Report of an RSPCA/AHVLA meeting on the welfare of agricultural animals in research: cattle, goats, pigs and sheep

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Introduction

The Royal Society for the Prevention of Cruelty to Animals (RSPCA) and the Animal Health and Veterinary Laboratories Agency (AHVLA) jointly convened a meeting to bring together animal technologists, researchers, veterinarians and students with an interest in the welfare of cattle, goats, pig and sheep used in research and testing, for a programme of talks and discussion sessions. The meeting, held in June 2013, addressed a range of topics including cognition and emotion in agricultural animals, welfare in containment systems, positive reinforcement training, pain assessment and alleviation and assessing actual severity. It was initiated as a follow up to an international meeting on harmonisation of the care and use of agricultural animals in research held by Norecopa, the Norwegian consensus-platform for alternatives, in September 2012.

Norecopa: a national consensus-platform for the 3Rs

Adrian J Smith, Norecopa

In 1999, following an initiative at the 3rd World Congress on Alternatives and Animal Use in the Life Sciences in Bologna the same year, a European organisation was established with the purpose of bringing together all four stakeholders interested in animal research: regulators, academia, industry and animal welfare organisations. This organisation, known as *ecopa* (European Consensus-Platform for Alternatives, www.ecopa.eu), offers membership and support to national platforms which follow the same principles. Currently there are 14 national platforms in Europe that are approved by *ecopa*.

Norway's national consensus-platform, Norecopa (www.norecopa.no), was established in 2007. Institutions and individuals can become members of Norecopa and most Norwegian research institutions have done so. Norecopa signals its commitment to all 3Rs of Russell & Burch by describing itself as a 'national platform for replacement, reduction and refinement of animal experiments'.

Inspired by the 2004 FELASA meeting in Nantes entitled 'Internationalisation and Harmonisation of Laboratory Animal Care and Use Issues', Norecopa has arranged a series of international consensus meetings on the care and use of animals in research. These meetings have so far covered fish (in 2005 & 2009), wildlife (in 2008) and agricultural animals (in 2012).

Norecopa wishes these meetings to be a lasting resource for the international research community, so each meeting has its own website (http://www.norecopa.no/sider/tekst.asp?side=21) where all the presentations are available, together with links to guidelines on the care and use of the species in question. In addition, participants write a consensus document describing the challenges to implementing the 3Rs which were identified during the meeting. These consensus documents have been used actively by Norecopa and others to initiate tasks designed to address these challenges. Norecopa has also established email-based discussion forums following these meetings but interest in these has so far been low.

The consensus document resulting from the 2012 meeting on agricultural animals included comprehensive recommendations and a list of tasks relating to the implementation of the 3Rs when using agricultural animals in research and testing. These included further meetings and discussion fora on 3Rs topics for a range of stakeholders. There was considerable support for this among UK researchers, animal technologists and veterinarians, so delegates from the RSPCA and AHVLA went on to convene a meeting based in the UK in June 2013.

Norecopa welcomed the RSPCA/AHVLA meeting as an initiative which should help to advance efforts to increase implementation of the 3Rs in the care and use of agricultural animals.

Agricultural animals in research: cognition, emotions and ethics

John Webster, University of Bristol

Agricultural animals used in research are considered to be sentient. Definitions of sentience vary, as does the nature of sentience itself within the animal kingdom. However within the homeothermic classes of mammals and birds, I stand by my definition of sentience as 'feelings that matter'.[1] Sensations resulting from environmental stimuli motivate the sentient animal to actions that are designed to avoid suffering and promote a satisfactory emotional state. If the actions are successful, the animal learns to cope. If they fail then the animal is likely to suffer. Failure to cope may occur either when the stresses are too severe, complex or prolonged, or when the animal is constrained in such a way that they are unable to take constructive action necessary to relieve the stress.

The primary motivation for sentient animals, including humans, is emotion; the need to feel good, avoid suffering and ignore the things that do not matter (see Table 1 for some examples of animal emotions and their positive and negative aspects). Cognitive ability, or the reasoned interpretation of sensation and experience, can help to improve welfare by teaching the animal to cope. However, it may in some circumstances increase the degree of suffering when the coping mechanisms fail. Nevertheless, suffering is an emotional state; it is a fallacy to assume that the greater the (apparent) cognitive ability of a species (still less its phenotypic similarity to humans), the greater its capacity to suffer. There is no good argument to suggest that the capacity of a chimpanzee to suffer is any greater than that of a dog or pig.[2]

Positive aspect	Emotion	Negative aspect
Security	Fear	Anxiety
Pleasure	Comfort	Pain
Satiety	Appetite	Hunger
Joy	Hope	Despair

Table 1. Aspects of different animal emotions

I also contend that sentient animals do not simply live in the present. Primitive sensations like hunger or pain lead a domestic animal to hope that a meal will be provided on time or fear that they may receive a beating. An animal with the capacity for hope will also have the capacity for despair.[3]

How then should we apply these concepts of sentience to our approach to the care of agricultural animals, especially those used in research, where we are obliged to weigh any harms to the animals against benefits to the society of humans (and other animals)? I suggest the following rules of engagement.

1. Harms should be assessed not only in terms of their short-term effects on the physical state of the animal but also in terms of their longer-term effects on emotional state (e.g. anxiety, learned helplessness).
2. The day-to-day husbandry of the animal must not only be sufficient to meet physical needs for nutrition, comfort, etc. but should also, wherever possible, provide the resources necessary to allow the animal to achieve a satisfactory emotional state through their own actions.
3. Species selection must be made on a case-by-case basis where the benefits are assessed by weighing the scientific evidence relating to the predictivity of the animal 'model', against the harm that may accrue to the animals both from the scientific procedures and from their lifetime experience within the research environment.
4. The capacity of an animal to experience suffering must be defined in terms of their own sentience, not their status in human society. It is unethical to promote agricultural animals (e.g. minipigs) as 'more acceptable' than dogs or monkeys simply on

the basis of public identification of the pig as a food animal, the dog as a companion animal and primates as those species closest to man.

Welfare challenges in high disease containment research

Hugh Simmons, AHVLA and NADIR (Network of Animal Disease Infectiology Research Facilities)

Disease-causing infectious agents must be contained if they are (i) exotic and contagious to animals, (ii) infectious to humans, (iii) genetically modified – or a combination of two or all three of these factors. These three different containment requirements are covered by three different pieces of legislation in the UK, which specify four different levels of containment in each piece of legislation. There is some variation in the detail of the containment required at each level. The highest are Categories 3 and 4; Category 3 applies to pathogens such as Classical Swine Fever, Blue Tongue Virus and Tuberculosis (TB), while Category 4 applies to Foot and Mouth Disease, Rabies and High Pathogenicity Avian Influenza.

These disease containment legislations define key elements of building design and management necessary to ensure containment, such as air handling units with high efficiency particulate air (HEPA) filters, effluent treatment plant (ETP) on the drainage system, sterilisation or incineration of waste and changing facilities where staff change into the required personal protective clothing and equipment (PPE). These factors can impose restrictions on the kind of housing and environment that can be provided for the animals, for example long stem fibre roughage and bedding may block ETPs, or PPE may affect interactions between animals and staff. Once such highly specialised facilities have been built, it can be difficult or impossible to update them, to take account of some new developments in housing and care, due to their construction and complexity.

Considering all of this, undertaking research using farm animals into diseases that require high containment can present challenges that must be overcome to ensure animal welfare.

Currently all the European organisations with these types of facilities for farmed animals, including AHVLA, are members of NADIR. This is a FP7 project funded by the European Union, with the aim of sharing good practice in a number of areas including animal welfare (http://www.nadir-project.eu). Some of the approaches used by NADIR and its members to improve animal welfare are set out below, using the Five Freedoms as an analysis tool (Box 1).

Box 1. The Five Freedoms

1 Freedom from hunger and thirst.

2 Freedom from discomfort.

3 Freedom from pain, injury and disease.

4 Freedom to behave normally.

5 Freedom from fear and distress.

Freedom from hunger and thirst

Fitted troughs, drinkers and water bowls are often found in Category 3 buildings just as in low security facilities. However, Category 4 buildings are more challenging due to the greater stringency on how waste can be removed from the room or building. In a lot of designs virtually all the waste has to be washed down the drain to the ETP. This means a complete diet has to be offered without long stem fibre for ruminants, which reduces normal rumination function. As there is no suitable alternative source of long stem fibre, studies are planned so as to minimise the duration of category 4 housing and animals are fed a diet with high content of fibre (but not long stem).

Freedom from discomfort

The risk of environmental discomfort should be low, as building management systems within containment facilities keep temperature and relative humidity within appropriate limits. With respect to physical comfort, animals need somewhere comfortable to rest, which can present problems if it is not possible to provide conventional bedding materials. If animals are held on non-slip flooring without bedding, they may be uncomfortable and can develop sores or bursae at pressure points during longer experiments. One way in which animal comfort is assessed is to evaluate how long they spend lying on different materials and then provide the preferred material unless there are significant veterinary or scientific constraints.

If some discomfort is unavoidable, the aim is to address this within the experimental design so that non-infectious phases are conducted outside, keeping the time in containment to a minimum.

Freedom from pain, injury and disease

The nature of the infectious agent used and design of the experiment, will also both be critical to the animal's freedom from pain, injury or disease. In common with animals kept in low security accommodation at AHVLA, a Health Plan is implemented for each animal to eliminate any health problems that are not related to the study. It is particularly important that animals are in good health before going into high containment; not only to minimise any effects on welfare of the experimental procedures and any husbandry constraints but also due to the logistical problems of treating any intercurrent disease in high containment facilities. This would have a potentially catastrophic impact on the validity of the study, especially as high containment experiments are generally done on small numbers of animals.

It is obviously impossible for animals to be 'free' from pain or disease when they are used in disease research, so refinement is critical. The impact of disease can be reduced by implementing an effective health and welfare monitoring protocol that includes humane endpoints. Staff contact is unfortunately limited to defined periods when animals are in higher categories of containment but CCTV can be used for continuous observations. Although this cannot substitute for interactions with an empathetic and experienced observer, or extra monitoring for animals on critical points of severe protocols, CCTV can help to maintain surveillance and can also provide footage that can be sampled and reviewed.

The 'welfare score charts' used at AHVLA are always tailored to individual projects and approved by the institutional ethics committee. Humane endpoints are refined using predictive indicators wherever possible. For example, clinical signs and disease progression vary between strains of classical swine fever but real time analysis of white blood cell (WBC) and platelet counts have enabled predictive endpoints to be established. Animals are now humanely killed when the WBC and platelet counts fall, so that they do not have to experience the full progression of the disease.

Other measures to reduce suffering and refine procedures at AHVLA include:

- 'pre-start' meetings for researchers, veterinarians, animal technologists and care staff to ensure that all are aware of critical indicators and decision points
- telephone contact list for out of hours, if euthanasia is required
- procedures timed so that the phase with the greatest potential to reach end point will occur early or mid week
- samples taken early in the morning so that results will be available that day, enabling better decision making with respect to endpoints
- experienced staff are responsible for animal monitoring and care for groups at greatest risk, e.g. unvaccinated controls
- use of microchips to monitor body temperature, which reduces handling

Freedom to behave normally
The legal minimum space allowances for animals in high containment are no different from those for animals in conventional housing. However, containment systems can have an impact on the kind of environment that can be offered to the animals and consequently on their freedom to behave normally. Environmental enrichment is possible in containment building designs and should be tailored to the species being housed, e.g. long fibre foodstuffs and social groups are very important for ruminants; straw and other materials or objects to manipulate are good for groups of pigs, reducing bullying and injuries within the group.

Freedom from fear and distress
A key concept here is facilitating emotional resilience, i.e. providing a set of conditions that allow emotional adaptation to different forms of adversity at different times in the animal's life. Ways of fostering emotional resilience include allowing acclimatisation periods to the housing system before animals are used and – very importantly – training animals before the experiment, including giving food rewards. Care is also taken to select individuals and breeds with suitable temperaments, as not all breeds are suited to high containment. This is also a human health and safety issue when working with large animals in contained spaces.

In addition to the Five Freedoms, at AHVLA we also sum up our approach as 'Four Ps':

– **Positive** cultural attitude towards identifying any issues or problems. The facility user group holds both 'pre-start' and 'wash-up' meetings before and after studies, for open discussion and learning for future studies.
– **Proactive** ongoing development of welfare score sheets, continually refining humane endpoints with the goals of moving to predictive endpoints, as well, as providing comfort and environmental enrichment.
– **Preventative** measures to directly or indirectly reduce suffering, such as building design, experimental design, developing emotional resilience in animals.
– **Productive** approach, acknowledging that better welfare and better science go hand in hand.

Clicker training in minipigs at Huntingdon Life Sciences

Finula Sharpe, HLS

Note: much of this presentation has previously been published in *Animal Technology and Welfare*, see Arblaster (2010).[4]

Introduction

Handling minipigs throughout long term scientific procedures can pose both welfare and practical problems. Mature minipigs can weigh 30 kg and animals of this size and strength are difficult for the majority of animal technologists to lift or carry safely, which can result in stress to the animal and physical strain for the handler.

Clicker training has therefore been introduced as a method of avoiding stressful carrying and sling restraint for minipigs undergoing dosing during dermal studies.[5] The aim of the clicker training programme at HLS was to train 52 minipigs to walk voluntarily from their pen into a dosing trolley, stand for the dosing procedure and walk back to their pen once it had been completed.

Method

The training programme used operant conditioning, in which the minipigs were trained to form positive associations between certain behaviours and fruit rewards such as pieces of apple and grape. The minipigs began training at the age of 4 weeks and each animal was trained individually in an empty pen for a session lasting approximately 5 minutes with the handler seated on the pen floor.

Animals were taken through 6 stages of training (listed below) which gradually progressed towards walking into a dosing trolley. If at any point a minipig was showing signs of confusion then the session would be stopped and training taken back to the previous stage to re-establish the desired behaviour.

Stage 1: 'Click' of clicker each time the minipig *takes a treat* from the trainer's hand.
Stage 2: Treat and simultaneous 'click' of the clicker each time the minipig *moves towards a target*.
Stage 3: Treat/click each time they *touch the target.*
Stage 4: Treat/click each time they *follow the target around the pen.*
Stage 5: Treat/click each time they *follow the target out of the pen and back in again.*
Stage 6: Treat/click each time they *follow the target into the dosing trolley and out again*.

Progress was recorded on a daily 'tick' sheet, which highlighted, for example, if the animal *'touched the target'*, *'followed the target around the pen'* or was *'nervous'* of the handler. This enabled us to ascertain whether or not animals were ready to move onto the next stage of training. Training sessions were carried out daily for 2 weeks before the start of the study.

Outcome

The initial aim of training all minipigs to walk voluntarily into the dosing trolley was achieved by the third week of the study. This was aided by animals having access to their daily food ration while standing in the dosing trolley, as it provided a distraction from the dosing procedure. Some minipigs were sufficiently confident to walk into the dosing trolley by the end of the 2 week acclimatisation period, while others were more cautious about taking treats from the trainer's hand and took a little longer.

To ensure consistency in the training method, each technologist involved was given training and a set of instructions to follow, in addition to the six stages of training:

Clicker training minipigs

- *it is important that the minipig is alone in the pen during each training session*
- *only reward the minipig when they perform the desired behaviour*
- *the moment a minipig performs the desired behaviour they should be rewarded immediately with a simultaneous treat and 'click'*
- *it is important to have a positive attitude at all times and not get frustrated if the animal doesn't perform what is required, they should be ignored until they can focus on the trainer again*
- *if the minipig becomes confused or unfocused, training should be stopped and taken back to a safe phase that the animal is more familiar with*
- *if the animal becomes scared and runs away while training outside the pen, calmly walk (do not run) after them and bring them back with the target and a reward*
- *before training animals to walk into the dosing trolley, raise and lower the trolley outside the pen so the minipig can get used to the sound*
- *once trained the minipigs will not need the target any more, as they will be attracted by their daily food ration in the trolley*

Conclusion

The aim of the clicker training programme was achieved and this positive behaviour continued throughout the remainder of the study. While the age of the minipigs was a significant issue, it was an unavoidable factor due to the constraints of the study protocol, which required animals to be 6 weeks of age at the start of the study. Clicker training did also serve a purpose in allowing the minipigs to become more familiar with handlers, outside of normal husbandry procedures.

Clicker training minipigs provides a significant improvement in the dermal dosing procedures used at Huntingdon Life Sciences, as it removes the need to handle the minipigs and therefore reduces stress to the animals. Using positive reinforcement as a method of refining dermal dosing procedures therefore improves animal welfare. It also reduces physical strain placed on the animal technologists involved. Clicker training could also be used for other studies using minipigs, where animals need to be moved from the animal unit to a dosing room.

Pain assessment and alleviation in agricultural species used in research

R. Eddie Clutton, University of Edinburgh

Introduction

Non-avian agricultural species (cattle, sheep, pigs and goats) are used for a number of different purposes in research[6]. Two examples of research fields where pain may be caused are (i) the investigation of legal, though potentially painful husbandry operations, e.g. castration; and (ii) experimental surgery with recovery, e.g. organ transplantation. Pain assessment and alleviation are clearly very important in both of these contexts. When applying a harm-benefit assessment it may be possible to justify inadequate pain management in (i), for example to demonstrate that a husbandry procedure is a welfare issue or to evaluate potential techniques for pain relief. However, inadequate pain management can never be justified in the case of (ii).

Sheep, goats and pigs have also been used to try to study human pain. In accepting the validity of these species as human pain 'models', the scientific community must accept that these species feel pain[7] and act accordingly: the provision of effective analgesia when these species undergoing painful procedures is a matter of justice as well as an act of *refinement.* The extensive use of pigs in biomedical research is constantly justified on the basis of their physiological and anatomical similarity to human beings so it is surprising that with few exceptions, the literature devoted to laboratory pig welfare is notable by its absence of references to pain recognition and treatment.

Pain recognition

Acute pain behaviours resulting from husbandry procedures in young agricultural animals are well recognised. Little is known about similar behaviours after experimental surgery and it may be imprudent to extrapolate information, because age and breed are confounding factors. Pain evaluation is also complicated because, in general, agricultural species show less obvious (to the human eye) pain behaviours than horses or carnivores. Behaviours may also be counterintuitive to humans, for example sheep may display 'obsessive' eating behaviour when in pain but this may be interpreted as animals feeling well. The fact that some agricultural animals are less likely to mount 'fight-or-flight' reactions may account for their popularity as 'large animal' models (along with legally-condoned 'speciesism').

Unfortunately, all of this means that attempts to categorise pain behaviours in order to assess pain severity may be misleading. Indeed, no validated, nor widely accepted, pain scoring system currently exists for farm animal species undergoing procedures that are unrelated to husbandry[8]. On a more positive note, if animal technologists are familiar with individual animals undergoing potentially noxious procedures, they can be better able to detect subtle behavioural changes that indicate the presence of pain and initiate suitable treatment. It can be time-consuming to build up this level of trust but empathetic staff play an important role in ensuring that animals are given the benefit of the doubt with respect to experiencing pain – and resources should be made available for this.

Pain alleviation

Information on analgesic drugs in agricultural species (including in the scientific literature) is extremely limited beyond those used in painful production disorders, e.g. mastitis. This may be because there has been no perceived need for analgesia (if pain behaviours are 'subdued') or because legislation drafted to protect human food supplies limits commercial incentives for the pharmaceutical industry to fund pain studies in 'food animals'. Determining the efficacy of *ad hoc* analgesic therapy is complicated by the limited pain behavioural repertoire in the species involved.

However, the literature is gradually increasing and attitudes are changing. Strategies being increasingly employed as part of anaesthetic techniques to minimise an animal's post-operative discomfort are: pre-emptive analgesia (the administration of analgesics before surgical injury is created); polymodal pain therapy (the administration of analgesics from several therapeutic classes at relatively low doses, such that the combined effect is adequate analgesia, but a reduced risk of side-effects); partial intravenous anaesthesia (in which analgesic drugs are used at higher doses in order to contribute to the state of anaesthesia and thus reduce the requirement for general anaesthetic) and prolonged post-operative analgesia (which involves anti-inflammatory medication being given until the surgical wound has healed). All four strategies may be combined within a given anaesthetic technique.

Conclusion

The dearth of information on pain recognition and treatment in agricultural animals, relative to companion and other laboratory species, prompts consideration of a major limitation on their use in potentially noxious recovery experiments. There is no justification for withholding analgesia, or some kind of pain relief technique, when conducting potentially painful procedures on agricultural animals.

Assessing pain using the Lamb Grimace Scale (LGS)

Mirjam Guesgen[1] and Matt Leach[2], (1) Institute of Veterinary, Animal and Biomedical Sciences, Massey University, New Zealand and (2) School of Agriculture, Food & Rural Development, Newcastle University

Pain in animals is of considerable public concern. Within biomedical research, pain is of additional concern because it not only compromises animal welfare but can also have implications for the validity of scientific results. In order to address this and alleviate pain, it is essential to assess its severity and duration effectively. New, behaviour-based methods for assessing pain are providing evidence for a relationship between pain and behaviour and providing additional tools for pain management.

For example, facial expressions are routinely used to assess pain in humans, particularly those who are non-verbal and it has also been shown that human observers tend to focus on animals' faces when assessing pain. This led to studies of 'pain faces' in non-human animals and the use of facial expressions as indicators of pain is now being developed for several species, such as rodents[9,10,11] and rabbits.[12]

In these studies, analysis of video stills has enabled the development of species-specific 'Grimace Scales', which have been shown to be accurate, reliable and valid measures of pain. A further benefit is that evaluation studies can be done using video footage of animals already undergoing scientific or husbandry procedures for other purposes, thereby gaining information that can help to reduce suffering but without causing additional harms.

The aim of this study was to identify whether lambs produce noticeable changes in facial expressions when experiencing pain, and if so, to develop and validate a Grimace Scale that incorporates these expressions.

Figure 1. Facial action unit in a rabbit: orbital tightening

Legend: The eyelid is partially or completely closed, and the globes may also be drawn in toward the head so that they protrude less. Score 0 = not present; 1 = moderately present; 2 = obviously present (the eye closure reduces the visibility of the eye by more than half)[12].

First, the LGS was defined using five so-called 'action units': orbital tightening, mouth changes, nose changes, cheek flattening and ear changes. Each one is scored on a 3-point scale; 0 = not present, 1 = moderately present and 3 = obviously present. Figure 1 depicts the Rabbit Grimace Scale[12] to give an impression of the appearance of animal facial action units; the Lamb Grimace Scale will be published at a later date.

The LGS was then trialled using still images of the faces of restrained Romney X lambs from video footage taken before and after sham docking or routine tail-docking with a rubber ring in an on-farm situation. Images were randomly selected and scored for four of the action units (not ear position, as lambs were restrained) by four treatment-blind observers. The results showed that in this instance, the LGS had high reliability within and between observers, but low accuracy, i.e. people were scoring consistently but there was a high proportion of false positives. This was likely due to restraint stress, which can also influence facial expressions.

In a follow up study, video sequences of the faces of unrestrained lambs were taken before and after tail-docking or sham docking and scored by treatment blind observers as above, with ear position also included. This time, reliability was also high within and between observers, and accuracy was significantly improved, with fewer false positives.

In summary, we found that the LGS changes in response to tail docking and that this can be reliably coded by observers. However, as LGS is also affected by restraint, further validation is required to see whether it is possible to identify those action units that are associated with pain and with distress.

This study demonstrates that lambs change a number of their facial features when experiencing pain and that these features can be accurately and reliably coded and quantified. It is hoped that the LGS can go on to become a routine tool for pain and welfare assessment.

Lifetime experiences and actual severity

Ngaire Dennison, Animals in Scientific Procedures Inspectorate (ASPI)

The UK Animals (Scientific Procedures) Act, 1986 (ASPA) requires that a project licence to carry out a programme of scientific work using living animals may only be granted where there has been a favourable evaluation of the proposed project. This evaluation must include a harm-benefit analysis of the programme, to assess whether the harms that would be caused to animals in terms of pain, suffering and distress could be justified by the expected outcome, taking into account ethical considerations and the expected benefits to human beings, animals and the environment.

Part of the **prospective** assessment of harm requires that the series of procedures that an animal undergoes during an experiment be classified as 'non-recovery', 'mild', 'moderate' or 'severe', with respect to suffering that may occur. In addition, due to the changes in the ASPA required to implement the recently enacted European Directive 2010/63 EU, there is now a requirement for the assessment and reporting of the **actual** severity of the regulated procedures. There are many benefits associated with assessing and reporting actual severity (Table 1) but with the proviso that judgements have to be suitably informed, objective and consistent.

Actual severity assessment should:
● ensure that what actually happened to the animal is recorded and understood
● provide evidence-based information for future prospective harm-benefit assessments
● facilitate effective retrospective review
● identify areas where the application of the Three Rs should be focused
● provide feedback to help refine ongoing studies
● provide input for thematic reviews
● lead to statistics that will better reflect the actual harms to animals
● improve transparency and understanding of the impact of science on animals

Table 1. Benefits of actual severity assessment.

The law requires that the assessment of actual severity be made by a competent person and, as with the prospective classification, classified as non-recovery, mild, moderate or severe – but in the case of actual severity it must be based on the **actual** impact on the individual animal. A number of sources of information should be used to determine the experience of the individual, including day-to-day observations of behaviours and clinical signs observed throughout the procedure. This requires good planning, team work and training, as well as appropriate choices of indicator and recording systems. Training, including ensuring appropriate attitudes, is critically important for staff working with farm animals as these animals can be perceived by those without the appropriate education as 'stoic' (due to lack of understanding of their behaviour, as discussed above) or, simply as 'production' animals, somehow less deserving of consideration than companion animal species.

Further guidance on all of the aspects of assessing actual severity outlined in the paragraph above has been produced by the European Commission,[13,14] which applies across all species but the examples provided are of limited help to those working with farm animals for two main reasons. First, the worked examples are in rodent and rabbit models and it is important to consider cases of relevance to large animals to identify any species- or model related difficulties in assessing severity for work involving larger animals. Second, the examples tend to relate to the classification of a single procedure, whereas farmed animals are often on study for a long time and are more likely to undergo a series of experimental techniques. Re-use of farm animals in further scientific procedures for a second and separate purpose may be requested for a number of reasons, including reduction of overall animal numbers, avoidance of the requirement for naïve animals for surgery, or for bio-security reasons. There may be an additional financial element to considerations, if significant resource has been expended on training or otherwise preparing the animals.*

There are understandable concerns in the scientific and welfare communities about achieving compliance with the legal requirement for assessment of actual severity, especially in terms of ensuring accurately and consistency and also with respect to how other potential causes of discomfort, pain or stress within the life time experience of the animal (e.g. transport) should be factored in. People are often anxious that they will 'get it wrong' and may simply opt for reporting the prospective severity limit, which is not helpful because it (i) provides little advantage over the previous system of reporting and (ii) provides no information about studies that are more or less severe than expected. Other concerns relate to the time taken to do the assessment for each animal – but if the assessment is done properly, the benefits in Table 2 should outweigh this – and confusion about what is meant by 'consistency' in assessments.

It is important to recognise that **the level of actual suffering may differ from the prospective judgement and also may vary between different animals undergoing exactly the same procedures, depending on the individual's responses to these**. That is, consistency is about everyone scoring each animal in the same way; it is not about expecting the same model to give the same results between or even necessarily within establishments.

* In the UK, any such re-use must be authorised in advance by the Secretary of State. The fact that the animal has been used before must be included within the harm-benefit assessment, the actual severity of the previous procedures must be assessed and checked against defined criteria and a veterinary surgeon with knowledge of the lifetime experience of the animal has to advise that the animal's general state of health and wellbeing have been fully restored following the previous use.

So, how to achieve this? Besides making full use of the available guidance from the European Commission (and the forthcoming guidance from the Home Office in the UK), it is a good idea to communicate with and consult others with relevant expertise. Within the establishment, this could include animal technologists, the Named Animal Care and Welfare Officer (NACWO)*, veterinarians the Named Information Officer (NIO), researchers and internal animal care and use committees including the Animal Welfare and Ethical Review Body (AWERB). Externally, useful contacts could be members of the Home Office Inspectorate (HOI), or scientists and technicians from other groups doing similar work.

Communication with the local Home Office Inspector (HOI) is absolutely essential if the severity limit of the protocol is found to have been exceeded, e.g. if an animal on a study with a moderate severity limit has experienced severe suffering. Some concerns have been expressed that this would (automatically and in itself) be non-compliant with the requirements of ASPA. However, provided each case is promptly reported to the HOI, as required by standard condition 18 of the project licence, the user should normally still be compliant with the Act. Condition 18 would only be breached if the HOI was not notified.

Discussion session

The rest of the meeting was devoted to a discussion session in which delegates exchanged views on the way in which they assessed severity and the kind of resources they felt might be useful to help achieve good standards of objectivity and consistency. An overview of the outcomes is presented below; note that 'TurningPoint' was used to survey the audience so the numbers of responses will vary.

Audience demographics

The audience of around 70 delegates comprised mostly animal technologists (28, of whom 12 were NACWOs); also 14 researchers, 9 veterinarians, several members of AWERBs, NIOs, Named Training and Competency Officers (NTCOs) and two HOIs. Most people (36) worked in government research or diagnostic facilities, with fewer employed within academia (19) and industry (10). Delegates worked with pigs (44 people), sheep (34), cattle (31), poultry (23) and goats (10). The majority of attendees (53) had attended because they felt there were welfare challenges associated with farm animal use, whereas 27 people felt reasonably happy with the situation but wanted to ensure they were updated.

* For non-UK readers, the NACWO is a senior animal technologist responsible for (inter alia) ensuring day-to-day care of the animals, and the NIO is responsible for ensuring that staff have access to relevant information specific to the species at the establishment.

What people were doing to assess suffering

Day-to-day welfare was mainly assessed by animal technologists, whom delegates also believed to be best at the task (see Figure 2). Most delegates (31) recorded observations using clinical record sheets that were mostly 'free text', whereas fewer (10) used numerical or binary 'score sheets, three used electronic data logging systems and 11 reported that the recording system depended on the species and experimental protocol. In a session with species-specific breakout groups, delegates listed the indictors that they commonly used to assess both good and suboptimal welfare (Appendix 1).

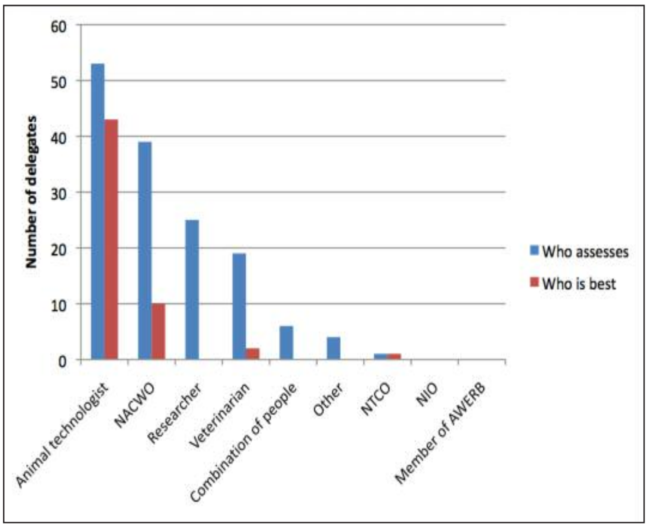

Figure 2. Delegate poll: who assesses animal welfare day-to-day and who does it best?

Legend: Delegates could vote for up to three options for 'who assesses welfare' and one for 'who does it best'. With respect to the latter question, 7 answered 'it depends'.

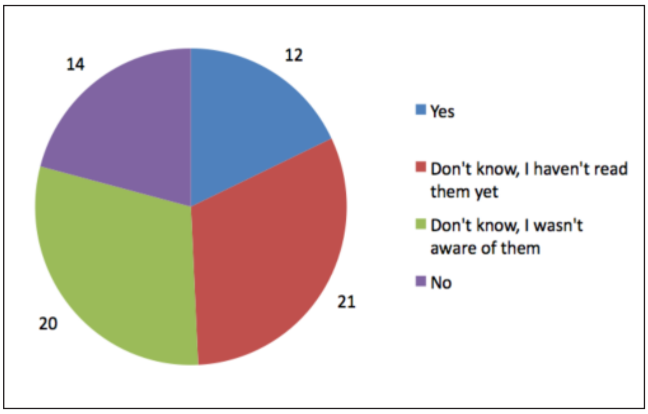

Figure 3. Delegate poll: are the Directive and/or the documents produced by the EC and its Expert Working Groups of any help with respect to assessing the welfare of agricultural animals?

Legend: The figures refer to the number of delegates voting for each option.

The requirement to record and report actual severity
Delegates were asked whether their facility was ready to take on the task of assessing actual severity; 19 said 'yes', 28 said they were 'working on it' and 17 said 'no'. Most people were entirely, or at least partly, satisfied with the training they had received relating to welfare assessment (24 and 22 respectively, as opposed to 15 who were not satisfied) but only 12 of 67 delegates who answered (18%, see Figure 3) had read the guidance from the EC on severity assessment and found it useful.

Discussion on a potential forum for large animal users
A straight question was put to the audience; would you use a large animal network, such as a discussion forum or virtual/actual meetings, if one were available? Fifty-four delegates answered 'yes', as opposed to twelve who replied that they would not. The potential benefits of a UK forum are set out in Figure 4. There was a fairly equal preference amongst delegates for an online discussion forum and meetings and 22 people felt that the IAT could do more for those working with large animals. Clearly, any forum would have to be hosted by an appropriate body, and the audience were given a number of options to vote for: a scientific welfare organisation (18 votes), a leading agricultural research facility (15), the NC3Rs (11), a body like IAT or LASA (10), 'other' (8) or the authorities (1).

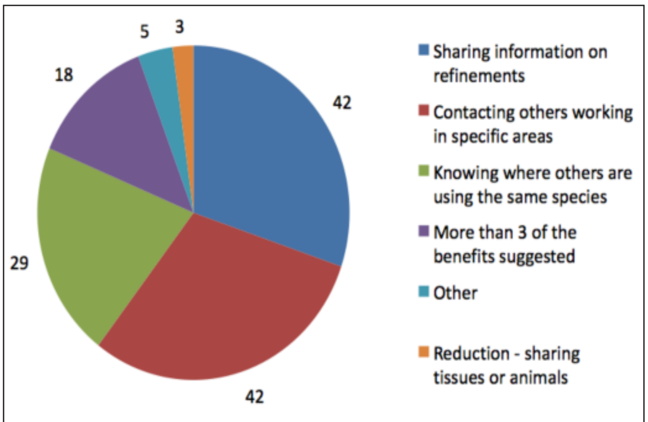

Figure 4. Delegate poll: what would you want from a UK forum?

Legend: The figures refer to the number of delegates voting for each option.

While there was support for a UK forum of some kind at the meeting, Norecopa's attempt to set up a similar, multinational forum was met with limited interest. Further thought and consultation will be necessary as to the kind of format that could be supported by relevant bodies. The outcome of this discussion will be passed on to IAT, LASA, the NC3Rs, the UK Animals in Science Committee and the Home Office. The RSPCA and AHVLA are also exploring the potential for another joint meeting at the time of writing.

Overall action points

The following action points are suggested on the basis of the talks and discussions on the day:

- Be prepared to accept and recognise emotional states in agricultural animals; challenge assumptions to the contrary.
- Consider how a positive emotional state might be encouraged for the animals in your care, taking into account (as appropriate) factors such as selection of species, strain and individual; the potential for refining housing, care, procedures and the way in which they are conducted; recognising and assessing desirable behaviours that indicate positive wellbeing.
- Review large animal housing and care with reference to the Five Freedoms, and AHVLA's 'Four Ps' (above) – including animals housed under all biosecurity levels.
- If animals in containment do not have suitable housing and husbandry refinements, identify any obstacles and work to overcome these.
- Consider whether there is the potential to use positive reinforcement training within any procedures, either to obviate restraint or provide stimulation for the animals.
- Make no assumptions about the nature and level of pain an animal may be experiencing on the basis of their behaviour alone. Keep up with the literature and current thinking on the assessment of pain and suffering, including new approaches such as Grimace Scales.
- Challenge any requirements to withhold analgesia, or some other appropriate pain management technique.
- Review the guidance on actual severity assessment produced by the European Commission and relevant national regulator (e.g. the UK Home Office), seek further advice and clarification if needed and feedback to the authors if the guidance is not useful at your facility.

If you have any thoughts relating to a discussion forum for those working with agricultural animals, or ideas for further meetings on agricultural animal use, contact research.animals@rspca.org.uk

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Appendix 1.

Commonly used indicators of good and suboptimal welfare in cattle, pigs and sheep

These indicators were listed by breakout groups addressing single species. They have been organised into the categories set out by the EC Working Group on severity assessment[13] with the intention of providing examples of indicators that may be helpful when reviewing welfare assessment for cattle, pigs and sheep. The 'procedure-specific' indicators are usually tailored to particular procedures, species, breeds (where appropriate) and stages of development but the examples in the tables below apply to a range of different procedure types for each species.

Good welfare – cattle

High level categories	Areas to focus on when observing animals	Specific indicators to monitor
Appearance	Body condition	Good body condition (although this can depend on the breed, e.g. Holstein-Fresians typically appear to have lower condition scores than other breeds, so other indicators should be considered in conjunction with body scores for these)
	Coat and skin condition	Shiny coat
Environment	Enclosure environment, including any litter, nesting material, enrichment items	Normal faecal consistency Interest in novel objects, curiosity
Behaviours	Social interaction	Socialisation and group interaction, including 'playfulness' and social grooming Good response to stockperson
	Posture and mobility	Good posture Lies down easily
	Other	Chewing cud Coming forward and vocalising for food Alert

Good welfare – pigs

High level categories	Areas to focus on when observing animals	Specific indicators to monitor
Appearance	Eyes	Bright eyes
Environment	Enclosure environment, including any litter, nesting material, enrichment items	Foraging, using toys, playing – with low grunting Inquisitive, curious – e.g. when person enters the room, in response to noise, new objects or change in environment Rooting, exploring with nose and mouth contact
Behaviours	Social interaction	Interacting with other pigs; snorting and running together Positive responses to stimulation Making eye contact, nose up
	Posture and mobility	Bouncing (‘pop-corning’) Relaxed posture
	Other	Tail wagging when happy Vocalising before feeding, interest in food Nest building with new bedding, bouncing into new beds Barking when excited or anticipating Quiet vocalisations, e.g. soft grunt when greeting Scratching dry skin

Good welfare – sheep

High level categories	Areas to focus on when observing animals	Specific indicators to monitor
Appearance	Body condition	Good health
Body functions	Food/water intake	Good appetite
Behaviours	Social interaction	Socialisation with humans Normal interactions with other sheep
	Other	Expression of normal range of behaviours

Suboptimal or poor welfare – cattle

High level categories	Areas to focus on when observing animals	Specific indicators to monitor
Appearance	Body condition	Poor body condition (although this can depend on the breed, see above)
	Eyes	Sunken eyes Wide open eyes
	Other	Bloat – this is an immediate cause for concern
Body functions	Respiration	Rapid, heavy breathing
	Food/water intake	Depressed appetite

	Other	Increased heart rate Decreased lactation
Environment	Enclosure environment, including any litter, nesting material, enrichment items	Changes in defaecation
Behaviours	Social interaction	Isolation – this is a cause for concern
	Posture and mobility	Changes in posture, movement or gait *Reluctance to rise ot increased lying
	Other	Escape attempts Agitation Specific vocalisations associated with pain or fear Specific tail movements associated with fear Pawing the ground Decreased rumination in adult, including dropping the cud Grinding teeth – this is a cause for concern
Procedure-specific indicators	These are identified on the basis of the individual project, its potential adverse effects and expected indicators of these	Sensitivity to touch Restlessness Depression Decreased maintenance behaviours and social grooming General malaise; head and ears down, inappetance Difficulty in changing position Hunched posture Dehydration (skin pinch test) Salivation Tail flicking Aggression (including head thrashing), kicking For infection studies: respiratory changes, mastitis, gastrointestinal signs e.g. scour, bloat, dropped cud, blood in faeces

Suboptimal or poor welfare – pigs

High level categories	**Areas to focus on when observing animals**	**Specific indicators to monitor**
Appearance	Body condition	Poor body condition
Body functions	Food/water intake	Poor food consumption or reduced drinking
	Body temperature	Problems thermoregulating, e.g. panting, blotchy skin, skin colour changes
Environment	Enclosure environment, including any litter, nesting	Diarrhoea Reduced interest in nesting material or toys; not curious – or even neophobic
Behaviours	Social interaction	No eye contact, do not come to pen door Isolation from group Nervous of other pigs
	Undesirable behaviours	Fighting, tail biting Bar biting or chewing, e.g. surfaces, nipple drinkers, tails, ears

	Posture and mobility	Posture – tail position and carriage, ear position
	Other	Reduced foraging Quiet, with reduced vocalisation; or barking when startled, angry or afraid
Procedure-specific indicators	These are identified on the basis of the individual project, its potential adverse effects and expected indicators of these	'Dog-sitting' Apathy Restlessness, e.g. postoperatively, shows that animal is uncomfortable Laboured respiration after surgery Bark or squeal reaction to acute pain, e.g. intramuscular injection Changes in skin colour – could be stress or problem thermoregulating Regurgitation Persistent vocalisation is a serious concern

Suboptimal or poor welfare – sheep

High level categories	**Areas to focus on when observing animals**	**Specific indicators to monitor**
Appearance	Body condition	Poor body condition score
	Coat and skin condition	Poor fleece or skin condition
	Other	Ear position
Body functions	Respiration	Panting
	Food/water intake	Inappetance
	Other	Disease prone
Behaviours	Social interaction	Isolation from other sheep
	Undesirable behaviours	Stereotypies
	Posture and mobility	Changes in gait or lameness Prolonged lying down
	Other	Vocalisation
Procedure-specific indicators		Aggression Behaviour signs of fear Unresponsiveness