anzccart HUMANE SCIENCE

News

December 1999 Vol 12 No 4

Do fish feel pain?

Can fish experience pain? This review summarises the findings from neurological, pharmacological and behavioural studies which suggest that fish can feel pain. Much remains to be learned about the mechanisms of pain perception in fish and, in particular, about the types of stimuli that fish find painful.

It is important to know whether or not fish can experience pain because that influences our views on how we should manage these animals. The anatomical, physiological and behavioural evidence that has contributed to our understanding of pain perception in fish is reviewed. Its implications for the marine fishing and fish farming industries have already been described (Farm Animal Welfare Council, 1996; Gregory, 1998).

Do fish experience pain?

There are three ways of trying to determine whether or not fish can experience pain.

It is necessary to establish whether or not fish possess the neurotransmitters, neurone types, and brain structures which are known to mediate or influence pain in other species. This approach does not give a precise answer, but if the conventional pain pathways are absent, it can be concluded that pain perception does not occur through those routes.

A second method is to inflict on fish stimuli thought to be painful, assess their physical responses, and determine whether those responses can be suppressed with analgesic drugs which in turn are blocked with analgesic inhibitors. A practical difficulty lies in determining, beforehand, the appropriate doses of analgesic and anti-analgesic likely to be effective in fish.

The third way is to condition fish to a potentially painful stimulus and examine whether they show aversion to the conditioned stimulus. One difficulty lies in distinguishing between pain and other forms of unpleasantness. This difficulty can, however, be overcome by examining whether the response is absent when the fish is pretreated with an analgesic which specifically inhibits pain without affecting motor control.

By collating observations from all three approaches, it should be possible to decide whether or not fish can feel pain.

Neuroanatomical evidence

Central nervous system

LaChat (1996) argued that, since the brains of fish do not have structures comparable with the human neocortex, they are unlikely to be able to consciously experience pain. This assumes that the neocortex is essential for pain perception and that the equivalent structure in fish and birds, the telencephalon, does not and cannot participate in pain perception. The basis for that assumption is not clear. There is little doubt that the telencephalon has sensory and higher functions such as learning and thinking. For example, Overmeir and Papini (1986) showed that avoidance learning in fish depended on a functional telencephalon. The absence of a true neocortex does not, therefore, mean that fish cannot perceive sensory and nociceptive stimuli.

Peripheral nervous system

In mammals two types of neurone relay nociceptive signals to the brain; those with myelinated axons and large cell bodies (A fibres), and those which are unmyelinated (C fibres). During evolution there has been a progression towards myelination of sensory neurones in vertebrates. This is important because it probably influences the type of pain that different species can experience. The initial sharp pain that occurs during an injury is mediated by the rapidly conducting myelinated A fibres , whereas, delayed aching pains are mediated by the slower unmyelinated C fibres. Neurones in the skin and viscera mediate pain signals and connect synaptically with ascending spinal neurones in the dorsal horn of the spinal cord. These are one of the first relay sites for a pain-provoking signal. The axons in the dorsal horn neurones are arranged in laminae. The outermost laminae (lamina I and II) include unmyelinated and myelinated neurones which respond to algogenic stimuli and project to the thalamus.

Contents ...

This issue contains the Facts Sheet on Pain — assessment, alleviation and avoidance in laboratory animals. The Facts Sheet is also available as an offprint.

These laminae are two of the more important paths that convey potentially painful signals to the brain.

The peripheral nervous system of fish differs from that of mammals and there is variation between types of fish. In lampreys, all peripheral nerve fibres are unmyelinated, and all the sensory nerve endings in the skin are free nerve endings (Martin and Wickelgren, 1971). However, elasmobranch species differ in the degree of myelination of their peripheral nerve fibres. Stingrays have virtually no unmyelinated fibres in the nerves of the outermost lamina of the dorsal horn, whereas in black-tip sharks about 16% of those neurones are unmyelinated (Snow *et al.*, 1993). The layer equivalent to lamina I is poorly represented in elasmobranchs, but its function may be served by one or more of the other laminae, and in particular by the substantia gelatinosa (Cameron *et al.*, 1990). Although elasmobranchs have relatively few unmyelinated preganglionic sensory neurones, they do have second order neurones within the dorsal horn (Cameron *et al.*, 1990), and these are either unmyelinated or finely myelinated. These second order neurones are concentrated within the substantia gelatinosa layer within the dorsal horn. That layer is relatively large in elasmobranchs, and it corresponds in mammals to lamina II, which is rich in C fibres and is partly responsible for mediating pain-provoking signals to the brain.

Neurotransmitters

In mammals, unmyelinated neurones contain a wide variety of neuropeptides which act as neurotransmitters and neuromodulators. In stingrays, rays, and black-tip sharks, substance P, serotonin, calcitonin gene-related peptide, neuropeptide Y and bombesin are present in the outer part of the substantia gelatinosa in the dorsal horn, and in the shovelnose ray met-enkephalin is concentrated in the lateral part of the substantia gelatinosa (Cameron *et al.*, 1990). This distribution is similar to that in the mammalian dorsal horn. To date, of these neurotransmitters, only substance P has been detected in afferent neurones in the elasmobranch substantia gelatinosa (Ritchie and Leonard, 1983). It is not possible to say which neurotransmitters are responsible for relaying nociceptive signals in elasmobranchs, but their presence suggests a potential for that function.

The μ opioid receptor is present in animals more primitive than vertebrates. One of its main functions in mammals is to suppress pain. Teleost fish possess at least six different opioid receptor-like proteins, and these may fulfil the same role.

Humans have specific regions in the brain which can attenuate the perception of pain. These include the periaqueductal gray matter in the mesencephalon, specific relay nuclei in the thalamus, and the rostroventral medulla in the brainstem. The raphe nucleus in the rostroventral medulla activates axons which project to the dorsal horn of the spinal cord, where they inhibit the relaying of afferent nociceptive signals through a variety of neuropeptide receptors. One group of pain modulating neuropeptides is the enkephalins, which are opiate-like compounds. The enkephalins help to reduce pain perception, and they appear to serve a number of other roles in reproduction, vision and chemosensory systems. Enkephalins have been discovered in a range of brain regions in teleost fish, but as yet their presence in pain-related pathways has not been adequately tested. This area of neuroscience is complicated by the fact that we do not know the functional piscine homologues for the periaqueductal gray and the raphe nucleus. Attempts at locating enkephalin-containing cell bodies in the dorsal horn of lamprey and trout have been unsuccessful (Vecino *et al.*, 1992). This suggests that either descending inhibition of nociceptive stimuli is mediated by another neuropeptide or that this method of pain control does not exist in these fish.

Physiological and behavioural responses

Physical responses to potentially painful stimuli are often used to determine whether an animal can perceive pain. This approach, however, can have limitations if the stimulus provokes a spinal reflex or a subconscious brainstem reflex. Some fish show sensitive spinal reflexes which could be confused with conscious behaviour. For example, in decapitated lampreys the dorsal fins move briskly to one side when the ventral abdominal skin on the same side is stroked. Similarly, pricking the skin below the dorsal fin with a needle, pinching the skin, or electrically stimulating the skin elicited the same fin reflex in the decerebrate fish (Birnberger and Rovainen, 1971). Similar responses have been described in higher fish species. It is important, therefore, to examine behavioural responses which are not spinal reflexes to potentially painful stimuli when investigating pain perception in fish.

Notwithstanding this, fish show many physical responses to tactile and noxious stimuli which do involve conscious perception. This has been shown in a number of experiments which involved a learning process to elicit a particular response. For example:

- In Japanese carp, applying a 50 msec 7 mA DC shock across the fish produced suppression of opercular (respiratory) activity when the fish was trained to expect the shock using a pre-shock light stimulus (Woodward, 1971).
- Paradise fish avoided a black compartment within their tank after they learnt that they experienced a mild electric shock when they were in the black compartment (Brookshire and Hognander, 1968). They also learnt how to activate an escape hatch in order to avoid the shock.
- In goldfish, fear of an imminent electric shock can be blocked by pretreating the fish with the anterograde memory blocker MK801, which is an N-methyl-D-aspartic acid antagonist (Davis and Klinger, 1994). Similar effects have been observed in rats.

Jansen and Greene (1970) used a mild electric current in goldfish to provoke an agitated swimming response, which consisted of a sudden, pronounced, increase in frequency and amplitude of fin and opercular movements. When morphine was added to the water, analgesia was achieved. Repeated electric currents in the non-morphine controls were not associated with a change in threshold stimulus. This is one of the most important studies demonstrating that fish can experience pain. The analgesic effect of morphine in goldfish has since been shown to be reversed by naloxone Ehrensing *et al.*, 1982)

Tactile stimuli are detected either by Merkel cells or by free nerve endings in the epidermis. In the lamprey, they innervate three types of sensory fibre within the spinal cord. There are two types of touch fibre which respond to indentation of the skin, and a population of nociceptive fibres which respond to very strong deformation of the skin or to excessive heat (Martin and Wickelgren, 1971). This is regarded as good evidence that lamprey have nociceptors which are triggered by potentially painful stimuli, and that these project a signal to the spinal cord.

As a non-experimental observation, carp show the following behaviours once

they are hooked during angling: rapid darting movements; coughing and spitting; head shaking; fleeing; belching gas from the swim bladder; sinking and lying on the bed of the tank. If, after hooking, the line is played out so there is no line tension, the fish do not show escape behaviour. Instead, the main behaviours are coughing or spitting and head shaking, then a resumption of feeding within a few minutes. This implies that playing the fish is more aversive than hooking the mouth. The observation that the fish soon resume feeding has also been used to argue that hooking in the lip is not in itself particularly painful for fish.

Summary

The neuroanatomy of fish, and their complement of neurotransmitters suggests, rather than precludes, the possibility that fish can feel pain. The appropriate question appears not to be *do fish feel pain ?* but rather, *what types of pain do fish experience?* It is not surprising that fish possess the peripheral anatomical and chemical prerequisites for pain perception. Simpler life forms, such as gastropods, also share these features and, like fish, they show nociceptive responses which are analogous to those in vertebrates (Kavaliers, 1989). These responses, which can be inhibited with conventional analgesics, are particularly convincing evidence that fish and lower life forms have the capacity for feeling pain. There is, however, room for substantial improvement in our knowledge about pain perception in fish, and in particular we need to know more about which types of stimuli appear to provoke pain responses in fish.

References

Birnberger, K.L. and Rovainen, C.M. (1971). Behavioural and intracellular studies of a habituating fin reflex in the sea lamprey. *Journal of Neurophysiology* **34:** 983-989.

Brookshire, K.H. and Hognander, O.C. (1968). Conditioned fear in the fish. *Psychological Reports* **22:** 75-81.

Cameron, A.A., Plenderleith, M.B. and Snow, P.J. (1990). Organization of the spinal cord in four species of elasmobranch fish: Cytoarchitecture and distribution of serotonin and selected neuropeptides. *Journal of Comparative Neurology* **297:** 201-218.

Davis, R.E. and Klinger, P.D. (1994). NMDA receptor antagonist MK-801 blocks learning of conditioned stimulus-unconditioned stimulus contiguity but not fear of conditioned stimulus in goldfish (*Carassius auratus* L.). *Behavioural Neuroscience* **108:** 935-940.

Ehrensing, R.H., Michell, G.F. and Kastin, A.J. (1982). Similar antagonism of morphine analgesia by MIF-1 and naloxone in *Carassius auratus*. *Pharmacology Biochemistry and Behaviour* **17:** 757-761.

Farm Animal Welfare Council (1996). *Report on the welfare of farmed fish*. MAFF, FAWC, Surbiton, UK. 52pp

Gregory, N.G. (1998) Chapter 11 Fish. In: *Animal Welfare and Meat Science*. CABI Publishing, Wallingford, UK.pp. 195-212.

Jansen, G.A. and Greene, N.M. (1970). Morphine metabolism and morphine tolerance in goldfish. *Anaesthesiology* **32:** 231-235.

Kavaliers, M. (1989). Evolutionary aspects of the neuromodulation of nociceptive behaviors. *American Zoologist* **29:** 1345-1353.

LaChat, M.R. (1996) An argument in defense of fishing. *Fisheries* **21:** 20-21.

Martin, A.R. and Wickelgren, W.O. (1971). Sensory cells in the spinal cord of the sea lamprey. *Journal of Physiology* **212:** 65-83.

Overmeir, J.B. and Papini, M.R. (1986). Factors modulating the effects of teleost telencephalon ablation on retention, relearning, and extinction of instrumental avoidance behavior. *Behavioral Neuroscience* **100:** 190-199.

Ritchie, T.C. and Leonard, R.B. (1983). Immunohistochemical studies on the distribution and origin of candidate peptidergic primary afferent neurotransmitters in the spinal cord of an elasmobranch fish, the Atlantic Stingray (*Dasyatis sabina*). *Journal of Comparative Neurology* **213:** 111-125.

Snow, P.J., Plenderleith, M.B. and Wright, L.L. (1993). Quantitative study of primary sensory neurone populations of three species of elasmobranch fish. *Journal of Comparative Neurology* **334:** 97-103.

Vecino, E., Pinuela, C., Arevalo, R., Lara, J., Alonso, J.R. and Aijon, J. (1992). Distribution of enkephalin-like immunoreactivity in the central nervous system of the rainbow trout: an immunocytochemical study. *Journal of Anatomy* **180:** 435-453.

Woodard, W.T. (1971). Classical respiratory conditioning in the fish: CS intensity. *American Journal of Psychology* **84:** 549-554.

Neville Gregory
MIRINZ,
Hamilton, New Zealand.

Email:
n.gregory@mirinz.org.nz

Editor's note
This article was published in *Surveillance* **26:** (3), 1999.

More on animal pain

For a detailed summary of the assessment, alleviation and avoidance of animal pain, see the Facts Sheet in this issue by Professor Paul Flecknell.

Offprints are available free of charge from ANZCCART.

Notes from Professor Flecknell's Australian workshops held last July are now available from ANZCCART's website -

www.adelaide.edu.au/ANZCCART/

Minimising the harm and maximising the benefits of animal use in science

In his book entitled *Animal Experimentation: A Student Guide to Balancing the Issues*, published by ANZCCART, Vaughan Monamy (1996) summarised aspects of the "Reverence for Life" philosophy of Albert Schweitzer (1875-1965). "Reverence for Life" emphasises the mystical awe felt when life forms, from the simplest to the most complex, reveal their exquisite elegance and their inherent will-to-live. People, when acting naturally, honestly and with wonder at the mystery of life, recognise their own will-to-live. They also feel compelled to give to every other life form with a will-to-live the same reverence for its life as they give their own.

"Reverence for Life" does not mean that causing pain or the death of another creature is wrong. Rather, it is causing pain or death when it can be avoided that is wrong. People guided by "Reverence for Life" will only cause suffering or the death of an animal in cases of necessity, never from lack of care.

This has particular relevance to the use of animals in science. "Reverence for Life" means that there should always be misgivings when a life is taken or other harm is done to an animal which has a will-to-live, no matter how great will be the expected benefit. Schweitzer thought that in each and every case these misgivings should motivate animal-based scientists to make sure that there is a very real need to use an animal for the particular purpose if that purpose involves taking the animal's life or causing it other harm. Moreover, scientists must take the utmost care to keep any harm they do as low as it can be.

I consider that there is value in combining elements of the "Reverence for Life" philosophy with the Utilitarian philosophical justification for the use of animals in science. Utilitarians consider that what counts above all other things is the consequences of actions. But they also say, and this is important, that actions can be judged as good *only* if they bring the *greatest* good to the *greatest* number. The use of the word *greatest*, instead of the weaker word *greater*, reduces the risk that this way of thinking can be used to justify getting the greatest good at the expense of a small number of victims. Achieving the *greatest good* therefore also means causing the *least harm*. This means we must consider *all* the good outcomes and *all* the harmful outcomes, not just those that provide a balance which spuriously justifies what we want to do.

The rigorous form of utilitarianism, which James Battye called *strong utilitarianism* (Battye, 1994), retains ethical credibility only if the separation between all of the good and all of the harm is the greatest that can be feasibly achieved (Mellor, 1998). If we add to this the humane restraint that arises from the misgivings scientists should have when taking a life or causing other harm, emphasised in Schweitzer's "Reverence for Life" philosophy, we have both ethically rational (Utilitarian) and humanely empathetic ("Reverence for Life") motivation to minimise the harmful consequences of the use of animals in science.

But what harm and what good (or benefit) should be included in these calculations? The rest of this paper deals with this question.

Minimising harm

We need to consider harm to animals and other harms.

Minimising harm to animals

The Three Rs principle is available to assist us to minimise the harm: *replacement*, use of non-animal alternatives to animals or the use of non-sentient or less sentient animals; *reduction*, keeping the number of animals used to the minimum required to achieve the objectives of the work; and *refinement*, minimising the noxiousness of the procedures applied to the animals used.

A dedicated, comprehensive and rigorous application of the Three Rs is an essential prerequisite for this approach to command respect. Thus, we must apply the Three Rs at every appropriate step during the design and execution of experiments. We must seek ways to demonstrate that we have done so, and we must also actively attempt to expand the options available for replacement, reduction and refinement in our own fields of interest.

Anything less than a conscientious commitment to this approach can be justifiably criticised as a mere facade designed to avoid criticism of what would then be indefensible actions. The growing international emphasis on seeking alternatives to the use of animals in the life sciences, and the successful development of many genuine alternatives via application of the Three Rs tenet, are therefore heartening and ethically *necessary* developments (Abstracts, 1993, 1996, 1999). Examples of the Three Rs have also regularly been provided in ANZCCART News (e.g., Mellor and Bayvel, 1998).

Minimising other harms

There are other possible harms which must be recognised and minimised. Some of them focus on the scientists and animal care staff and include the following.

- The need to suppress our natural inclination to care for animals which become ill or injured during the purposeful imposition of illness, injury or distress as part of some scientific investigations.
- The grief experienced by some scientists and animal care staff who have bonded with study animals, when and if the animals are killed at the end of an experiment.
- The potential for callousness to be the outcome of the distancing process that is often a part of coping with our thwarted impulse to care for animals and the grief we experience for those which die or are killed.

We clearly need to be aware of these possibilities and have procedures in place to deal with them.

Other harms include the following.

- The negative impact on animals and people of what are eventually shown to be errors in scientific reasoning which have arisen during the early stages of understanding particular body processes.
- The possible use of the discoveries of animal-based science for irresponsible, callous, malign or other purposes which harm animals or people.
- The genuine concern, offence or outrage caused to those who adopt different ethical positions from animal-based scientists and who sincerely oppose the use of animals in research, teaching and testing.

We need to remain aware of such possibilities and attempt to minimise them.

Maximising the benefits

There are two main issues here: our attitude to achieving the anticipated benefits, and what those benefits are and how they can be assessed.

Attitude to achieving the anticipated benefits

We must be resolute and vigorous in our attempts to maximise the benefits of our work.

This requires the following.

- A careful choice of the questions our work is designed to address to ensure that they are answerable scientifically.
- Ensuring that those questions can be answered with the methods that are currently available.
- Evaluating the relative importance of the perceived animal or human need the proposed work is designed to address in relation to other known needs, *and* assessing the chances of success in addressing them.

"Strong utilitarianism" *also* demands an ethical commitment to seeing the process through to its completion. Thus, leaving the outcomes of soundly-based animal work unpublished or otherwise not effectively disseminated is unethical. Merely publishing our findings is the minimum requirement, because we have a further ethical obligation to promote the beneficial application of those findings as widely as can be feasibly managed. Such application, for new fundamental knowledge, should at least include updating tertiary-level course material with the latest established information. For applied research outcomes, it should include ensuring that the findings are actually used to minimise the problems the research was designed to address.

As few animal-based scientists individually are likely to possess all of the skills required to successfully manage the full spectrum of these activities, we need to ensure that current and future networks of scientists have members who collectively cover the required skill range.

What are the benefits?

I want to divide these into primary and secondary benefits.

Primary benefits include the following:

- Knowledge itself — the knowledge of life processes and its incorporation into educational programmes.
- The outcomes of applying or using that knowledge:
  * to improve the health and well-bring of people by among other things, improving the prevention, diagnosis, and treatment of illness and injury, by aiding healthy lifestyle decisions, and by enhancing sports performance and recreational enjoyment;
  * to improve the health, welfare and productivity of food, fibre and draft animals, and of companion, recreational, sporting and service animals;
  * to contribute to the successful conservation and management of endangered, exotic or wild animals;
  * to help maintain an appropriate ecological balance by the humane control of pest animals,
  * and other similar outcomes.

Secondary benefits include the following:

- For the organisations which employ the scientists: the contributions the conduct of animal-based science make to the reputation and success of those organisations.
- For individual scientists and their support staff: the enhancement of career prospects, earning power and the capacity to provide for their own and their family's needs.
- For the wider community (the city, region or country): the economic, educational, social and other contributions made by the organisations, scientists and support staff who are part of it.
- In the intellectual arena: the exercise of our creative imagination, rationality and problem-solving skill in the pursuit of the animal-based wing of science which is part of our culture.
- In the ethical arena: the stimulus and, especially now, the requirement to explore the value context, content and implications of human-animal interactions in science and in all other areas.

As with the harms, the benefits of animal-based science are wider than may be obvious at first sight. But against this last point must be placed a constraining caveat. *We must apply just as much energy to searching for and minimising the potential harms of animal-based science as we do to identifying and maximising its potential benefits.* Giving less attention to the harms than we do to the benefits, simply to get approval for something we want to do, weakens utilitarian ethical support for it, and our behaviour can then be *justifiably* criticised as questionable. There is another stimulus to conscientious, honest and rigorous exploration of *all* harms and benefits. It is the serious misgivings, highlighted by Schweitzer's "Reverence for Life" philosophy, that we should retain while we still need to use animals in science.

David Mellor
Animal Welfare Science and Bioethics Centre,
Massey University,
New Zealand.

References

Abstracts (1993). *First World Congress on Alternatives and Animal Use in the Life Sciences; Abstracts* pp 1-299. Johns Hopkins University, Baltimore, U.S.A.

Abstracts (1996). Second World Congress on Alternatives and Animal Use in the Life Sciences. *Alternatives to Laboratory Animals* 24 (Special Issue), 41-338.

Abstracts (1999). Third World Congress on Alternatives and Animal Use in the Life Sciences. *Alternatives to Laboratory Animals* **27** (Special Issue), 35-442.

Battye, J. (1994). Ethics and animal welfare — where do we go from here? In: *Animal Welfare in the Twenty-first Century: Ethical, Educational and Scientific Challenges,* (Eds. R. M. Baker, D. J. Mellor, and A. M. Nicol), 3-10. ANZCCART, Adelaide.

Mellor, D.J. (1998). How can animal-based scientists demonstrate ethical i-ßntegrity? In: *Ethical Approaches to Animal-Based Science,* (Eds. D.J. Mellor, M. Fisher and G. Sutherland), p. 19-31. ANZCCART, Wellington.

Mellor, D.J. and Bayvel, A.C.D. (1998). Promoting awareness of the Three Rs. *ANZCCART News* **11:** (1), 1-5.

Monamy, V. (1996). *Animal experimentation: a student guide to balancing the issues.* ANZCCART, Adelaide.

The new Animal Welfare Act 1999 and conducting animal-based science in New Zealand

The Animal Welfare Act 1999 focuses attention on meeting the wider needs of animals, not just the avoidance of cruelty. It reaffirms public support for the conduct of animal-based science, but only when strict and clearly defined conditions are met, and it provides for heavy penalties for breaches of the Act.

The Animal Welfare Act 1999 binds all of us in New Zealand to a "duty of care" towards animals, whereby we are required to meet the physical, health and behavioural needs of the animals we own or control. Our duty of care covers a much wider spectrum of behaviour towards animals than merely defining, preventing, catching and punishing cruelty, which was the major focus of the 40-year-old legislation the new Act replaced. The details of how we can exercise our duty of care appropriately in different areas of animal use are provided in Codes of Welfare developed, with public consultation, by the National Animal Welfare Advisory Committee. These Codes are specific to particular industries or circumstances which involve animals and are to be updated regularly to take account of new scientific knowledge and changing public expectations regarding animal welfare. Maximum penalties for breaches of the Act are a $50,000 fine and/or three years imprisonment for individuals and a $250,000 fine for corporations or institutions. Instant fines of $400, and other fines of $1,200, can also be imposed for minor infringements.

The Act, which received almost unanimous support in Parliament, also provides the legal framework for the conduct of animal-based science in New Zealand. It is clear that many of the restraints and intrusions imposed on animals during their use in research, teaching and testing contravene our defined duty of care and, if done outside the laboratory, would attract penalties under the law. However, most members of the New Zealand public want the benefits of animal-based science, and, via the appropriate part of the Act, have given permission for research, teaching and testing involving animals to be conducted, but only if stringent conditions are met. These conditions include the following:

- a national body, the National Animal Ethics Advisory Committee (NAEAC), must have oversight of all matters regarding the use of animals in research, teaching and testing;
- each institution undertaking such activities must have a Code of Ethical Conduct, reviewed by NAEAC and approved by the Director General of the Ministry of Agriculture and Forestry (MAF), which defines the ethical and practical obligations of the organisation when engaging in animal-based science;
- each institution must have a properly constituted Animal Ethics Committee which includes three independent members (a member of a recognised animal welfare organisation, a layperson nominated by the local authority, and a veterinarian nominated by the New Zealand Veterinary Association) as watchdogs on behalf of animals and the public;
- the Animal Ethics Committee must consider and, only if it is satisfied, approve all research, teaching and testing procedure before they begin, taking into account the anticipated benefits of the work and how those benefits will be maximised, the likely harm that will be done to the animals and how that harm will be minimised, whether the benefits outweigh the harm sufficiently to justify the work, the quality of the science proposed, whether the qualifications of those involved are appropriate, the standards of animal care and the lines of responsibility for those involved in the work;
- every person wishing to conduct a research, teaching or testing procedure must first apply to, and receive approval for the proposed work from, their institution's Animal Ethics Committee, by providing that Committee with all the information just noted;
- each Code of Ethical Conduct has a tenure of no more than 5 years and can be renewed only if the institution demonstrates to an independent reviewer, accredited by MAF, that its animal ethics processes, procedures and culture have to that point conformed with its Code and acceptable national standards. This review procedure is likely to be similar to that devised by the New Zealand Board of ANZCCART (Jolly, 1998).

Breaches of these conditions, when operating within the Codes of Ethical Conduct and Animal Ethics Committee system, attract fines of up to $25,000 and/or six months imprisonment for individuals and fines of up to $125,000 for corporations or institutions. Any individual prosecuted successfully and penalised by the Courts for a serious breach of their institution's Code of Ethical Conduct would presumably also be dismissed or banned by the institution from conducting animal-based procedures. In very serious cases an institution's Code of Ethical Conduct can be suspended or revoked, which would stop all of its animal-based science activities covered by that Code, not just those that led to the revocation. This penalty, the most severe from the institution's viewpoint, would presumably be used sparingly, but it earns its place by assuring the scientists and the public that all other disciplinary measures will be conducted rigorously.

Engaging in animal-based science outside the Codes of Ethical Conduct and Animal Ethics Committee system removes the protection of the part of the Act which deals with animal-based science and can therefore attract the much harsher penalties mentioned earlier.

A central feature of the regulation of animal-based science in New Zealand is the emphasis on individual scientists and their institutions accepting ethical responsibility for their own behaviour within the legally devolved framework of the Codes of Ethical Conduct and Animal Ethics Committee system. For this system to engender and retain public trust, animal-based scientists must not only conform to the letter of the law, but they must also manifestly operate according to the spirit of the law. The latter will only be convincing if animal-based scientists not only operate within the law, but also exhibit exemplary behaviour, altruistic purpose, engagement with values and the highest standards of animal care.

Pain – assessment, alleviation and avoidance in laboratory animals

Paul Flecknell
University of Newcastle
UK
(based on material from Pain Management in Animals, edited by Flecknell and Waterman-Pearson, publication due August 2000, Saunders, London)

ANZCCART Facts Sheet

ANZCCART
PO Box 19
Glen Osmond SA 5064 Australia
Tel: 08–8303 7393 Fax: 08–8303 7113
E-mail: anzccart@waite.adelaide.edu.au

Pain in laboratory animals is a major animal welfare problem that must be addressed if we are to apply Russell and Burch's principle of Refinement - "to reduce to an absolute minimum the pain and distress experienced by those animals that are used (in research procedures)".

In order to provide effective analgesia, it is essential that we have a good knowledge and understanding of animal pain:

- we need to know when pain might occur, how long it might last and how well it will respond to therapy;
- we need to consider the advantages and disadvantages of the various methods of managing pain, and how we can best apply these in different situations.
- for optimal pain management we need to recognise the presence of pain and assess its severity; and
- more fundamentally, we need to be certain that pain occurs in animals; that it can result in suffering, in a similar way to pain in man; and so become convinced that its avoidance and alleviation need to be given a high priority.

Do animals experience pain?

Although it is widely accepted that animals experience pain, it is important that we establish a basis for this assumption. There can be no doubt that the ability to detect damaging or potentially damaging stimuli, for example excess heat or mechanical pressure, is present in many animal species. Possession of this detection system does not, in itself, mean that animals experience pain. Pain in man has both a sensory and an emotional component. Without interpretation by the brain of the sensory information arriving from peripheral nerves, the characteristic unpleasant and distressing nature of pain is not appreciated. The initial processing of information arising in the peripheral detection system, which relates to potentially damaging stimuli, is termed nociception. These processes are virtually identical in animals and man, but interpretation of this information centrally, in the cerebral cortex, is needed for pain to be experienced.

Whether animals possess the same, or a similar capacity as man to experience emotions such as pain has been extensively debated for centuries. The main reason for the continued debate is that it is impossible to investigate such emotional states directly — we can only draw inferences from other, indirect, measures, such as investigation of behavioural responses. Scientific support for the belief that animals can suffer often consists simply of drawing parallels in animal and human neuroanatomy, and making the assertion that animals "are given the benefit of the doubt". When comparing the central nervous system structures believed to be associated with pain perception, or at least with the unpleasant aspect of pain, it is likely that the pre-frontal cortex has an important role. In man, pre-frontal lobotomy was used as a treatment for some psychiatric disorders. Patients who had undergone this procedure still responded to painful stimuli by reflex movements, but expressed no concern about their pain — it was no longer considered unpleasant. Most animal species have relatively small areas of pre-frontal cortex, and this has led to the suggestion that pain in animals is comparable to that experienced by lobotomised humans (Melzack and Dennis, 1980; Bermond, 1997). This assumes that absolute size of the pre-frontal cortex will determine the capacity for pain perception, but it may be that other areas of the brain carry out a similar role in other species. What is clear, however, is that animals do not behave in simple, reflex ways, in circumstances that would cause pain in man.

Animals and their response to pain

Aside from immediate avoidance or defence reactions, such as struggling or biting when an injured limb is handled, animals show a range of more subtle behavioural responses to pain. Animals can be trained to perform complex tasks to avoid brief painful stimuli, and more complex studies have shown that animals can choose to self-administer analgesics when they develop chronic painful conditions (Colpaert, 1987). The response to an analgesic has often been used to determine whether a behaviour was pain related, and although it can become a circular argument (animal pain behaviour is behaviour modified by analgesic drugs, which are drugs that alleviate pain), it provides some useful information when developing pain assessment schemes for animals.

The development of assessment schemes is of central importance to our understanding and appreciation of animal pain. If we cannot assess pain, we cannot manage it effectively, and it is likely that a failure to appreciate the severity of pain in individual animals is the single most important factor in the apparent underuse of analgesics in animals. Most of us expect to be able to recognise pain in animals, and we develop clear ideas concerning responses to acute pain. Unfortunately, we retain a level of anthropomorphism, which leads us to expect animals in pain to behave in the same way as humans in pain. Animals in pain could be expected to behave in different ways depending upon the site, severity and type of pain, but we should also expect them to behave in a species-specific way. Some species, especially those which may expect support from others, may show very obvious pain-related behaviour. In other species, expressing such overt behaviour would simply alert predators that they were less fit and hence easy prey. If overt pain-related behaviour is expressed, then the animal may mask this behaviour when it is aware it is being observed.

Animals may also change their responses when in a familiar, secure environment, and express less pain-related behaviour than when in an unfamiliar environment – for example when removed from their cage for examination.

It is important that we examine our preconceptions about pain behaviour critically and try to establish which clinical signs indicate the presence of pain in animals. These clinical signs are of course likely to vary in different species and with different clinical conditions. Although our ability to recognise pain in animals remains poor, adopting a critical approach has enabled pain scoring systems for dogs, cats, horses, sheep, calves and small rodents to be developed (see below). As further studies progress, it should be possible to devise systems of assessment that can be introduced successfully into most research animal units. One important point to note is that many of these schemes are attempting to differentiate small gradations in the animals' sensation of pain. Recognising obvious clinical signs of marked pain in some species such as the dog and cat is not difficult, and should result in use of appropriate analgesic therapy.

When could pain occur?

It does not seem unreasonable to assume that since the peripheral mechanisms for detection of potentially painful stimuli are similar in animals and man, and the mechanisms for processing these signals are remarkably similar, then the circumstances that could give rise to pain will also be similar. Clearly, we must also give careful consideration to differences in anatomy, and differences in the natural environment of particular species, but broad similarities are likely to exist. If this is so, then it should influence our decision-making. At present, in veterinary clinical practice, analgesics are widely used to control pain in two groups of animals – those which have undergone surgery or have suffered traumatic injuries, and those with acute or chronic arthritis. In research animal facilities, alleviation of post-operative pain probably represents the greatest area of analgesic use. In man, there are a range of other circumstances in which pain can occur – for example, disease processes with a marked inflammatory component, or some types of neoplasia. When these conditions are modelled in laboratory species, in order to develop novel therapies or study underlying mechanisms of these disease processes, use of analgesics may be precluded because of interactions with the research protocol. It is important that these potential interactions are addressed logically, and this issue is discussed further below. The potential interaction between analgesic therapy and research protocols also arises when dealing with post-surgical pain, but even when this is not seen as a significant issue, other reasons for withholding analgesics may be advanced.

- *Alleviation of post-operative pain will result in the animal injuring itself.* Provided that surgery has been carried out competently, administration of analgesics, which allow resumption of normal activity, rarely results in problems associated with the removal of pain's protective function. Claims that analgesic administration results in skin suture removal are unsubstantiated, and contrary to findings in our laboratory. In our institute, administration of analgesics to laboratory animals after a wide variety of surgical procedures has not resulted in any adverse clinical effects.

- *Analgesic drugs have undesirable side-effects such as respiratory depression.* The side-effects of opiates in animals are generally less marked than in humans and should rarely be a significant consideration when planning a post-operative care regimen.

- *We don't know the appropriate dose rates and dosage regimens.* This is primarily a problem of poor dissemination of existing information. Virtually every available analgesic drug has undergone extensive testing in animals. Dose rates are therefore available for a range of drugs in many common laboratory animal species. It is occasionally difficult to extrapolate available dose rates from one species to another and to translate dose rates that are effective in experimental analgesiometry into dose rates which are appropriate for clinical use. Nevertheless, in most instances a reasonable guide as to a suitable, and safe, dose rate can be obtained.

- *Pain-relieving drugs might adversely affect the results of an experiment.* Although there will be occasions when the use of one or other type of analgesic is contra-indicated, it is extremely unlikely that there will be no suitable analgesic that could be administered. More often, the reluctance to administer analgesics is based upon the misconceived idea that the use of any additional

medication in an experimental animal is undesirable. The influence of analgesic administration in a research protocol should be considered in the context of the overall response of the animal to anaesthesia and surgery. The responses to surgical stress may overshadow any possible adverse interactions associated with analgesic administration. An additional consideration is that many arrangements for intra-operative care fail to control variables such as body temperature, respiratory function and blood pressure. It seems illogical to assume that changes in the function of the cardiovascular or respiratory systems are unimportant, but that administration of an analgesic will be of overriding significance. It should be considered an ethical responsibility of a research worker to provide a reasoned, scientific justification if analgesic drugs are to be withheld. It is also important to realise that the presence of pain can produce a range of undesirable physiological changes, which may radically alter the rate of recovery from surgical procedures. In animals, post-surgical pain can reduce food and water consumption, interfere with normal respiration (for example after thoracotomy), and reduce a whole range of "self-maintenance" behaviours. The immobility caused by pain can lead to muscle spasm, can cause atrophy of areas, and can slow healing. Prolonged immobility can also cause pressure sores, urine scalding, faeces soiling and can greatly complicate animal care routines.

Finally, there may be legal constraints concerning analgesic use that can restrict their administration. In many countries, the use of the majority of opioids is controlled by legislation. Complying with this legislation often requires careful record keeping of the purchase, storage and dispensing of opioids and may restrict the persons who are able to dispense and administer these substances. In some countries the degree of record keeping required can act as a strong disincentive. Legislative control, together with genuine safety concerns may also limit the dispensing of this class of analgesics for use by investigators or technicians .

Progress in pain assessment

If we are going to control pain effectively, we need to assess it accurately. The difficulty in assessing pain often results in one of the following approaches being adopted:

- analgesics are withheld because the animal shows no obvious signs of pain (in other words, it does not behave in a similar way to a human experiencing pain); or

- it is assumed that since a human who had undergone a similar procedure would require analgesics, the animal is in need of pain relief, and analgesics are administered.

In the first case, animals that are almost certainly in pain will not receive adequate analgesia. In the second case, since no proper assessment of the degree of pain has been made, it is a matter of chance whether an appropriate degree of pain relief is provided. It is important to emphasise that, in our experience, adopting the latter approach and administering an initial dose of analgesic is almost invariably beneficial, and rarely causes significant clinical side effects. Administering repeated doses of analgesics to animals which are not experiencing pain may, however, be detrimental – for example the drug may depress appetite and so delay recovery (Flecknell and Liles, 1992). Clearly it is preferable to try to assess pain, and adjust the analgesic regimen according to this assessment.

When considering how we might assess pain in animals, considerable parallels can be drawn with the situation in human infants. The most widely used techniques have been pain-scoring systems based upon criteria such as crying, facial expression, posture and behaviour (McGrath and Unruh, 1989). An experienced observer then scored these behaviours. This approach has been used in a wide range of species, mainly to assess post-surgical pain, with some success. All of the pain-scoring techniques used are highly subjective, and standardising scores between observers remains a problem.

In laboratory animals, a number of different approaches have been used to assess pain or distress. An initial assessment scheme, using a numerical scale, was proposed by Morton and Griffiths (1985). This paper influenced a large number of other groups, who modified the original hypothesis, but retained the central notion of identifying pain-specific behaviours, and rating them in some way (e.g., AVTRW, 1986; LASA, 1990; Flecknell and Liles, 1991). Loss of appetite and reduction in body weight have been noted in rodents post-operatively (Morton and Griffiths, 1985; Wright *et al.*, 1985) and these variables have been studied in rats as potential means of assessing the degree of post-operative pain, and comparing the efficacy of different analgesic regimens (e.g., Flecknell and Liles, 1991; Flecknell and Liles, 1992; Liles and Flecknell, 1992, 1993a, 1993b). Measures of food and water consumption and body weight are, of course, retrospective, and do not allow the analgesic regimen to be modified to meet the requirements of the individual animal. They have, however, enabled broad assessments of analgesic efficacy to be made. A number of recent studies have used more detailed behavioural analyses to assess pain, and further development of this approach should lead to practically useful scoring systems. In summary, whether a scoring system is used or not, pain assessment will be facilitated by:

- a good knowledge of the species-specific behaviours of the animal being assessed;

- a knowledge and comparison of the individual animal's behaviour before and after the onset of pain (e.g., pre - and post-operatively);

- the use of palpation or manipulation of the affected area and assessment of the responses obtained;

- examination of the level of function of the affected area e.g., leg use following injury or limb surgery, together with a knowledge of any mechanical interference with function.

- the use of analgesic regimens or dose rates that have been shown to be effective in controlled clinical studies, and evaluation of the change in behaviour this brings about; and

- a knowledge of the non-specific effects of any analgesic, anaesthetic or other drugs that have been administered.

Pain relief

Leaving aside the problems of pain assessment, it is not unreasonable to assume that analgesic therapies shown to be effective in man are likely to also be effective in animals. Analgesics can be broadly divided into two groups, the opioids or narcotic analgesics and the non-steroidal anti-inflammatory drugs (NSAID) such as aspirin. Local anaesthetics can also be used to provide post-operative pain relief by blocking all sensation from the affected area. Suggested dose rates of analgesics are given in Tables 1-2.

Clinical use of analgesics

When formulating an analgesic regimen for a particular animal, several factors need to be considered.

- What is the likely severity of pain, and what is its anticipated duration?

- Which drug or drugs should be administered, and at what dose rates?

- Are there any special factors that will influence the choice of analgesic, for example, the species of animal, any potential interactions with the particular research project, or any particular features of the current condition and the type of pain?

- What facilities are available for management of the animal? What level of nursing care and monitoring of the animal is available? Can staff attend throughout a 24 hour period? Are there facilities for continuous infusion of analgesics?

Timing of analgesic administration

Although an animal may be unconscious during surgery, the peripheral nerves carrying nociceptive information are still active. This information arriving in the central nervous system produces changes that increase the perception of pain once the animal has regained consciousness. To be most effective, analgesics should prevent the noxious stimuli from reaching the central nervous system. Reducing or eliminating peripheral inflammation, which in itself increases input into the CNS, and so aggravates central hypersensitivity, is also important. Therefore:

- administer analgesics pre-operatively whenever possible;

- administer additional analgesics in the post-operative period, recognising that pain will be more easily controlled if pre-emptive analgesia has been used;

- use of pre-emptive analgesia will often reduce the dose of anaesthetic drugs required, so reducing anaesthetic side-effects and reducing risks associated with anaesthesia;

- if analgesics cannot be given pre-emptively, administer them as soon as is practicable. The longer pain is established, the greater will be the degree of central hypersensitivity, and the more difficult pain management becomes.

Multi-modal pain therapy

Since pain arises because of activation of a large number of different mechanisms, the most effective pain relief is provided by administering drugs from several different classes of analgesics, each acting on different parts of the pain system.

This concept is easy to apply in clinical practice, for example, by combining the use of opioids with NSAIDs. The opioid acts centrally to limit the input of nociceptive information into the CNS and so reduces central hypersensitivity. In contrast, the NSAID acts both centrally, to limit the central changes induced by the nociceptive information that does get through, and also peripherally to decrease inflammation during and after surgery, and thus limits the nociceptive information entering the CNS as a result of the inflammation.

Anaesthesia and analgesia

Anaesthesia does not necessarily equate with analgesia. General anaesthesia produces loss of consciousness, so the animal cannot perceive pain, but in unconscious animals, noxious stimuli will still be transmitted to the CNS. Although these noxious stimuli will not be consciously perceived as pain, central hypersensitivity will still develop, and so post-operative pain perception will be heightened. Some anaesthetic agents do have analgesic effects (e.g., ketamine and alpha $_2$ adrenoreceptor agonists such as medetomidine) and analgesics may be used as part of the analgesic regimen (e.g., opioids such as fentanyl). These factors, together with the need to use analgesics as soon as possible, and the advantages of using multiple classes of analgesics, should be taken into account when planning a peri-operative analgesic protocol.

Pain relief – practical considerations

Most of the opioid (narcotic) analgesics have a relatively short duration of action. Maintenance of effective analgesia with, for example, pethidine, may require repeated administration every one to three hours, depending upon the species. Continuation of such a regime overnight can cause practical problems. One method of avoiding this difficulty is to use buprenorphine as the analgesic, since there is good evidence in humans and a number of animal species that it has a duration of action of six to twelve hours. An alternative approach is to adopt the well-established human clinical technique of administering analgesics as a continuous infusion.

NSAIDs tend to have long durations of action, and the newer agents (e.g., carprofen, ketoprofen, and meloxicam) are effective in controlling moderate post-surgical pain in many circumstances.

Epidural and intrathecal opioids have been shown to have a prolonged effect in man and to provide effective analgesia, and clinical studies have indicated that the technique can be used in a number of species. The necessary techniques of epidural or intrathecal injection have been described in the rabbit (Kero, Thomasson and Soppi, 1981; Hughes, Doherty and Charman, 1993). In larger species such as the cat, dog, sheep and pig, descriptions of the injection technique can be found in most veterinary anaesthesia texts and a number of other publications (e.g., Thurmon *et al.*, 1996)

The need for repeated injections of analgesics is time consuming and may be distressing to the animal, particularly smaller species, which require firm physical restraint to enable an injection to be given safely and effectively. Analgesics can be added to food or water, but some animals eat and drink relatively infrequently, or may only do so in the dark phase of their photoperiod. In addition, food and water intake may be depressed following surgery, and this, coupled with wide individual variation in consumption, makes routine application of the technique difficult. Finally, the high first-pass liver metabolism of opioids administered by the oral route requires that high dose rates are given, and this can represent a significant cost if all of the animals' drinking water or food is medicated. Administration of small quantities of medicated food does not avoid the need for repeated attendance overnight, but does remove the need for repeated subcutaneous or intramuscular injections in small rodents. Provision of analgesia with buprenorphine in flavoured gelatin "Buprenorphine Jello", (Pekow, 1992) seems to be an effective means of providing post-operative pain relief. In our laboratory, we have noted that rats are initially cautious of jelly pellets, but once one pellet has been consumed, subsequent pellets are eaten as soon as they are offered. It is therefore advisable to commence administering pellets, which do not contain analgesic, two to three days before surgery. After surgery, analgesic-containing jelly can be given. The flavoured gelatin used is domestic fruit-flavoured jelly, reconstituted at double the recommended strength. We have also recently used meloxicam (which is available as a palatable oral preparation) for post-surgical pain relief in rats.

Administration of opioids by any route can be associated with the development of respiratory depression. It must be emphasised that this is rarely of clinical significance in animals unless high doses of pure μ agonists (e.g., fentanyl) are used. If respiratory depression occurs, it can be treated by the administration of the opiate antagonist drug, naloxone. Administration of naloxone will also reverse the analgesic effects of the opioid and it may be preferable to correct the respiratory depression by the use of doxapram. Alternatively, if a μ agonist opioid such as morphine or fentanyl has been used, the respiratory depression can be reversed using nalbuphine or butorphanol, and some analgesia maintained because of the action of these latter two agents at kappa receptors. Repeated administration of these agents may be required, and the animal should be observed carefully for several hours to ensure adequate respiratory function is maintained.

Gastric distension associated with pica has been reported in rats given large doses (0.5mg/kg s/c) of buprenorphine, although effects in rats receiving a lower dose (0.05mg/kg) were minimal (Clark *et al.*, 1997). There are also reports of gastric obstruction occurring after use of buprenorphine. It seems likely that this effect varies with the strain of rat and the anaesthetic regimen used. If problems are encountered, then alternative analgesics should be used.

Additional considerations in pain relief

Although the use of analgesic drugs remains the most important technique for reducing post-operative pain, the use of these drugs must be integrated into a total scheme for peri-operative care.

Including an analgesic drug in any pre-anaesthetic medication can provide pain relief in the immediate recovery period.

If a neuroleptanalgesic combination has been used to produce anaesthesia, it can be reversed by the use of buprenorphine, nalbuphine or butorphanol, rather than with naloxone. These agents have been shown not only to reverse the respiratory depressant effects of opioids such as fentanyl but, in contrast to naloxone, to provide effective prolonged analgesia.

The expertise of the surgeon can also greatly influence the degree of post-operative pain. Good surgical technique, which minimises tissue trauma and the prevention of tension on suture lines, can considerably reduce post-operative pain. The use of bandages to pad

and protect traumatised tissue must not be overlooked and forms an essential adjunct to the use of analgesic drugs.

Aside from measures directed towards alleviating or preventing pain, it is important to consider the overall care of the animal and the prevention of distress. Distress is used in this context to describe conditions which are not in themselves painful, but which are unpleasant and which the animal would normally choose to avoid. For example, recovering from anaesthesia on wet, uncomfortable bedding in a cold, unfamiliar environment would be likely to cause distress to many animals. It is essential to consider the methods described for the control of pain in conjunction with good post-operative care.

References

AVTRW (Association of Veterinary Teachers and Research Workers) (1986) Guidelines for the recognition and assessment of pain in animals. *The Veterinary Record* **118:** 334-338.

Bermond, B. (1997) The myth of animal suffering. In: Dol, M. *et al., Animal consciousness and animal ethics*, Van Gorcum, The Netherlands.

Clark, J.A., Myers, P.H., Goelz, M.F., Thigpen, J.E. and Forsythe, D.B. (1997) Pica behaviour associated with buprenorphine administration in the rat. *Laboratory Animal Science*, **47**: 300-3.

Colpaert, F. (1987) Evidence that adjuvant arthritis in the rat is associated with chronic pain. *Pain* **28**: 201-222.

Flecknell, P.A. (1984) The relief of pain in laboratory animals. *Laboratory Animals* **18:** 147-160.

Flecknell, P.A. and Liles, J.H. (1991) The effects of surgical procedures, halothane anaesthesia and nalbuphine on the locomotor activity and food and water consumption in rats. *Laboratory Animals* **25:** 50-60.

Flecknell, P.A., and Liles, J.H. (1992). Evaluation of locomotor activity and food and water consumption as a method of assessing postoperative pain in rodents. In: *Animal Pain* Eds. C.E. Shortland and A. Van Poznak. Churchill Livingstone, New York. pp. 482-488.

Hughes, P. J. , Doherty, M. M. and Charman, W. N. (1993) A rabbit model for the evaluation of epidurally administered local anaesthetic agents. *Anaesthesia and Intensive Care* **21:** 298-303.

Kero, P. , Thomasson, B. and Soppi, A.M. (1981) Spinal anaesthesia in the rabbit. *Laboratory Animals* **15:**, 347-348.

LASA (1990) The assessment and control of the severity of scientific procedures on laboratory animals. *Laboratory Animals* **24:** 97-130.

Liles, J. H. and Flecknell, P. A. (1992) The use of non-steroidal anti-inflammatory drugs for the relief of pain in laboratory rodents and rabbits. *Laboratory Animals* **26:**, 241-255.

Liles, J.H. and Flecknell, P.A. (1993a) A comparison of the effects of buprenorphine, carprofen and flunixin following laparotomy in rats. *Journal of Veterinary Pharmacology and Therapeutics* **17** , 284-290

Liles, J.H. and Flecknell, P.A. (1993b) The effects of surgical stimulus on the rat and the influence of analgesic treatment. *British Veterinary Journal* **149** , 515-525

McGrath, P. J. and Unruh, A.M. (1989) *Pain in Children and Adolescents.* Elsevier, Amsterdam.

Melzack, R and Dennis, S.G. (1980) Phylogenetic evolution of pain-expression in animals. In: *Pain and Society.* Eds H.W. Kosterlitz and L.Y. Terenius, pp 13-26

Morton, D. B. and Griffiths, P. H. M. (1985) Guidelines on the recognition of pain, distress and discomfort in experimental animals and an hypothesis for assessment. *Veterinary Record* **116:** 431-436.

Pekow, C. (1992) "Buprenorphine Jello" recipe for rodent analgesia. *Synapse* **25:** 35-36.

Thurmon, J. C. , Tranquilli, W. J. and Mbenson, G. J. (1996) *Lumb and Jones' Veterinary Anaesthesia*, 3rd Edition, Williams and Wilkins, Baltimore.

Wright, E. M., Marcella, K. L. and Woodson, J. F. (1985) Animal pain: Evaluation and control. *Laboratory Animals* **14:** 20-30.

Opioid analgesic	Ferret	Guinea pig	Mouse	Rat	Rabbit
Buprenorphine	0.01-0.03mg/kg i/m, s/c or i/v 6-12 hourly	0.05mg/kg s/c 8-12 hourly	0.05-0.1mg/kg s/c 8-12 hourly	0.01-0.05mg/kg s/c or i/v 8-12 hourly 0.1-0.25mg/kg by mouth 8-12 hourly	0.01-0.05mg/kg i/m, s/c or i/v 6-12 hourly
Butorphanol	0.4mg/kg i/m 4 hourly	?	1-2.0 mg/kg i/m or s/c 4 hourly	1-2.0 mg/kg i/m or s/c 2-4 hourly	0.1-0.5 mg/kg i/m, s/c or I/v 4 hourly
Morphine	0.5-2mg/kg i/m, s/c 4-6 hourly	2-5mg/kg i/m, s/c 4 hourly	2-5mg/kg i/m, s/c 4 hourly	2-5mg/kg i/m, s/c 4 hourly	2-5mg/kg i/m, s/c 4 hourly
Nalbuphine	?	1-2mg/kg i/m 4 hourly	2-4mg/kg i/m 4 hourly	1-2mg/kg i/m 4 hourly	1-2mg/kg i/m, i/v 4 hourly
Pethidine (Meperidine)	5-10mg/kg i/m 2-4 hourly	10mg/kg i/m 2-4 hourly	10-20mg/kg s/c or i/m 2-3hourly	10-20mg/kg s/c or i/m 2-3hourly	5-10mg/kg s/c or i/m 2-3hourly

Table 1. Opioid analgesics for use in rabbits, ferrets and small rodents. Dose rates are based on published data and the clinical experience of the author. Dose should be adjusted to produce the desired effect, and administration repeated as needed to control pain. Particular care should be taken when administering these drugs by the intravenous route, as rapid administration can lead to inadvertent overdose. No good data are available concerning suitable dose rates for gerbils or hamsters, but clinical experience suggests that dose rates suggested for rats are appropriate.

Opioid analgesic	Non-human primates	Dog	Cat	Pig	Sheep
Buprenorphine	0.005-0.01mg/kg i/m, s/c or i/v 6-12 hourly	0.005-0.02mg/kg i/m, s/c or i/v 6-12 hourly	0.005-0.02mg/kg i/m, s/c or i/v 6-12 hourly	0.005-0.05 mg/kg i/v or i/m 6-12 hourly	0.005-0.01 mg/kg i/v or i/m 4 hourly
Butorphanol	0.01mg/kg i/v ?3-4 hourly	0.2-0.6mg/kg i/m, s/c or i/v 2-4 hourly	0.2-0.8mg/kg i/m or s/c 2-4 hourly		
Morphine	0.1-2mg/kg i/m, s/c or i/v 4-6 hourly	0.1-1.0mg/kg i/m, s/c or i/v 4-6 hourly	0.1-0.2mg/kg i/m, s/c or i/v 6-8 hourly	0.2-1.0mg/kg i/m ? 4 hourly	0.2-0.5mg/kg i/m ? 2 hourly
Nalbuphine	?	0.3-0.5mg/kg i/m, s/c 3-4 hourly	0.3-0.5mg/kg i/m, s/c or i/v 3 hourly		
Pethidine (meperidine)	?	3.5-10mg/kg i/m or 10-15mg/kg s/c, 2.5-3.5 hourly	3.5-10mg/kg i/m or 10-15mg/kg s/c, 2-3 hourly	2mg/kg i/m or i/v 2-4 hourly	2mg/kg i/m or i/v 2 hourly

Table 2. Opioid analgesics for use in larger animals. Dose rates are based on published data and the clinical experience of the author. Dose should be adjusted to produce the desired effect, and administration repeated as needed to control pain. Particular care should be taken when administering these drugs by the intravenous route, as rapid administration can lead to inadvertent overdose.

NSAIDs and mild analgesics	Ferret	Guinea pig	Mouse	Rat	Rabbit
Acetylsalicylic acid	200mg/kg by mouth, ? once	80-90mg/kg by mouth, ? once	120mg/kg by mouth, ? once	100mg/kg by mouth, ? once	100mg/kg by mouth, ? once
Carprofen	?	?	5mg/kg s/c or by mouth, daily	5mg/kg s/c or by mouth, daily	4mg/kg s/c daily or 1.5mg/kg by mouth, bid
Diclofenac	?	2.0mg/kg by mouth, daily	8.0mg/kg by mouth, daily	10.0mg/kg by mouth, daily	?
Flunixin	0.5-2mg/kg s/c, 12-24h	?	2.5mg/kg s/c ?12-24h	2.5mg/kg s/c ?12-24h	1.0mg/kg s/c ?12-24h
Ketoprofen	2mg/kg s/c daily for ? Up to 3days	?	?	5mg/kg s/c or by mouth, daily	3mg/kg s/c daily

Table 3. NSAID and other analgesics for use in rabbits, ferrets and small rodents. Dose rates are based on published data and the clinical experience of the author. Refer to the text for contraindications and precautions to be observed, particularly for long-term administration.No good data is available concerning suitable dose rates for gerbils or hamsters, but clinical experience suggests that dose rates suggested for rats are appropriate.

NSAIDs and mild analgesics	Non-human primates	Cat	Dog	Pig	Sheep
Acetylsalicylic acid	20mg/kg by mouth, 6-8 hourly	10-25mg/kg by mouth every 24-48 hours	10-25mg/kg by mouth every 24hours		50-100mg/kg by mouth, 6-12 hourly
Carprofen	?	2-4mg/kg s/c or i/v, single dose 2mg/kg orally for 4 days, then every other day,well-tolerated long-term	4mg/kg s/c or i/v, single dose 4mg/kg orally,well-tolerated long-term	2-4mg/kg s/c or i/v daily	
Flunixin	2-4mg/kg s/c or i/v daily	1mg/kg s/c or slow i/v, single dose 1mg/kg orally, single dose	1mg/kg s/c or slow i/v, single dose 1mg/kg orally, daily for up to 3 days	1-2mg/kg s/c or i/v, daily	2mg/kg s/c or i/v, daily
Meloxicam		0.2mg/kg s/c, single dose 0.3mg/kg orally on day 1, then 0.1mg/kg orally daily for 3 days, then 0.1mg/cat daily	0.2mg/kg s/c, single dose 0.2mg/kg orally on day 1, then 0.1mg/kg orally daily, well tolerated long-term		
Ketoprofen		2mg/kg s/c, daily for up to 3 days 1mg/kg orally, daily for up to 5 days	2mg/kg s/c, daily for up to 3 days 1mg/kg orally, daily for up to 5 days		

Table 4 . NSAID and other analgesics for use in the dog and cat.. Dose rates are based on published data and the clinical experience of the author. Refer to manufacturers' data sheets for contraindications and precautions to be observed, particularly for long-term administration.

Surveillance in the animal-based science arena is already achieved in several ways in New Zealand. The three independent members of each Animal Ethics Committee have a pivotal role at the animal-use coalface. In recognition of this, ANZCCART, NAEAC and their nominating organisations [including the Royal (NZ) Society for the Prevention of Cruelty to Animals and the New Zealand Veterinary Association] all provide support and advice to help them fulfil this function.

Colleagues of the animal-based scientists who actually conduct the work also have a role as watchdogs, but their credibility in that role to a critical public will depend on the respect they engender by exemplary behaviour. Surveillance is now also achieved via a 5-yearly mandatory independent review of the processes, procedures and activities of all Animal Ethics Committees (Animal Welfare Act, 1999) and, as before, by continuing NAEAC oversight of the whole system.

David Mellor
Animal Welfare Science and Bioethics Centre
Massey University
New Zealand

References

Animal Welfare Act, 1999. Full text available at: http://www.knowledgbasket.co.nz/kete/database.html

Jolly, R.D. (1998). *Reviews of animal ethics committees.* In: Ethical Approaches to Animal-Based Science, (Eds. D.J. Mellor, M. Fisher and G. Sutherland), pp.105-109 ANZCCART, Wellington.

Newly published

Humane endpoints in animal experiments for biomedical research

This 150-page publication contains the Proceedings of an international conference held in Zeist, The Netherlands, from 22 to 25 November, 1998. They are edited by Coenraad Hendriksen and David Morton and were published by the Royal Society of Medicine, London (ISBN 1-85315-429-6).

There are moral, legal, social and economic reasons for implementing humane endpoints in medical research (e.g., cancer, transplantation, development of new medicines), toxicity testing, and studies on infection, as well as vaccine quality control. The purpose of this conference was to bring together persons with expertise in these areas to present their latest research results, with an emphasis on the practical implications. Important issues relating to the recognition and assessment of endpoints in areas of animal experimentation where animal well-being may be adversely affected and the determination, validation, implementation and acceptance of humane endpoints were addressed.

New techniques, new approaches and new strategies using non-invasive methods were discussed, as well as the training of observers and the use of recently developed remote sensing devices.

This conference was intended for those with responsibility for the use, care and welfare of research animals, such as regulators, scientists, veterinarians, technicians, animals welfarists and members of animal ethics committees.

Copies are available from:

David B Morton,
Centre for Biomedical Ethics,
University of Birmingham,
Edgbaston, Birmingham,
B15 2TT, UK
Tel: +44 (0) 121 414 3616/4517
Fax:+ 44 (0) 121 414 6979/6842
Email:
d.b.morton@bham.ac.uk

or

Coenraad Hendriksen, RIVM,
Central Animal Laboratories,
PO Box 1, 3720 BA, Bilthoven,
The Netherlands.
Tel: + 31 (0) 30 2742503
Fax: + 31 (0) 30 2744408
Email:
coenraad.hendriksen@rivm.nl

or ANZCCART's Adelaide office (3 copies only).

New ANZCCART publication -

The use of wildlife for research

Proceedings of ANZCCART's 1999 Australian Conference have been published and are available from our Adelaide and Wellington offices for $A20 or $NZ35, including postage (ISBN 0 9586821 2 7).

The 128-page Proceedings was edited by Professor David Mellor and Dr Vaughan Monamy and contains 20 very interesting papers covering a diversity of topics.

An order form was inserted in the September, 1999 issue of *ANZCCART News.*

Animal Welfare - Special issue on genetics and animal welfare

Guest editors: Professor L.F.M. van Zutphen, Utrecht University, The Netherlands and Professor P.G.C. Bedford, The Royal Veterinary College,London.

The November 1999 issue of *Animal Welfare* was published as a special issue, devoted to the topical subject of genetics and animal welfare. Papers cover issues ranging from the welfare implications of extreme breed types in farm and companion animals, to the effects of strain on the behaviour of poultry and laboratory animals. The practical and ethical implications of advances in genetic technologies are also discussed in a range of authoritative and thought-provoking papers.

Animal Welfare (ISSN 0962-7288) has established itself as an objective, international forum for quarterly publication of peer-reviewed papers on all aspects of farm, laboratory, zoo, wild and companion animal welfare science. It ranks among the top 25 per cent of all veterinary/zoological journals covered by the Science Citation Index, attesting to the quality and impact of its contents.

Individual copies of the Special Issue are priced at £15/US$30.00 and are available from -
Universities Federation for Animal Welfare,
The Old School,
Brewhouse Hill,
Wheathampstead,
Herts, AL4 8AN, UK.

Fax: 44 0 1582 831414 or
Email: ufaw@ufaw.org.uk.

NSAIDs and mild analgesics	Ferret	Guinea pig	Mouse	Rat	Rabbit
Acetylsalicylic acid	200mg/kg by mouth, ? once	80-90mg/kg by mouth, ? once	120mg/kg by mouth, ? once	100mg/kg by mouth, ? once	100mg/kg by mouth, ? once
Carprofen	?	?	5mg/kg s/c or by mouth, daily	5mg/kg s/c or by mouth, daily	4mg/kg s/c daily or 1.5mg/kg by mouth, bid
Diclofenac	?	2.0mg/kg by mouth, daily	8.0mg/kg by mouth, daily	10.0mg/kg by mouth, daily	?
Flunixin	0.5-2mg/kg s/c, 12-24h	?	2.5mg/kg s/c ?12-24h	2.5mg/kg s/c ?12-24h	1.0mg/kg s/c ?12-24h
Ketoprofen	2mg/kg s/c daily for ? Up to 3days	?	?	5mg/kg s/c or by mouth, daily	3mg/kg s/c daily

Table 3. NSAID and other analgesics for use in rabbits, ferrets and small rodents. Dose rates are based on published data and the clinical experience of the author. Refer to the text for contraindications and precautions to be observed, particularly for long-term administration.No good data is available concerning suitable dose rates for gerbils or hamsters, but clinical experience suggests that dose rates suggested for rats are appropriate.

NSAIDs and mild analgesics	Non-human primates	Cat	Dog	Pig	Sheep
Acetylsalicylic acid	20mg/kg by mouth, 6-8 hourly	10-25mg/kg by mouth every 24-48 hours	10-25mg/kg by mouth every 24hours		50-100mg/kg by mouth, 6-12 hourly
Carprofen	?	2-4mg/kg s/c or i/v, single dose 2mg/kg orally for 4 days, then every other day,well-tolerated long-term	4mg/kg s/c or i/v, single dose 4mg/kg orally,well-tolerated long-term	2-4mg/kg s/c or i/v daily	
Flunixin	2-4mg/kg s/c or i/v daily	1mg/kg s/c or slow i/v, single dose 1mg/kg orally, single dose	1mg/kg s/c or slow i/v, single dose 1mg/kg orally, daily for up to 3 days	1-2mg/kg s/c or i/v, daily	2mg/kg s/c or i/v, daily
Meloxicam		0.2mg/kg s/c, single dose 0.3mg/kg orally on day 1, then 0.1mg/kg orally daily for 3 days, then 0.1mg/cat daily	0.2mg/kg s/c, single dose 0.2mg/kg orally on day 1, then 0.1mg/kg orally daily, well tolerated long-term		
Ketoprofen		2mg/kg s/c, daily for up to 3 days 1mg/kg orally, daily for up to 5 days	2mg/kg s/c, daily for up to 3 days 1mg/kg orally, daily for up to 5 days		

Table 4 . NSAID and other analgesics for use in the dog and cat.. Dose rates are based on published data and the clinical experience of the author. Refer to manufacturers' data sheets for contraindications and precautions to be observed, particularly for long-term administration.

Book review

Management and Welfare of Farm Animals, UFAW Farm Handbook, 4th Edition.

Edited by R. Ewbank, F. Kim-Madslien, C.B. Hart.
Universities Federation for Animal Welfare, 1999.

ISBN 1 900 63000 1

Price: £17.00 or $US40.00

I was interested to review this book as I have had the 3rd edition (published in 1988) on my bookshelf for a number of years. The first edition was published in 1971 with the title *UFAW Handbook on the Care and Management of Farm Animals.* In spite of having the previous edition, in reality I made little use of it (I may have looked at it about four times in eight years), and I thought it would be interesting to see why this was the case and whether the new edition was potentially more useful. The fourth edition of 308 pages is about 18% longer than the previous edition and most of this is due to four new chapters covering red deer, quail, guinea fowl and fish.

The structure of the latest edition is similar to the previous one in that there is an introductory chapter on animal welfare including definitions, stress, legislation (in the UK) and the science of animal welfare. This is followed by separate chapters for each species, with each chapter written by a different author. The other species covered are dairy cattle, beef cattle and veal calves, sheep, goats, pigs, rabbits, laying hens, broiler chickens, turkeys and ducks. Each chapter has a generally similar structure including sections on the structure of the relevant industry in the UK, breeding and genetics, natural history and behaviour, reproduction, production, nutrition and feeding, environment and housing, health and disease and "the way ahead". However, there are variations in chapters with the shorter chapters omitting some subsections and the health and disease sub-heading changing to health and welfare in some later chapters. The text is clearly written and contains a considerable amount of information. The only typographical error I noticed was a change in print size on the last page of text on red deer.

In reading the book I focussed on those species that I was more familiar with (dairy cows, beef cattle, laying hens, broilers and pigs) and although having read the other chapters I have insufficient expertise to comment on the detailed information they contain. My comments on this book are that:

i) it is totally UK-focussed, which dramatically limits its use internationally;
ii) the chapters vary considerably in the depth of information and this is reflected by chapters of varying length such as 3 (quail), 7 (turkeys), 35 (sheep) and 41 (laying hens) pages;
iii) it is unclear who the audience is; and
iv) the focus is definitely on management rather than welfare and it takes considerable effort to determine what the welfare issues are for each species.

However, these criticisms must be tempered by the expectations of the reader - as the UK focus and the focus on management of each species may not be a concern to some. Also, with welfare in the title, my expectations were raised and unfortunately unfulfilled. A better title would have been as in the first and second editions that used the word "Care" rather than "Welfare". The UK focus means that a number of chapters are less relevant to other countries e.g., the details on indoor housing of dairy cows during winter and management of "hill" sheep are of no relevance in Australia and without some expertise (in which case one may not need the book) there is nothing in the text to allow the reader to determine what was common in management and care of farm animals in the UK compared to other countries. Similarly, in pigs there is considerable information on feeding methods but the use of electronic feeding stations and trickle feeding were dismissed in less than a sentence. Perhaps these methods are neither widely used nor of interest in the UK.

I got the impression from the preface that this book took a considerable time to complete. It is an unfortunate act of timing that the July 1999 European Union Directive on banning conventional cages for laying hens was just too late to be included as this Directive has far-reaching consequences for egg production systems in Europe and would probably have resulted in some different comments in the chapter on laying hens.

While the target audience is clearly stated in the preface to the third edition (veterinary and agricultural students), it is missing from this new edition. In fact, the wording on the back cover is "the overall aim is to promote a humane attitude in all those responsible for the care, management and use of farm animals". I interpret this as meaning to at least include those people caring for animals on a day-to-day basis e.g., farmers and stockpeople. If this is one of the target audiences, I imagine most of the chapters would not be relevant. To reach this audience, consideration should be given to having the chapters separated into booklets for each species.

While the welfare issues are within the text it would be more useful for those readers more interested in welfare if they were either listed separately or highlighted in the text. Also, while different housing systems are described, there is often little discussion of the arguments for and against individual systems.

While the *UFAW Handbook on the care and management of laboratory animals* is used as the "bible" of laboratory animal management and care, unfortunately the same cannot be said for this book on farm animals, because farming practices vary so much around the world. In spite of the above criticisms, the book contains a lot of interesting information. I would recommend it as source material for secondary schools and universities, and that these organisations' libraries and public libraries have a reference copy. I would recommend students and others interested in animal welfare read it, but the content is not of sufficient value to recommend they buy a copy.

John Barnett,
Animal Welfare Centre,
Victorian Institute of Animal Science,
Werribee
Victoria 3030.

Letter

The development of standard operating procedures for the use of livestock in teaching

In the section on *Care and use of livestock for scientific and teaching activities*, the *Australian Code of Practice for the Care and Use of Animals for Scientific Purposes* provides for the development of standard operating procedures (SOPs). These can be referred to in AEC project proposals, thereby simplifying AEC applications while still providing the required information on techniques.

In this institution, the publication of the new code coincided with a major restructure in the teaching of agriculture. The Institute of Land and Food Resources was formed when the Faculty of Agriculture and Forestry amalgamated with the six colleges of the Victorian College of Agriculture and Horticulture. The teaching activities of this new entity are far broader than they were for any of the parent bodies – they span vocational education and training, higher education and postgraduate education. Concomitant with these organisational changes have been new arrangements for the AEC. There is now a single committee for the institute instead of a separate AEC for each campus.

The development of SOPs for teaching has been one of the first initiatives of the new AEC in conjunction with the University's Research and Innovation Office. The SOPs are being developed specifically for teaching because of the degree of commonality across the range of Institute courses and the potential to reduce repetition and duplication. By comparison, research applications are much more focussed and involve more specialised procedures. SOPs will have advantages for both the AEC and for teaching staff, but most importantly they will help to promote and maintain high standards of animal welfare. Expected benefits are:

- standardisation of routine procedures. The SOPs will foster a common understanding across campuses, teaching sectors and discipline groups of what is required and why those requirements are stipulated;
- simplification for the AEC. Because of the number of campuses and the many industry-oriented short courses, the AEC has to review a large number of teaching applications involving routine management procedures. SOPs will enable the AEC to easily identify applications which deviate from standard practices; and
- simplification for teaching staff. Reference to SOPs in applications will simplify the preparation of applications and reassure applicants that the proposed procedures conform to the AEC's preferred practices. The SOPs will also be of more general assistance to teaching staff. They give guidance as to how students should be introduced to the procedures, suggestions for preparing and debriefing students on animal welfare matters and indications of the levels of supervision necessary for particular procedures.

Separate documents are being produced for each of the main species or industries covered in teaching: sheep, poultry, horses, pigs, dairy cattle and beef cattle. These cover not only individual procedures, but also: how to handle animals safely; handling facilities; housing, feeding, maintenance, inspection and transport of animals; how soon after arrival they may be used in teaching; quarantine and occupational health and safety considerations; and emergency procedures. There is also an over-arching document which covers the purpose of the SOPs, a general statement on animal welfare in teaching, and the responsibilities of the course coordinator, class coordinator and demonstrators.

The process of writing the SOPs has entailed drafting documents based on current teaching activities and relevant codes and guidelines, then circulating drafts to a representative group of teaching staff for discussion. Once approved by teaching staff, draft SOPs are reviewed by a reference group comprising the Chair of the AEC, the Animal Welfare Officer and a senior scientist from the Animal Welfare Centre.

The relevant State and SCARM codes have been a useful source of information, but it is important the SOPs also describe how to undertake certain procedures, how students should be taught about them, what pitfalls to avoid, and the level of supervision required. Issues of supervision are especially important in competency-based training, where students have to make the transition from observers to operators without risk to animals or humans. The AEC and teaching staff believe that the University should be taking a lead in animal welfare matters. In certain cases, procedures are not acceptable for teaching although they may be standard in industry, and the SOPs reflect this.

A number of important issues have become apparent:

- Teaching staff should be included in the early stages of the consultation process;
- The expectations of the AEC and teaching staff should be defined at the outset;
- SOPs should not intrude into curriculum areas;
- There must be a mechanism for regularly reviewing and revising SOPs.

Many institutions will be undertaking similar exercises. My own enquiries, both in Australia and overseas, before starting the SOPs were not especially fruitful, although a number of colleagues expressed interest in hearing how we progressed. Clearly, SOPs must be developed with teaching staff and AECs to meet the needs at their institution. Equally, there is a need to avoid duplication and to learn from others. Perhaps there is a role for ANZCCART to act as a point of contact?

Ann Hargreaves
Office of Research
University of Melbourne
Parkville
Victoria 3052

Changes to the Board of ANZCCART Australia

New Chairman

Professor Roger Holmes is the new Chairman of ANZCCART Australia. His appointment by the Board at its meeting on 20 November follows the retirement (effective from 20 November) of Professor Mike Rickard, Chief of the CSIRO's Division of Animal Health as Chairman. Professor Rickard, who served two years as Chairman, will continue to represent CSIRO on the Board. The Board thanked Professor Rickard for his considerable contribution as Chairman.

Professor Holmes, who is the representative of the Australian Vice-Chancellors' Committee, is the Vice-Chancellor of the University of Newcastle, NSW. A biochemist, he has many years research and administrative experience.

Retirement of Professor Mellor

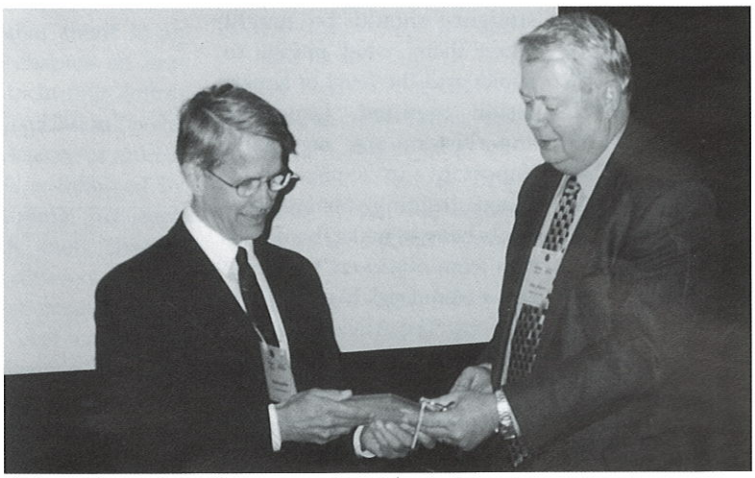
The Board at its meeting on 20 November accepted with regret the retirement of Professor David Mellor, who has been the representative of the Royal Society of New Zealand since 1 January, 1993. Professor Mellor is a physiologist whose research interest is improving the welfare of production animals. He holds the Chair in Animal Welfare Science and Bio-ethics at Massey University. He has also retired from the Board of ANZCCART New Zealand, where he represented the New Zealand Vice-Chancellors' Committee.

Professor Mellor has been a very active supporter of ANZCCART, and has contributed many papers to ANZCCART Conferences and to *ANZCCART News*, including two in this issue.

At the recent ANZCCART Conference in Wellington, Professor Mellor was thanked for all of his work for ANZCCART by Professor Rickard, who presented him with a special plaque bearing the logos of ANZCCART and the Royal Society of New Zealand (see photograph).

Dr Mark Fisher, an animal physiologist with AgResearch, succeeds Professor Mellor as the representative of the Royal Society of New Zealand on the Board of ANZCCART Australia.

The new Chairman of ANZCCART, Professor Roger Holmes



Professor David Mellor receiving his plaque from Professor Mike Rickard at the ANZCCART Conference in Wellington on 19 November 1999

ANZCCART's 2000 Conference

The theme will be "Farm animals in agricultural research - how to meet the conflicting demands of ethics, welfare, science and industry".

The two day conference will be held at the Roseworthy Campus of the University of Adelaide on Thursday 30 November and Friday 1 December.

Roseworthy is the site of agricultural research facilities of the South Australian Department of Primary Industries and Resources and the University of Adelaide.

The conference is likely to be preceded by a one-day workshop for Animal Welfare officers on 29 November, on a theme related to that of the conference.

There will be a post-conference tour of the Barossa Valley wineries on Saturday, 2 December.

Innovation, ethics and animal welfare: public confidence in science and agriculture

A report on ANZCCART's 1999 New Zealand Conference

ANZCCART and the National Animal Welfare Advisory Committee (AWAC) held a very successful conference at Te Papa Tongarewa - Museum of New Zealand in Wellington on 18 and 19 November 1999. The conference theme was *Innovation, ethics and animal welfare: public confidence in science and agriculture.*

This conference addressed how the application of knowledge has affected the welfare and productivity of farm animals during the past century and how it might affect the livestock industry in the future.

Farming animals in 2020: issues and options was the focus of the first day of the conference. Papers included *Pastoral farming of animals in 2020 – a committed scientist's view and caveats* by Dr Paul Hemsworth from the Animal Welfare Centre in Melbourne, *Intensive farming of animals in 2020* by Dr Neville Gregory from MIRINZ, and *"Green" animal farming* by Sue Kedgley, Convener of the Safe Food Campaign and Health Spokesperson for the Green Party.

Science and trust: innovation on the edge, was the focus of the second day. Speakers explained innovative technologies such as cloning and transplantation in lay terms and considered how science and technology create ethical dilemmas, excitement and fear, and place obligations of trust on scientists, the media, and regulatory authorities. Papers included *A beginner's guide to gene technology* by Dr Sue Galloway from Agresearch Invermay, *Developing public policy on xenotransplantation* by Dr Stewart Jessamine from the Ministry of Health, *Choosing a future - who will decide?* by Dr Barbara Nicholas from the Christchurch of Medicine, and *Making a profession of science: public trust and concern for public good – a two-way street* by Professor David Mellor and Mr James Battye from Massey University.

Dr Jean Fleming of the University of Otago presented the Cam Reid Oration for 1999. The title of her paper was *Science, scientists and trust.*

During the two days of the conference a small group of animal activists, who are supporters of Wellington Animal Action, NZ Anti-Vivisection Society and Animal Liberation Front (ALF), and who are opposed to the use of animals in research and teaching, staged noisy protests outside Te Papa from time to time. A bomb scare, believed to have been instigated by the animal activists, necessitated all people visiting Te Papa to clear the building at one stage. Thankfully no damage was reported to the building or injury to any individuals.

Earlier in the week, a small group of ALF supporters also targeted the Royal Society, Victoria University, the Wellington School of Medicine, and the Malaghan Institute of Medical Research.

The attendance of nearly 200 people was the best ever for an ANZCCART conference.

The Proceedings will be published in March - April, 2000

Gill Sutherland
ANZCCART,
Wellington.

Conference Centre - Te Papa Tongarewa - the National Museum of New Zealand, Wellington

Coming up

Electronic media: animal care - 2000
9-11 February, 2000
Orlando, Florida, USA

website:
www.emac2000.org

Consciousness, cognition and animal welfare UFAW symposium
11-12 May, 2000
London

Contact: Dr Stephen Wickens, UFAW

Tel: 44-01582-831818
Fax: 44-01582-831414
email:wickens@ufaw.org.uk

Australian Veterinary Association conference
25-30 June, 2000
Perth

Contact: Ms Doreen Culliver,
AVACOS
7 Phipps Place, Deakin,
ACT 2600

Tel: 02-6285-2600
Fax: 02-6285-3600
email: avacos@ava.com.au

International Conference on Animal Science and Veterinary Medicine towards the 21st century
(ICA SVM 2000)
12-15 August, 2000
Beijing, China

Contact: Ms Xu Jinhua
Fax: 86-10-6289-5351
email:
xmskyczy@public3.bta.net.cn

XXI World Buiatrics Congress
4-8 December, 2000
Punta del Este, Uruguay

Contact: Gabriela Rohr
Congressos and Reuniones
Cerrito 307
Montevideo 11.000
Uruguay

Fax: 598-2-916-8902
email: grohr@rohrsa.com;
or
rjsu@adinet.com.uy

News

Animal experimentation in Europe

The European Commission this year published the second set of EU statistics of animals used for experimental and other scientific purposes. The first set of statistics was published in 1994 and covered 1991 and this second set, with one exception, covered 1996.

The 1996 figure was 11.65 million animals used, compared with 11.79 million for 1991. This covers 15 member countries, two of which did not provide data in 1991. According to the report in the newsletter of the Research Defence Society (October, 1999), the real reduction in animal usage over the five year period is probably about 24%. Countries with well-established data recording systems all showed decreases e.g., the UK (18%), Netherlands (25%) and Germany (37%).

Proctor and Gamble eliminates animal tests on broad range of products

On 30 June 1999, Proctor and Gamble announced that, effective immediately, it will end the use of animals in safety tests for their current beauty, fabric and home care, and paper products, except where required by law, in all countries where the company operates. According to a press release, animals will no longer be used in safety tests for "roughly 80 per cent" of finished Proctor and Gamble products including cosmetics, shampoos and hairstyling aids, skin care, tissue and towel products, laundry and dishwashing detergents and household cleaners. "Science and technology have advanced to the point where we can confirm the safety of these finished products through non-animal alternatives," said the company. Over the past 15 years, Proctor and Gamble has invested nearly $100 million dollars in the study and development of alternative research methods. Their decision to end animal testing was reached after confirmation that human safety for these products can now be determined using non-animal methods.

(Source: NABR Update, 1 July, 1999)

Training courses for animal technicians

While a number of universities and research institutions provide training courses in the ethics, legislation and practical issues associated with animal experimentation, there are many which do not. Such courses are intended for honours and post-graduate students, new researchers and members of animal ethics committees. While varying in content, they provide a useful introduction to animal use in research and teaching.

ANZCCART has discussed with the NSW Animal Research Review Panel the need to coordinate and facilitate such courses and wishes to know which institutions currently offer such courses and what is their content, so that they can be made more widely available. Institutions which do offer such courses are asked to provide details to ANZCCART's Adelaide office.

Alternatives in education video

EuroNICHE has released a 33 minute video on alternatives to traditional animal experiments and dissections. Products featured include computer simulations and learning packages, computer-linked human self-testing apparatus, waste organ surgical training apparatus, high-resolution videos, and a veterinary training model.

The film also gives examples of classical experiments in which conventional animal use has been replaced by a range of alternative methods.

Copies of the video are available from Animals Australia for $A30.

To order a copy, contact:

Animals Australia
PO Box 1023
Collingwood
Victoria 3066

Fax: 03 - 9329 6441
Email:Animals@melbpc.org.au

Alternatives website

Sheffield BioScience Programs was established in 1986 and offers a range of high-quality, interactive computer-assisted learning (CAL) programs aimed at enhancing the teaching of physiology and pharmacology to undergraduate medical and science students.

Details are available from:

Dr David Dewhurst
Director of Learning Technology
Faculty Group of Medicine and Veterinary Medicine
The University of Edinburgh
Hugh Robson Link Building
15 George Square
Edinburgh
EH8 9XD, UK

Email: d.dewhurst@ed.ac.uk

http://members.aol.com/Sheffbp/sbp.htm

ANZCCART News is published quarterly by the Australian and New Zealand Council for the Care of Animals in Research and Teaching Limited.

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:

Dr R.M. Baker, Director, ANZCCART,
PO Box 19, Glen Osmond, SA, 5064.

Tel. 61-8- 8303 7393: Fax. 61-8- 8303 7113
E-mail address: anzccart@waite.adelaide.edu.au

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

or

Mrs G. Sutherland, ANZCCART New Zealand
PO Box 598, Wellington, New Zealand

Tel. 64-4-472 7421: Fax. 64-4-473 1841
E-mail address: anzccart@rsnz.govt.nz

http://anzccart.rsnz.govt.nz

ISSN 1039–9089