

involves studying the effects on behaviour of compromising or removing neural tissue) with transcranial magnetic stimulation (TMS) is detailed. The latter technique replaces the need for permanent, surgical interference of brain tissue and has been used successfully to study the timing of information transfer between human cortical areas, and changes in brain function due to learning.

This guide is aimed at scientists new to research involving animals and to the debate surrounding animal use. For those requiring more detailed information, a list of organisations that are active in these issues is included. Appendices contain details of current UK legislation and a statement of the Royal Society's position on this topic.

The use of non-human animals in research: a guide for scientists (2004). 28 pp A5 paperback (ISBN 0 85403 598 2). Produced and published by The Royal Society and available free of charge from Science Advice Section, The Royal Society, 6-9 Carlton House Terrace, London SW1Y 5AG, UK. Also available at: <http://www.royalsoc.ac.uk/news>

Welfare of animals during transport

In March 2002, the European Commission adopted a report by its Scientific Committee on Animal Health and Welfare (SCAHAW) on the welfare of animals during transport, which covered horses, pigs, sheep and cattle. A subcommittee of SCAHAW then set to work, under the chairmanship of Professor Donald Broom, to produce a further document covering the welfare of other species that are transported commonly. The resulting work (see details below) was adopted by the Commission on 31st March 2004 and has been published by the European Food Standards Authority. This report covers broilers, laying hens, turkeys, ducks, geese, pigeons, quails, ostriches and other ratite birds, deer, reindeer, rabbits, dogs, cats, rodents, primates, fish, reptiles and amphibians for the pet market, wild animals for translocation, invertebrates, and circus animals. In defining the task for the working group, SCAHAW requested that the group should address, in particular, loading densities, traveling times, resting times, watering and feeding intervals and interactions of these and other factors.

The report discusses general principles relevant to achieving good standards of welfare for transported animals and provides specific recommendations about transport on a species by species basis. Regarding the general principles, there are chapters on welfare assessment during transport, inspection, training of personnel, and on infectious disease aspects which include: effects of transport stress on susceptibility to infection, increased shedding of infection during transport, and the effects of transport on transmission and disease.

The species-specific sections vary in layout because very much more is known about the transport of, and the effects of transport on, some of the species covered than others. In most cases there is discussion of relevant aspects of the biology of the animals and the potential stresses of transport on them. This is followed by sections that cover pre-transport preparation and handling, journey management, feeding and watering, stocking density, thermal environment, and, for some species, transport times and post-transport treatment.

This is a valuable review and summary of the extensive scientific literature on this subject: the list of references includes some 700 publications. Some species are covered in very much greater depth than others (eg there are 24 pages on chickens but only one on primates). As the authors point out, "*the amount of scientific work about welfare during transport of animals varies from substantial to about zero*". Their aim, given that transport has to occur, has been to present "*the best possible basis for recommendations and legislation*". A few sections, for example that on ornamental fish, are so brief that it is hard to see how they could be used in this way but, in general, this is a substantial contribution that will be very useful to all those involved or interested in transporting animals.

The welfare of animals during transport (March 2004). Scientific Report of the Scientific Panel on Animal Health and Welfare on a request from the Commission related to the welfare of animals during transport (Question No. EFSA-Q-2003-094). 183 pp A4 paperback. Published by the European Food Standards Authority. Available at: http://www.efsa.eu.int/science/ahaw/ahaw_opinions/424_en.html

Animal pain: the need for a cross-species approach

In September 2002, 29 experts in animal and human pain (including veterinarians, biomedical researchers, and ethicists) gathered for an international workshop in Virginia, USA, in an effort to encourage cross-disciplinary communication and collaboration in the study of animal pain and to raise awareness of key areas where knowledge is lacking. A report on the workshop has recently been published in the *Journal of the American Veterinary Medical Association*, in which the participants state that "*animals feel pain and that although it is unclear... at what taxonomic level nociception is associated with pain and whether all species, including humans, feel pain with the same qualities and intensities, operationally, vertebrates and some invertebrates experience pain.*"

The report begins by discussing the debate concerning nociception versus pain, concluding that animals can experience pain although they cannot verbally express the emotional component of it. There follows a short discussion on taxonomic differences in the complexity of the CNS anatomy as one progresses up the phylogenetic tree, including whether pain perception differs from one species to the next. The report states that "*although higher degrees of encephalization imply greater self-awareness... and potential for mental distress, this may have minimal effect on the immediate, acute perception of and response to pain.*"

The next section highlights a number of gaps in our current knowledge of animal pain and analgesia, many of which relate to a lack of data on molecular biology, cell signalling, genomics, proteomics, and other basic mechanisms of pain. In order to address this issue, the report calls for a collaborative effort to form a new understanding of animal pain. Areas of particular concern include the large variability in the amount of species-specific information (especially related to analgesia), limited formal training in animal analgesia

for veterinary students and graduate veterinarians, and the lack of resources for research and education devoted to animal pain and analgesia. The main gap identified in the report is the lack of agreed upon standards for assessing pain; determining whether a treatment has been successful relies on being able to measure the effect of the treatment. To address this issue, the report's authors present guidelines for developing pain scales in animals and for the use of animals in pain research (see appendices). In addition, workshop participants developed several action plans based on the other major gaps in knowledge:

- to support a multidisciplinary approach to treating animal pain
- to create a special interest group in the International Association for the Study of Pain (IASP)
- to improve funding for pain research
- to inform the public about animal pain

The report concludes that *"we need to work together to achieve a future in which the study of pain and analgesia is a collaborative, multidisciplinary effort that recognizes that animals experience pain."*

The need for a cross-species approach to the study of pain in animals (2004). *Vet Med Today: Special Report*. Paul-Murphy J, Ludders JW, Robertson SA, Gaynor JS, Hellyer PW and Wong PL. *Journal of the American Veterinary Association* 224(5): 692-697

Improving sheep welfare in extensively managed flocks

There is a common belief among members of the public that extensively farmed sheep experience higher standards of welfare than species kept in intensive systems. However, whilst sheep may usually be free to express natural behaviour, they may also be at risk of suffering through extremes of temperature, increased prevalence of disease or injury, and associated neonate mortality.

In February 2003, the Scottish Agricultural College (SAC), and Macaulay Institute organised a workshop in Aberdeen, Scotland, to discuss issues relating to the improvement of sheep welfare in extensively managed flocks. The proceedings of this meeting, edited by Dr Pete Goddard, have now been published and comprise nine chapters covering a variety of topics, including the importance of the stockperson-animal interaction (X Boivin), consideration of how sheep respond to different welfare compromises (MW Fisher & DR Scobie), on-farm welfare assessment systems (D Main), and stakeholder opinion of foot-rot control (S Peddie, P Goddard & A Stott). Papers from different stakeholder groups are also presented in order to bring a range of perspectives to the discussion on sheep welfare: the food retailer/consumer (R Layton), farmer (DR Raine), and welfare organisation (J Wrathall). To enable delegates to contribute, four sessions were scheduled following each introductory paper, summaries of which are included in the report.

At the conclusion of the workshop, delegates were invited to submit their views on key issues associated with the welfare of sheep in extensive systems. The main welfare concerns

identified relating to health were ectoparasites and lameness, whilst stockmanship and quality of facilities were seen as the main factors affecting welfare during handling. Overall, the top threats to welfare were those associated with nutrition and lameness/foot-rot.

Given the broad spectrum of views and experiences of delegates, these proceedings represent a valuable contribution to the field of sheep welfare.

Proceedings of a workshop on improving sheep welfare on extensively managed flocks: economics, husbandry and welfare (February 2003). 80 pp A4 paperback (ISBN 0 7084 0654 8). Edited by Dr P Goddard and published by the Macaulay Institute, Aberdeen, UK. Available at: http://www.sac.ac.uk/envsci/external/hill&mountain/defraproject/non_members/proceedings.pdf

Zoo research guidelines: monitoring stress in zoo animals

The second of a series providing guidelines on zoo research, which is aimed at assisting zoo staff, scientists and students planning studies on zoo or captive animals, has recently been published by the Federation of Zoological Gardens of Great Britain and Ireland (who describe themselves as the principal, professional zoo body representing the responsible zoo community of Britain and Ireland). Following the first set of guidelines on project planning and behavioural observation, this publication is concerned with non-invasive physiological measures of stress, concentrating on the measurement and use of glucocorticoids.

The guidelines begin by defining stress as *"the biological response elicited when an individual perceives a threat to its homeostasis"* (Moberg 2000). A discussion then ensues on the importance of monitoring stress in zoo animals. The position adopted here is that *"it is essential that zoo animals experience good welfare and minimal stress for ethical reasons, to maximise reproductive output and longevity and for the conservation of essential natural behaviours through successive generations."*

Although attention is focused particularly on the role of glucocorticoids, and especially cortisol, there is a short discussion on how to select appropriate indices for the assessment of stress. This outlines the use of other components of the stress response, including parameters of immune function, cardiovascular output, and behaviour. The guidelines describe how to plan and formulate a study to assess stress, and discuss variables that might confound cortisol measurements. The latter section includes topics on dealing with individual variation in cortisol levels and the frequency and timing of sample collection. There is also discussion of invasive versus non-invasive sampling, sample collection methods, and the analysis and interpretation of results. With regards to sample collection, the advantages and disadvantages of the different media used to collect cortisol are listed. The procedures necessary for handling and preparing various samples (saliva, blood, faeces, urine) are outlined.

These guidelines will be very useful to those new to the methodologies of stress assessment in zoo and other captive