measured in the animal facility, and the heights corresponded to each of the five rows within the standard rodent rack. Muscle loadings as a function of muscle activity and worker posture were measured for

each worker as cages were changed. The most significant finding of the study was that the position of the cage within the rack was the main factor affecting muscle loading, and therefore musculoskeletal disorders of cage changing (35). As far as it can be ascertained, this is the first study of its kind to look specifically at manual handling in the laboratory animal workplace.

3.3. Physical injury

The HAZOP survey of the laboratory animal unit mentioned previously (4), identified three major areas of physical injury: slips and falls, bites and scratches, and burns and cuts.

With the exception of injury from non-human primates (40), physical injuries in the laboratory animal workplace do not appear to have been widely studied (5). In most countries with well developed OHS legislation there is a legal obligation to report to the government agency responsible for OHS any accidents that cause death or serious injury, or injury that results in loss of employment greater than 10 working days (41). However, for lesser injuries that may or may not result in loss of production there is no requirement to report incidents to the government authority so that there are no reliable statistics to determine the extent of workplace physical injuries. However, individual workplaces, especially larger facilities, generally maintain an incident reporting system which, if well managed, can provide quite accurate workplace physical injury statistics, particularly in relation to lesser physical injuries, for their respective workplaces (4, 5, 33). This information can provide the baseline data for measuring any improvement as a consequence of workplace changes (7).

3.4. Biohazards and chemical and physical hazards

Biohazards, chemical and physical hazards are ubiquitous in the laboratory animal workplace. Biohazards include infectious diseases and zoonotic diseases. Chemical hazards include anaesthetic gas contamination of the laboratory environment as well other chemicals used in the laboratory that can potentially contaminate the workplace. Physical hazards include radioactive material contamination of the animal facility and associated laboratories, as well as excessive workplace noise and high environmental temperatures in work areas (5, 34).

3.4.1. Biohazards

Occupationally acquired infections within the laboratory workplace and clinical environment have been reported and reviewed by several authors (5, 42). The type of infections depend largely on the nature of employment and the workplace setting. Significantly, laboratory workers and those in allied fields have a higher prevalence of certain infections (including tuberculosis, shigellosis and hepatitis) than the general population, indicating the increase in diversity and severity of biohazards in the laboratory environment (26, 33, 34, 43, 44).

For the purpose of this paper infectious agents can be divided into two broad categories: non-zoonotic infectious disease and zoonotic infectious disease.

Non-zoonotic infectious disease:

- *Tuberculosis.* Transmission of *Mycobacterium sp.* bacilli from laboratory animals to employee is principally by the respiratory route. Specific situations that create aerosols or airborne particles include dusty bedding from infected animals, aerosolisation of organisms from cage cleaning procedures, and aerosolisation during necropsy (26, 34).

- *Hepatitis B (HBV).* The greatest risk factor for transmission of HBV and HIV (human immunodeficiency virus) in the clinical environment is needle stick injury (26, 33, 34). Data on exposure in the laboratory animal setting are not known, but the risk is present, particularly where clinically derived and unscreened human products are used in the laboratory animal (e.g. to raise polyclonal antibodies). Non-human primates, especially Cynomolgus monkeys, have also been identified as potential sources of hepatitis B infection (34), placing non-human primate handlers in the "at-risk" category.

Zoonotic infectious diseases:

- *Enteric pathogens.* The most common occupational zoonoses are enteric pathogens such as *Campylobacter, Salmonella* and *Shigella.* (5, 34). The most common host species include, but are not limited to non-human primates, dogs, guinea pigs and rabbits (5, 34).

- *Q fever.* The organism responsible for Q fever is ubiquitous in Australian agriculture and is therefore a common zoonotic infection in any employee working with ruminants, especially goats and sheep (5, 34, 42). However, these animals are not the sole hosts for this organism; rabbits are considered at high risk of being asymptomatic carriers (5).

- *Protozoal diseases. Cryptosporidium* species, *Giardia* species and *Toxoplasma gondii* have been identified in rodents (particularly guinea pigs), cats, sheep and non-human primates (5, 34). Infection due to aerosolisation of tissue fluids, accidental ingestion or needle stick injury have all been documented as means of transmission for these organisms (5, 34, 42). Generally infection is self-limiting but individuals who are immunocompromised or pregnant are particularly at risk of either developing a fulminating disease in the former case, and foetal abnormalities or abortion in the latter case (34, 42).

- *B virus infection. Herpesvirus simiae* is a significant zoonotic hazard for employees working with non-human primates of the *Macaca* genus (45).

Transmission is by exposure to saliva from infected and shedding non-human primates, with entry into the human via scratches, bites or contamination of mucous membranes (45). Morbidity and mortality from herpes B is high and, significantly, seroprevalence studies in asymptomatic non-human primate handlers have demonstrated the absence of herpes B antibodies, suggesting that the herpes B virus does not cause asymptomatic infection in humans (46).

- *Other pathogens.* Pathogens that are zoonotic are well described in standard text books (42) and the circumstances in individual workplaces vary so greatly that the risk from any one pathogen will not be equally applicable across laboratory animal facilities. Some of the other more common zoonotic diseases include:
  - helminths and cestodes, particularly of non-human primates, but also of other animals (42);
  - leptospirosis (47);
  - rat bite fever (causative agents are *Streptobacillus moniliformis* and *Spirillum minus*) (42);
  - Korean Haemorrhagic Fever (Hantaan virus is considered to be exotic in Australia (48)); and
  - *Pasteurella* particularly from cat bites.

3.4.2. Chemical hazards

- *Anaesthetic gas contamination of the environment.* Occupational hazards of anaesthesia are well documented (49, 50, 51, 52, 53) and it is not appropriate to discuss in detail the findings of these papers. There is evidence that chronic exposure to inhalational anaesthetic agents may be associated with psychomotor, hepatic and renal dysfunction. In addition it has been shown that an increased susceptibility to infectious and neoplastic diseases and an increased incidence of miscarriages and foetal abnormalities can occur (49, 51). Exposure to high concentrations of nitrous oxide appears to pose the greatest risk to pregnant women, although halothane has also been implicated in birth defects (51). While not all laboratory facilities are equally at risk, levels of halothane can reach 400 ppm and nitrous oxide 8000 ppm in small, poorly ventilated rooms when these agents are used for several hours (51). Ether is highly flammable and can become explosive if mixed with air or oxygen (51, 54, 55). As ether vapour is heavier than air it accumulates at floor level where concentrations can reach explosive levels, especially in poorly ventilated corners of rooms and laboratories (51). The concentration can remain explosive for several hours after the ether source has been removed and can be set off by any source of flame, for example an electric spark created by the switching on of a refrigerator compressor (51).

- *Laboratory chemicals.* Chemical hazards are associated with the research and development laboratory and where work involves animals there is also the risk of exposure to laboratory animal employees. The number of chemicals that pose a hazard to laboratory animal unit employees is difficult to compile and managers should undertake a chemical audit as part of a HAZOP study. One of the more commonly encountered chemical hazards in the laboratory animal environment is formaldehyde.

- *Formaldehyde.* A ubiquitous chemical in any modern industrial society (56, 57), formaldehyde is a primary irritant of the respiratory tract and eyes, as well as an allergen and a hapten capable of causing either respiratory hypersensitivity or allergic dermatitis (17, 33, 56). It is also a carcinogen and is possibly associated with an increased risk of sino-nasal cancer in employees exposed to formaldehyde in manufacturing processes (57). Generally an individual can detect formaldehyde vapour as a pungent odour at around 0.1 to 1.0 ppm. The USA has set the standard for exposure at or below 0.5 ppm with a peak exposure no greater than 1.0 ppm in any 30 minute sampling period (56). The significance of these levels is that the level at which formaldehyde begins to have an adverse biological action is the same level at which the employee can detect the chemical. These levels are unlikely to be achieved in the laboratory animal facility with the exception of formaldehyde fumigation of animal rooms. However, at lower levels seen in the laboratory environment, allergies to formaldehyde have the most common biological effect (56). Allergic dermatitis has been documented at concentrations of aqueous formaldehyde as low as 0.2 parts in 1 million parts of water (56). At concentrations of formaldehyde vapour below 0.5 ppm the primary action of formaldehyde is to act as a hapten for various allergens, thereby eliciting an allergic response, principally an allergic rhinitis, in the exposed individual (17, 56).

- *Other chemical hazards found in research facilities.* Chemical hazards in research facilities include ozone used in water sterilisation (58), chemicals used in gel electrophoresis such as acrylamide and ethidium bromide, reagents such as gluteraldehyde, glacial acetic acid and dimethyl sulphoxide (DMSO), organic solvents such as xylene, chloroform and methanol (33, 34), and anaesthetic agents such as urethane (55) and MS-222 (59).

3.4.3. Physical hazards

- *Radiation.* Radiation as a hazard has been well described elsewhere (34, 60, 61, 62). Radiation sources are frequently used as research tools in biomedical research (33, 60, 63), including the associated animal facility (5). Radiation can be either ionising or non-ionising and both sources can be found in the animal facility. Ionising radiation sources

include radio-isotopes and X-ray equipment, while non-ionising radiation includes laser, ultraviolet and electromagnetic radiation. Radio-isotopic tracers are commonly used in studies involving investigation of bioactivity of cells or compounds (34). Fortunately, in most animal facilities radiation used is of low level so that the risk is quite reduced. However, this does not permit or excuse improper handling of so called 'hot' animals contaminated with radioactive substances (64). Strict safety precautions must be used whenever 'hot' animals are handled. It is important that researchers and animal facility staff are aware of the risks associated with the different radio-isotopes and types of radiation. The most common tracers are I^{125}, P^{32}, S^{35}, C^{14}, and H^3 (34, 64). All except I^{125} are beta ray emitters whereas I^{125} emits gamma and X-rays (34, 64). All the beta emitting radio-isotopes except P^{32} are low energy emitters and do not pose a major external threat to staff members exposed. Protective shielding is therefore not generally necessary (60, 64). On the other hand P^{32}, which is a more energetic beta emitter, does require shielding even though the material used does not need to be very substantial. Material such as perspex (ie. low atomic number material) is adequate (60, 64). X-rays and gamma rays, which have greater penetrating capacity, do pose a greater external risk to staff exposed, and so shielding must be more substantial (60, 64). Lead (ie. high atomic number material) is the preferred material for shielding (60, 64). Radio-isotopes can also pose an internal threat. The danger of beta emitter radio-isotopes especially in animal facilities is that they contaminate airborne and surface dust, urine droplets and faecal particles, and can be ingested or inhaled (60, 64). Once inside the body these radio-isotopes pose their greatest risk. The greatest internal risk comes from I^{125}, an organ-specific radio-isotope that is readily taken up and concentrated in the thyroid gland (60, 64).

- *Noise hazards.* Animal facilities are often overlooked as sources of potentially hazardous sources of noise, but there are several locations in an animal facility in which noise levels tend to be high. These include dog and pig holding areas, wash areas (where high pressure water sprayers or cage washing equipment are in use) and even in empty animal rooms (where rapidly exhausted air can resonate through the exhaust ducting). Maximum permissible levels of noise vary from jurisdiction to jurisdiction and so it is difficult to recommend a maximum threshold level. However, background noise in an unoccupied animal room is generally around 50db(A) (65) and any noise over 85db(A) is considered to be deleterious to the hearing of humans (2, 5, 34, 39).

- *Other physical hazards: electrical and thermal energy sources.* Managers must be aware of the risks associated with electrical and thermal hazards within an animal unit (5, 34).

4. Methods to be used for hazard control

The following section covers some of the more common methods used to control the significant hazards of a laboratory animal facility.

4.1. Allergic rhinitis, occupational asthma and allergic dermatitis

While it is not possible to identify positively individuals who will become sensitised to animal house allergens, there are indicators which can assist in identifying those at greatest risk. One measure frequently employed to determine the risk of development of LAA is the pre-employment medical examination to identify medical problems such as asthma, allergies, atopy, exposure to animals and pet ownership (14, 33, 66). Supplementary tests such as skin prick testing, total IgE antibody assay radio immuno-sorbent test (RIST), specific IgE antibody assays radio allergo-sorbent test (RAST), respiratory function (13, 20, 66) and the presence or absence of specific human leukocyte antigens (21) can provide additional information. A family history of atopy is not useful in predicting the likelihood of development of LAA (13, 24), rather the personal history of the individual as well as skin prick tests to diagnose atopy are more predictive of the potential development of LAA (13, 24). Positive skin prick tests to house-dust mite and pollen are less predictive of the potential development of LAA than a positive skin prick test demonstrating an allergy to animal proteins such as dog and cat allergens (13, 31, 67). A pre-employment medical examination is useful (66) to:

- identify those who would be more vulnerable if they develop LAA (including those with medical problems);
- identify those who have already developed allergies to animals;
- provide baseline data for later periodic screening;
- raise awareness of the disease.

The right to use the examination to preclude employment varies from jurisdiction to jurisdiction and has been recommended in several studies where individuals have chronic skin disease and asthma (31, 68). However, other studies have not recommended these types of examinations to preclude an individual from employment with laboratory animals because it is not definitive about a person's likelihood of developing LAA (13, 66, 69). It would seem that if all the atopic people were excluded from working with animals about a third of the population would be excluded unjustifiably (31, 66, 69). Atopic individuals have an increased susceptibility to LAA but an exclusion employment policy would prevent as many as three times the number of individuals from working than would develop the disease, since not all atopic individuals develop LAA (13, 31). Furthermore, the identification of and exclusion from the work-place of high risk individuals does not remove the employer's obligation in law to provide, where practicable, a working environment in which

employees are not exposed to hazards via the maintenance of safe atmospheric quality (41). It is also the employees' obligation to take reasonable care to ensure their own health and safety. Hence their co-operation in programs designed to minimise the hazard and to remove the risk is necessary (41).

As part of any hazard minimisation program, it is recommended that exposed staff are monitored annually. Early detection of LAA will enable precautionary measures to be adopted and may prevent the progression of more severe symptoms (12, 19, 33, 66).

The other part of a hazard minimisation program is the use of appropriate measures to minimise the exposure to allergens. Measures to reduce the allergen concentration in the workplace include reduction of aerosol production and dispersion of allergens, and prevention of employee exposure to the aerosols and allergens (5, 12, 14, 15, 22, 30, 31, 33, 66, 69). Such measures begin with good standard operating procedures for working with animals where the type of personal protective gear worn in specific situations is mandated. For example, gloves, protective clothing and good quality and well fitted masks are used when routinely handling animals while respirators fitted with high efficiency dust filters, or even the more sophisticated forced air ventilated hoods are used, in high risk activities such as cage and room cleaning (5, 66). Such fundamental methods have reduced the incidence of LAA in one institution from 37% to 12% in a 5 year period (31). Studies have shown that concentrations of allergens in the environment are the most significant factor in the development of symptoms of LAA and that the response is dose dependent with no lower threshold limit (5, 18). For environmental control methods to be successful, the airborne allergen concentrations need to be reduced to undetectable levels (15, 18).

Reduction of allergens to undetectable levels requires good management practices as well as well engineered facilities (5, 8). Examples of good management practices include attention to cage types used, quality of litter, or better still the use of absorbent material to contain urine and reduce aerosol production. Well engineered facilities include the incorporation of adequate ventilation and efficient air filtering where appropriate, as well as a negative pressure work environment particularly in cage cleaning areas (5, 8, 12, 14, 15, 22, 30, 31, 33, 66, 69,).

Specific mention needs to be made about the role of smoking and LAA. Tobacco smoke is one air pollutant which can be associated with an increased prevalence of atopic disease, bronchial asthma and allergic rhinitis (22, 24, 30, 68). Employers need to provide counselling, education, and support services to discourage smoking not only because of general health considerations, but in the case of animal care staff, for specific occupational reasons (24)

Finally, this paper has not discussed the medical treatment of LAA (13, 66). Palliative measures are not recommended as a replacement for proper environmental control or the use of appropriate personal protection. A survey has shown that 45% of LAA sufferers use medication in order to work with animals (69).

4.2. Manual handling

Risk control for manual handling hazards (39) can best be achieved by a combination of:

- job redesign;
- use of mechanical assistance and aids; and
- provision of specific training.

Priority of options should always be the first and preferred of these with specific training being used only when it is not practicable to redesign the job or provide mechanical assistance (39).

A summary of options available (39) to an animal facility manager might include:

- *Modification of object.* The object being handled may be modified or repackaged into a:
  - bigger size, so that it can only be handled by mechanical lifting devices (for example, the purchase of hay in rolls rather than bales. Hay rolls can only be lifted by a mechanical lifter thereby avoiding manual lifting. This option is suitable for farm animal operations);
  - smaller size, so that it can be more easily lifted (for example have feed repackaged from the standard 20 to 25 kg bags into 10 to 15 kg bags);
  - different shape (for example replace large faecal trays under rabbit cages with two smaller trays to cover the same under-floor area).

- *Modifications of actions or movements.* With or without workplace modifications, a task may be done in a different way, using different actions and movements (39). In the manual handling study described in Section 3.2 (35), the removal of cages for cleaning in the lowest and uppermost rows of the five row rodent rack was shown to be the most likely to cause musculoskeletal injury. Risk to the employee of muscular injury was reduced if the person used a set of mobile safety steps. Similarly for changing the lowest cages the employee should place the hand of the limb not being used on the steps to provide balance and support for the upper body as the person leans over to pull out the cage/s with the other hand (35). For changing the uppermost cage/s the employee should use the steps to gain height so that at no time are the arms above shoulder height (35).

- *Modification of the task.* A task can be improved by mechanical assistance or assistance of others (e.g., team lifting) (39). Heavy articles such as feed in bags can be stored on pallets and moved by pallet trucks or lifters, alternatively bags of feed can be replaced completely by bulk feed delivered by truck and blown directly into silos. If hay rolls are not a practicable alternative (see above) then conventional hay bales can be lifted and moved by team lifting and simple mechanical devices such as trolleys and conveyers. To accommodate such changes managers may need to modify workplace

layout, to re-arrange plant and equipment and to provide an improved or effective maintenance program.

- *Use of mechanical handling equipment.* If the task is modified then the purchase of mechanical handling equipment may be necessary. This has budget and human resource implications for the facility. However, as with any capital equipment purchase the pay back period will need to be determined (5). For example, if a power operated forklift is purchased, factors for consideration might include:
  - cost off-sets by improved storage capacity within existing store rooms (by being able to stack palleted products two or three high);
  - additional costs for specialised pallet shelving;
  - staff who use power driven forklifts (even if they are the non-ride-on type) may require an operator's licence; and
  - cost off-sets by reduced worker claims for manual handling injuries.

4.3. Physical injury

Physical injury in the workplace can be minimised by the application of good standard operating procedures that include a rigorous housekeeping program, an ongoing preventative maintenance program, an immediate response for repairing damaged equipment, mandatory wearing of appropriate safety equipment, such as non-slip toe-capped safety footwear, wet area boots (e.g. gumboots), well maintained overalls with no broken straps or tears that can get trapped in equipment, protective goggles to prevent eye injuries, and appropriate training programs to instruct employees in all aspects of using and maintaining plant, equipment, and safety wear. An injury reporting system that is enforced, no matter how minor the injury, is also an essential part of controlling safety. It enables the manager of the facility to monitor the number and nature of injuries occurring, thereby allowing identification of hazards and their rectification (5, 10).

4.4. Biohazards and chemical and physical hazards

4.4.1. Biohazards

Prevention and protection against biohazards is far more important than treatment and cure (33). Therefore any biohazard control program must include, wherever possible, the use of animals that are free of the common zoonoses and, where this is not possible because of the ubiquitous nature of the organism (e.g. Q fever in small ruminants) or the special nature of the organism, (e.g., B Virus where non-human primates can not assumed to be free of the organism as the animals may be non-symptomatic carriers), appropriate protection is essential. Protection includes vaccination (5), written guidelines for staff working with potentially hazardous animals (43), personal protection (44) and good hygiene (5).

4.4.2. Chemical hazards

Chemical contamination of the work environment must be avoided so this will require atention to appropriate storage facilities, adequately ventilated fume hood facilities, appropriate waste disposal procedures, spill containment and cleanup procedures, anaesthetic gas scavenger systems (33, 34) and good housekeeping. Activities that create dust, fumes or aerosols need to be minimised and smoking and eating in the laboratory prohibited. Personal hygiene measures after handling chemicals should also be meticulous (5). The use of chemicals in the animal facility may require appropriate personal protection such as respirators with chemical filters attached, gloves and protective clothing (5).

4.4.3. Physical hazards

Radiation protection is an essential requirement whenever radiation is used in an animal facility. In many ways the requirements for using chemicals are similar to those for radiation usage. There must be adequate ventilation, no dust or aerosol generation, adequate and safe storage, safe and environmentally appropriate waste disposal methods used as well as personal protection such as shielding. Although not a protective device *per se,* the use of dosimeters is essential in order to monitor exposure to radiation and cumulative doses (60, 70). Emergency procedures to contain and clean a spill are an essential part of any radiation safety program (60). Specifically for the animal house, bedding must be dust-free in order to avoid inhalation of radioactive particles. Cages must be in excellent condition and designed for ease of maintenance and cleaning. If it holds large animals, the cage should be dismantlable and cleaned and decontaminated without injuring staff. For rodent caging, which is generally a one piece plastic bottom with a metal mesh lid, there should not be any cuts, scratches or damage that will prevent cleaning and decontamination. In particular, lids must not be able to injure the staff with broken wires or sharp edges. Animal carcasses must always be stored in holding freezers to allow radiation decay. Staff with open wounds must ensure their exposed wounds are covered with an impervious dressing, as these are particularly vulnerable to radiation contamination.

Cleaning procedures in the room holding 'hot' animals should include (60, 71, 72):

- dustless bedding;
- always wet mop rather than sweeping in rooms;
- wearing of personal protective equipment which is disposable (in the case of overalls, these must be reserved specifically for the radiation room and laundered, using appropriate methods, after each use);
- sealing of all floors, walls and junctions;
- wearing of a film badge by staff;
- the keeping of all 'hot' animals in a separate room, isolated from normal animals;
- good ventilation of rooms holding 'hot' animals;

- remaining in the room holding the 'hot' animals no longer than necessary and working as far away as possible from the 'hot' animals;
- keeping all rooms spotlessly clean;
- cleaning up all spillages immediately using approved procedures, and reporting any accident to the appropriate safety person; and
- monitoring radiation levels continuously using Geiger counters.

5. Working with animals and pregnancy

All workers are exposed to hazards in the workplace, but the pregnant woman is potentially vulnerable. This is because risks apply to the mother and her unborn child. Often the unborn child is at greater risk than the mother. The most significant hazards are ionizing radiation, physical trauma, zoonosis and chemical contamination (33, 73).

- *Radiation*. The human embryo and foetus are more sensitive to radiation than the adult. Somatic effects which may result from irradiation of the unborn include mutations and genetic defects. This can lead to developmental defects (especially if exposed during organogenesis) and mental retardation. The magnitude of the risk depends on the dose and the gestational age at time of exposure. Of particular concern for the woman of child bearing age is the susceptibility of the pre-implantation embryo to radiation damage (especially 8 to 10 days after conception). This is the time at which knowledge of and confirmation of the pregnancy is unlikely (73).

- *Physical trauma*. Pregnancy *per se* does not increase the risk of physical trauma but physical changes associated with late pregnancy make the pregnant woman susceptible to injury from manual handling of objects or applying inappropriate lifting techniques to compensate for altered body shape (73).

- *Zoonoses*. The key zoonotic diseases for pregnant women, although not the only ones, include toxoplasmosis and listeriosis (42, 73). Intrauterine infections may result in congenital abnormalities or even death of the foetus. Fastidious personal hygiene for pregnant women, if working with animals, is essential. This includes frequent and thorough hand washing, wearing of clean protective outer clothing and personal safety wear such as gloves, glasses and mask. Furthermore, no items of laboratory equipment or contaminated clothing should be present or worn when eating or drinking (73).

- *Chemical contamination*. Formaldehyde and anaesthetic gas are the two most frequently used chemical contaminants in an animal facility. If the precautions discussed in section 4.4.2 are applied then the pregnant woman should be exposed to no greater risk than other employees of the facility (73).

6. Conclusions

Health and safety of people in the workplace is the responsibility of both the employer and the employee. These obligations are mandated by the OHS laws of the States and Territories of Australia, and are equally detailed in the OHS laws of the major developed economies of the world (e.g., Canada, USA and UK). As each workplace is an unique environment, the laws tend to be descriptive rather than prescriptive and they tend to rely on consensus rather than conciliation. It is therefore in the employers' and employees' interests to perform a safety audit (HAZOP study) to identify hazards. Although the major hazards are generally common to all animal facilities and associated laboratories, the attendant risks are dependent on the individual workplace. A well-structured HAZOP study will estimate the risks and suggest methods to eliminate or reduce the risk. This paper has briefly described the structure of a HAZOP study, listed the common and less common hazards seen in an animal facility and associated laboratory, and discussed potential control methods. The most significant hazards for an animal facility are LAA, manual handling, zoonosis, waste anaesthetic gases and radiation. Smokers and atopic individuals are at greater risk of developing LAA, while the pregnant woman needs to protect her unborn child from radiation and zoonotic disease due to its increased vulnerability compared to the adult.

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The Boyd Group

All around the world, hostility and suspicion between those involved in the debate over the use of animals in research have remained unaltered for decades, resulting in a trench warfare attitude being adopted by all the parties involved.

In the United Kingdom, following an exchange of correspondence and subsequent meetings between Colin Blakemore, Professor of Physiology at the University of Oxford, and anti-vivisectionist Les Ward, Director of Advocates for Animals, both came to the conclusion that some of the mutual suspicion and hostility might be allayed through discussion and debate. A number of individuals from various organisations with an interest in animal research were invited to a series of exploratory meetings at the end of which the Boyd Group was formed in 1992.

The Group, which takes its name from its Chairman, Dr Kenneth Boyd, Senior Lecturer in Medical Ethics at Edinburgh University Medical School and Research Director of the Institute of Medical Ethics, currently has as members anti-vivisectionists, members of animal welfare organisations, veterinarians, philosophers, scientists using animals and those involved in replacement techniques and members of bodies which fund or are directly engaged in research.

The Group is constituted as a forum for the open exchange of views on issues of concern related to the use of animals in science. Its objectives are to promote dialogue and, where there is consensus, to recommend practical steps towards achieving common goals.

The initial discussions of the Group focussed on the question of communication between the scientific and animal welfare / rights communities and on the quality and openness of the review process for project licence applications to use animals under the *Animals (Scientific Procedures) Act 1986*. Since then, three reports have been published. The first was, *Ethical review of research involving animals: a role for institutional ethics committees?* (March 1995). This report discusses the arguments for and against the establishment of such committees and is believed to have helped persuade the Home Office to require that an ethical review process should be in place in every research establishment from April 1999.

The second report was on *Advancing refinement of laboratory animal use* (April 1998). It makes recommendations on how awareness of refinement can be increased in the education and training of users of laboratory animals, in research protocol review, in the policy of funding agencies and in the day to day conduct of research, assigning specific responsibilities to relevant members of the establishment staff. It also recommends ways in which knowledge about refinement can be more widely disseminated. The Boyd Group is encouraging implementation of these recommendations.

The latest report is *The use of animals for testing cosmetics* (July 1998). It welcomes the decision by the British Government not to issue any further licences to use animals for testing finished cosmetic products. In relation to the wider purposes for which animals are used in research and testing, the report records the Group's opposition to the use of animals in the testing of products that do not offer significant benefit over those already in existence. It urges the cosmetics industry, in future, to formulate non-medical cosmetics only from existing, tested ingredients or from new ingredients that have been tested for other, justified purposes and which do not require further animal testing. It hopes that this position will be adopted internationally. The report also calls for an urgent need to expedite the development, validation, adoption and immediate use of alternatives and to promote the concept of a phased introduction of alternatives under the European Cosmetics Directive; that increased funding for alternatives development is vital; and that the development and publication of a clearly defined strategy – from both government and industry – aimed at reducing and ultimately replacing the use of animals in toxicity testing is essential.

The Group's next task is to explore the ethics of using transgenic animals in research and a report on its findings will be published next year.

The Center for Animals and Public Policy at the Tufts University School of Veterinary Medicine in the USA, in a report released in 1995 entitled *The Animal Research Controversy*, sums up the thinking behind the Body Group. The report states:

That the current debate over the use of animals in research may be intense, but it is largely unproductive. The assumptions that both sets of protagonists have about each other are generally false and obstruct constructive discussion. While there are always likely to be intense feelings about animal research, it is not necessary to assume that progress towards a broad public consensus is impossible. Some progress has already occurred, although more by accident than by design. Formal mechanisms should be established where free and open discussion of the issues that concern both sides is initiated and encouraged between both sets of protagonists.

The Boyd Group is one such mechanism, albeit on a more informal basis, through which it is hoped some of the heat will be taken out of the debate, resulting in positive action on behalf of laboratory animals.

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Continued from page 6...

increasing use of transgenic animals and greater numbers of fish, there is an even greater problem to address. The AEC system is too important to be allowed to stagnate.

Delegates highlighted the need for the research community and government departments responsible for the animal protection legislation to look again at the support system for AEC members, and at the need for inspection, auditing and public reporting, if our participation in the system can be justified. Our current preference to remain 'within' the AEC system is waning.

Glenys Oogjes
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Newly published

Animal Welfare Aspects in the Quality Control of Immunobiologicals – a critical evaluation of the animal tests in pharmacopoeial monographs

Eds. K. Weisser and U. Hechler.
ISBN 0 9501 700 4 6

ANZCCART recently received a copy of the English translation of this report from Professor Michael Balls, Director of ECVAM, the European Centre for the Validation of Alternative Methods, Ispra, Italy.

The report is based on a study carried out at the Paul-Ehrlich Institute in Langen, Germany, which was funded by the German Federal Ministry of Education, Science, Research and Technology. The English version was produced with the support of ECVAM and FRAME (Fund for the Replacement of Animals in Medical Experiments).

The study investigated every animal test which is stipulated for the quality control of immunobiologicals by the European Pharmacopoeia, for possible improvement, according to the principles of the three Rs and to provide recommendations for modifying the methods in the interests of animal welfare.

The 348 page report comprises three sections – an introduction, followed by a detailed coverage of immunobiologicals for human use and then of immunobiologicals for veterinary use. The human immunobiologicals covered include the following vaccines – diphtheria, pertussis, tetanus, BCG, cholera, typhoid, poliomyelitis and rabies, as well as antitoxins for tetanus, diphtheria, botulism and gas-gangrene. Veterinary immunobiologicals are classified according to species – pigs, ruminants, horses, poultry, dogs, cats, ferrets, mink and foxes.

The term immunobiologicals is used to describe vaccines and immunosera which undergo very strict quality control prior to release for sale. They are assessed according to tests prescribed in the monographs of the European and / or German Pharmacopoeia. The Paul-Ehrlich Institute in Langen is the German control authority for immunobiologicals.

Tests stipulated can be divided into three main categories: identification tests (qualitative determination of the effective component(s)), safety / toxicity tests (exclusion of contaminants / toxic components) and potency tests (quantitative determination of the effective component(s), or qualitative determination of the minimum potency required). Many of the toxicity and potency tests require the use of animals. The report includes the evaluation of 27 animal tests from 31 monographs for human immunobiologicals and 101 animal tests from 42 monographs for veterinary immunobiologicals.

The total number of animals used for the testing of all immunobiologicals for human use in Germany in 1991 to 1993 was 63,798, or about 21,000 per year. Mice were the most used (66 per cent), followed by guinea pigs (25 per cent) and rabbits (6 per cent). The number of monkeys used was 412. The introductory chapter considers these data, together with a detailed discussion of how to implement the principles of reduction, refinement and replacement.

The report is available free of charge to manufacturers and regulatory agencies from ECVAM, Institute for Health and Consumer Protection, MVMC Unit, 21020 Ispra (VA) Italy. Fax: 39-0332-785336, email: michael.balls@jrc.it.

Attitudes and Dispositional Optimism of Animal Rights Demonstrators

by Shelly Galvin and Harold Herzog
Society and Animals **6**(1); 1-11

The authors distributed surveys to animal activists attending the 1996 March for the Animals in Washington DC. A total of 209 activists participated in the survey. This march attracted about 3,000 demonstrators, compared with 25,000 who attended a similar event in 1990. The authors had previously surveyed demonstrators in the 1990 march and were particularly interested in the demographics and attitudes of the demonstrators, who were asked a number of questions, one of which was to rank the importance of nine objectives of the animal rights movement. These included cessation of the use of animals for biomedical research, consumer product testing, meat, dissection, leather, sport hunting, zoos, circuses and companion animals.

These were rated according to their importance and to the likelihood of their being achieved. Consumer product testing rated highest, animal trapping for fur next, then in descending order, dissections in schools, biomedical research, sport hunting, meat consumption, animals in zoos and circuses, use of leather products and companion animals. While there was little variation in the perceived importance of all of the goals except companion animals, which was rated much less important, it was the perceived likelihood of their being achieved which varied. The likelihood of abolishment of dissection in public schools being achieved was rated at 73 per cent, whereas the figure for biomedical research was 41 per cent.

Of the 209 returns to the survey, 153 (or 74 per cent) were from women and 55 from men (one did not indicate gender). They ranged from 13 to 70 years of age, with a median age of 34.

Participants ranked their perceived effectiveness of eight strategies of the animal rights movement. These included education in schools (rated second), marches and demonstrations (rated sixth), liberation of laboratory animals (seventh) and harassment of animal researchers (last). Ratings were based on perceived future effectiveness, which correlated well with past effectiveness.

The authors concluded that the animal rights movement (in the USA) had not broadened its gender distribution in the period 1990 to

1996 and that its support was predominantly from women. The median age of respondents was slightly older and participants claimed to have been involved in the movement for longer than those surveyed in 1990.

Ethics, Welfare, Law and Market Forces: The Veterinary Interface

Eds. A.R. Michell and R. Ewbank, 1998. Proceedings of a Royal College of Veterinary Surgeons (RCVS) and Universities Federation for Animal Welfare (UFAW) Symposium, held 14-15 November 1996. UFAW, London. ISBN 0 900 767 99 5

The purpose of this two day symposium was to celebrate the new RCVS headquarters in London, the fiftieth anniversary of UFAW and the new RCVS Certificate in Animal Welfare Science, Ethics and Law.

While the importance of veterinary surgeons to animal welfare has long been recognised, teaching of animal welfare to undergraduate veterinary students varies between universities. Indeed, as the introduction to this publication states – "perhaps the symposium was a rite of transition from the belief that, since all veterinarians have to have ethical concern for welfare and knowledge of the relevant science and law, a postgraduate certificate was superfluous". While this may have been the case in the past, where veterinarians were expected to have a good knowledge of most problems in most species, there is now an increasing tendency for specialisation, covered in the UK by the establishment of additional qualifications in fields such as anaesthesia, radiology or cardiology. While similar specialisation has occurred in Australia and New Zealand under the Australian College of Veterinary Scientists, there has not yet been recognition of the need for a specialist qualification for veterinarians in animal welfare, although this may be about to change.

This 235 page proceedings comprises six sections, in addition to a general discussion. The six sections are:

- Suffering in animals;
- Special issues: perceived and actual welfare;
- The economics of welfare;
- The science of welfare;
- The international context;
- The ethical limits of care.

Contributors include M.S. Dawkins, B. Rollin, D. Broom, A. Webster and D. Morton, all of whom have published widely in the field of animal welfare. The opening paper by Marian Dawkins examines the bio-behavioural background to animal suffering by taking a "Darwinian look at animal suffering" and the ways in which animals respond physiologically and behaviourally to various challenges to their survival and reproduction. She argues that the signs of stress and suffering which we use to make reasonable ethical decisions about animals have to be seen in an evolutionary context as part of animals' equipment for survival – there is no simple list of symptoms we can use to define an animal's response to the external environment; for example, to escape from a predator or to deal with injury, hunger or thirst. The Proceedings are available for $30.00, including postage, from ANZCCART's Adelaide Office.

Letters

Antarctic Wildlife

A meeting organised by the Australian Antarctic Division in August 1998 was held in response to discussions held at the Antarctic Treaty Consultatiive Meeting in May 1997. The impetus for the workshop was a rising concern that current and developing human habitation and activities may place at risk Antarctica's unique biodiversity and to discuss diseases in Antarctic wildlife, structured around the following issues:

- What are the risks to Antarctic wildlife of disease introduction and spread, including endemic versus exotic disease risks, and are the risks changing?
- What procedures should be put in place to reduce the risk of disease introduction and spread?
- What should be done if disease is identified within Antarctic wildlife, referring to "natural" endemic disease versus introduced disease?
- What procedures should be in place to ensure early detection of endemic, introduced or emerging disease?

The following major risk factors contributing to both introduction and spread of disease were identified:

- People may have contaminating organic matter, seeds, fungal spores, faecal matter, microbio-

National Statistics Package now available electronically

This package is now accessible from ANZCCART's home page and can be down-loaded from the following address: http://www.adelaide.edu.au/ANZCCART/.

For a detailed description of the package, see the leading article by Dr Deborah Kelly in *ANZCCART News* **10**(3) September 1997.

For information about the package and its application, contact Dr Kelly at the SA Department of Environment, telephone (08) 8204 9176, facsimile (08) 8204 9178.

Letters to the Editor are always welcome and can address any issue relevant to the use of animals in research and teaching

logical material, human food waste (particularly poultry products) on their boots and clothing.

- Procedures used in research which may spread disease between animal populations when moved between various research sites.

- Reintroduction of vagrant or other animals that have been removed from a population, especially where cross-species contact may have occurred.

These issues should concern all scientists involved in research on wild animals, especially when work involves movement between groups or breeding populations. This includes animals that may be in the wild, temporarily captive (caught and released after project completion), or which may be reintroduced to the wild e.g. captive propagation of threatened species.

Each animal (including the human) is a mini-ecosystem, including microbes, endoparasites, and ectoparasites. These may be pathogenic, if not to their host, then to other species with whom they may come into contact. Novel diseases can easily be introduced to susceptible wildlife within a naive population.

Researchers entering the field should be challenged by these considerations of animal health and welfare. Most situations will pose a unique set of circumstances, where the ideal theoretical response will be tempered by pragmatic solutions. The specific response of restrictions or procedural variations that minimise the risk of damaging a population or environment will also vary from case to case. An example may be, that when anaesthetising animals within a given population, basic cleaning and wiping of an anaesthetic mask is adequate, but that the same anaesthetic equipment be thoroughly cleaned and disinfected when moving to another population.

Probably the most important factor is that *these issues are considered,* and that people are aware of risks. Research establishments, animal ethics committees or other bodies with jurisdiction over such research should establish appropriate guidelines. Alternatively, researchers may be requested to consider these issues and note appropriate procedures in their project protocols.

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Editor's note:
For more on this topic, see *New Scientist*, 5 September, 1998, p.4.

Score sheets are good value for farm animal research

In response to David Morton's fact sheet in the June issue of ANZCCART News, I was pleased to see comments on humane end points and the use of score sheets. This can have a significant role in improving animal welfare and refining experimental technique.

I recall working with a researcher several years ago who was undertaking a project to evaluate the protective effect of a feed additive on minimising acidosis induced by grain overload in sheep. I developed a score sheet to improve the sophistication of the assessment of individual animals, as well as to reduce animal suffering. The aim was to 'score' animals every two hours, based on clinical assessment using very basic parameters (demeanour, body temperature and ability to stand). In the past, similar trials did not incorporate such a scoring system. The other important factor which had not previously been considered was that animals should be monitored over 24 hours for the duration of the experiment. It was not uncommon for several control animals to be found dead after a night of nil observations.

Three criteria were used to assess animals' condition; demeanour (depressed or alert), ability to stand with or without assistance, and body temperature. Animals were monitored every two hours. Acidosis was assessed as severe, moderate or mild, based on the above criteria. Other clinical signs, such as heart rate and abdominal distension were either inaccurate or difficult to assess. Animals' data were tabulated.

Animals were assigned to three different categories based on clinical signs, with animals showing signs of advanced acidosis to be euthanased immediately, although no animals were expected to die as a result of the experiment. Differences between test groups should be evident from the numbers of animals which show signs of varying severity. The same criteria should be used for animals used in a pen study as in field trials.

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Reference

Blood, D.C. and Radostits, O.M. (1994). *Veterinary Medicine.* Bailliere, Tindal, London

New Zealand Animal Welfare Advisory Committee (AWAC) Annual Report

The 1997 Annual Report of this Committee, which advises the New Zealand Ministry of Agriculture and Forestry (MAF) has been published. Its terms of reference are to advise the Minister of Agriculture on all matters relating to the welfare of animals other than those which fall within the jurisdiction of the National Animal Ethics Advisory Committee.

One of its major roles is to develop codes of minimum standards for the welfare of different classes of livestock and other animals. These are intended to encourage all persons responsible for animals to adopt the highest standards of husbandry, care and stockmanship. One new code was published in 1997 – the *Code of Recommendations of Minimum Standards for the Emergency Slaughter of Farm Livestock*, one other code was revised and a third was amended.

One of the other terms of reference for AWAC is to recommend specific areas where research into animal welfare matters is required. In this regard, AWAC submitted a report to the Foundation for Research, Science and Technology on establishment of animal welfare priorities for the animal industries and in particular, the dairy industry.

AWAC also encourages relevant institutions to apply for grants for animal welfare research under the New Zealand Government's Public Good Science Fund. In addition, funding for animal welfare-related projects is provided by the Science Policy Unit of MAF.

The Committee has identified a further 15 specific topics relating to animal welfare, which need to be addressed and / or where further work is required. Most of these relate to farm animal production, but there is specific mention of the design of a system for rapid retrieval of data concerning alternatives to the use of experimental animals in research, teaching and for toxicity testing.

Copies are available free of charge from MAF, PO Box 2526, Wellington, New Zealand.

Note: Australia does not have a National Animal Ethics Advisory Committee or a National Animal Welfare Advisory Committee, as these matters are the responsibility of the eight State and Territory governments. Its nearest equivalent to the latter is the Animal Welfare Committee of SCARM, the Standing Committee on Agriculture and Resource Management.

New Zealand National Animal Ethics Advisory Committee (NAEAC) 1997 Annual Report

This report is also available free of charge from MAF, Wellington. It details the Committee's activities during 1997 and provides statistics of animal usage by species and by organisation. The total number of animals used for scientific purposes was 220,990 compared with 264,516 in 1996. Species used in the greatest numbers (in descending order) were cattle, mice, sheep and fish.

Coming up

Second International Conference on Transgenic Animals
26 - 29 October 1998
Beijing
Contact: BILONG Transgenics
C13, Bei Yi Tiao, Zhong Guan Cun, Haidian District, Beijing 100080, China
Fax: 86 10 6253 2114
Email: 2ndICTA@bilong.com
http://www.bilong.com

Workshop on Pain Management and Humane Endpoints
2 - 3 November 1998
Washington
The workshop will focus on the science, ethics, assessment and alleviation of pain, stress and distress in animals involved in research
Sponsored by ASPCA, HSUS, ILAR, NIH and OPRR
Contact: Dr Marilyn Principe
CAAT, Baltimore
Fax: 1 410 223 1603
Email: mprincip@caat.jhsph.edu
http://wwwaltweb.jhsph.edu

Australian Society for Medical Research Conference
22 - 25 November 1998
Hobart
Contact: Conference Design
Tel: 03 6224 3773
Fax: 03 6224 3774
Email: conf.design.hba@trump.net.au

International Conference on the Use of Humane Endpoints in Animal Experiments for Biomedical Research
23 - 25 November 1998
Zeist, The Netherlands
Contact: Bjorn Steen
Tel: 31 30 274 2503 / 2377
Fax: 31 30 274 4408
Email: Bjorn.Steen@RIVM.nl

Australian Society for Immunology Conference
29 November - 3 December 1998
Melbourne
Contact: Convention Associates
Tel: 03 9887 8003
Fax: 03 9887 8773
Email: ca@netwide.com.au

IACUC Responsibility for Research Animal Well-being
7 - 8 December 1998
San Antonio, Texas
Sponsored by OPRR, SCAW and The University of Texas
Contact: Scientists Center for Animal Welfare (SCAW), 7833 Walker Drive, Suite 340, Greenbelt, MD 20770 USA
Fax: 1 301 345 3503

AustralianVeterinary Association Conference
16 - 21 May 1999, Hobart
Contact: Ms Doreen Culliver
AVACOS, 7 Phipps Place
Deakin, ACT 2600
Tel: 02 6285 3600
Fax: 02 6285 3913
Email: avacos@ava.com.au

The Use of Wildlife for Research
26 - 27 May 1999
ANZCCART's 1999 Australian Conference
Western Plains Zoo, Dubbo, NSW
Contact: ANZCCART's Adelaide office for information

Third World Congress on Alternatives and Animal Use in the Life Sciences
19 August - 2 September 1999
Bologna, Italy
Contact: JRC Public Relations and Publications Unit
Tel: 39 33 278 9889
Fax: 39 33 278 2435
Email: prp@jrc.it
http://www.ei.jrc.it/ecvam/bologna/testbol.html

News

Europe

For news on changes in legislation and on all aspects of biomedical research using animals in Europe, readers are referred to the *EBRA Bulletin*, produced quarterly by the European Biomedical Research Association.

The July 1998 issue includes a number of interesting articles. The leading story reports a vote in Switzerland on 7 June to reject a proposal to ban many forms of genetic engineering and restrict all other applications of the technology. Over the last 20 years there have also been several referenda in Switzerland aimed at banning animal experimentation, none of which has been passed.

Since the defeat of the referendum on genetic engineering there has been discussion of a new initiative from environmental campaigners focussing on genetically modified food ingredients.

The Council of Europe will revise its guidelines on the housing and husbandry standards which should be applied to laboratory animals in countries which have ratified the convention.

Appendix A of the Council of Europe Convention ETS 123 includes these guidelines, as well as tables of recommended cage sizes.

Other subjects covered in this issue are a change to German animal welfare law, a restructuring of the Group of Advisers on the Ethical Implications of Biotechnology (set up in 1991 by the European Commission) and a report on the UK Labour Government's initiatives to further control the use of animals in scientific procedures. These included a ban on the use of animals for the production of monoclonal antibodies by the ascites method, to be implemented from the end of 1998. The issue likely to have most effect on animal research and testing in the UK is the introduction of a system of local ethical review. (This was reported on p. 12 of the June issue of *ANZCCART News*).

The *EBRA Bulletin* can be obtained free of charge from 58 Great Marlborough Street, London, W1V 1DD, UK, email: secretariat@ebra.org.

1998 NEAMS Trust Grant Awarded

This year's NEAMS Trust (New Educational Aids in Medicine and Science) Grant of $10,000 was awarded to Dr Rod Cooter, Mr Peter Sylaidis and Mr Timothy Proudman, of the University of Adelaide's Department of Surgery at the Queen Elizabeth Hospital.

Their aim is to develop a fully interactive CD-ROM dealing with basic surgical wound management. It will contain text-book style information, graphics and multimedia and will guide users through a range of options of skin wound management, including anaesthesia, suturing and wound care. It will be used for teaching medical, dental and other biomedical students as well as general medical practitioners.

One of the main outcomes will be to reduce the need for animals in teaching surgical wound management. For further information contact the NEAMS Trust, PO Box 516, Darlinghurst, NSW. Tel: (02) 936 7114, fax: (02) 9361 6448.

AVASE becomes AVERT and seeks new members

The need for an association of veterinarians working in research and teaching in Australia has long been recognised. This resulted in the formation in the 1970s of the Australian Association of Veterinary Teachers and Researchers (AAVTR), which subsequently evolved into a Special Interest Group of the AVA, known as AVASE — Australian Veterinarians Associated with Scientific Establishments. AVASE has provided scientific sessions for a number of years at AVA conferences, but has been constrained by a very small membership (currently only 46 persons).

AVASE assisted ANZCCART and ANZSLAS with the workshop held in Melbourne on 21 September 1998 on monitoring the health of experimental animals. It also co-sponsored the visit to Australia in 1997 of Dr Joanne Zurlo, from CAAT, Baltimore, USA.

At the AGM of AVASE on 14 August 1998, it was agreed to change its name to AVERT — Australian Veterinarians in Ethics, Research and Teaching, to more accurately reflect the interests of its current membership and to appeal to a wider cross-section of veterinarians.

Veterinarians in Australia and New Zealand interested in joining AVERT or requiring further information should contact the AVERT President, Dr Steve Atkinson, University of New England, Armidale, NSW. Tel: (02) 6773 2329, fax: (02) 6771 1388 or the national AVA office in Sydney. Tel: (02) 9411 2733, fax: (02) 9411 5089, email: avahq@ava.com.au.

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It is a publication for researchers and teachers; members of animal ethics committees; staff of organisations concerned with research, teaching and funding; and parliamentarians and members of the public with interests in the conduct of animal-based research and teaching and the welfare of animals so used.

Contributions to ANZCCART News are welcomed and should be sent to:

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http://www.adelaide.edu.au/ANZCCART/

or

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