Sheep Behaviour, Needs, Housing and Care

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Summary
Sheep (*Ovis aries*) are an attractive animal for scientific procedures; for medical, veterinary and fundamental biological research. They are docile, rarely show aggression, have a (relatively) short flight distance and are gregarious. In the UK, of 3 million animal scientific procedures in 2006, over 36,000 involved sheep. Small as a proportion perhaps, but exceeded only by the number involving rats and mice, among mammals, and chickens and fish (all species). And the numbers of sheep used in experimental procedures are increasing (up 24% on the previous year). They live longer than mice and rats (up to 15 years potentially) so can be used for longer term studies. They are smaller and more manageable than cows, yet have an analagous digestive system. They are commonly used for testing for veterinary vaccines. They have a similar neural axial structure to humans, so have been used for analagous studies, such as drug testing for treatment of Huntington's disease. They have traditionally been used in foetal physiological experiments, and in altering their genetic component to produce compounds that may be harvested in their milk, such as insulin or clotting agents for haemohpilia. Their use in fundamental genetic research has been well publicised. Other advantages are that they are highly domesticated, and we have a substantial knowledge bank of work on their behaviour. Nevertheless there remain specific welfare issues relating to the use of the sheep as an experimental animal. This presentation considers the particular behaviour of the domestic sheep and relates this to their housing, welfare, handling, and general care.

Sheep as Laboratory Animals
The use of sheep in scientific procedures is more frequent than may commonly be supposed. From United Kingdom figures of 2006 (*Home Office, 2006*), there were over 36,000 scientific procedures involving sheep, out of a total for all species of 3 million. This was less than only rats, mice, chickens and fish (all species). And the numbers of sheep used in this way are increasing, with these numbers representing an increase in sheep procedures of 24% on the previous year. So it may be expected that in the future still larger numbers of sheep will be used. The report (*Home Office, 2006*) identifies that the likely source of this increase is the increased use of sheep for fundamental genetic research.

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Why sheep are used in scientific procedures
As domesticated animals there are many and varied reasons why their use is of advantage in scientific work (*Arney, 2009*). In short, they have adapted to thrive in the presence of humans, so should not be as stressed in the company of humans as non-domesticated animals. Sheep have particular advantages in animal science in having a relatively long lifespan (compared with small mammals) of up to 15 years, they are relatively inexpensive to purchase, are easily available and inexpensive to feed. The thousands of years of domestication of sheep, and our general societal acceptance of their exploitation for meat, and wool, means that their use may be viewed as more morally acceptable by society in general than the use of other animals, particularly such species commonly kept as pets such as dogs

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and rabbits. This has been reviewed by Wolfensohn and Honess (*2007*).

We also have a significant bank of knowledge regarding the husbandry, behaviour, and other welfare needs of sheep. This does not alas always translate into high quality husbandry in practice, of which the following is an example:

> *Sheep which should have been considered as continuing under project licence controls and personal licensee care were and not given adequate diet. Their poor condition was not recognised and a few died.*

Animals (Scientific Procedures) Inspectorate Report 2006

It may be that a more extensive and worthwhile exchange of information and good practice could be achieved between practitioners of agricultural science and laboratory animal science.

Uses of Sheep in Animal Science

The uses of sheep in animal science are many and varied. They are commonly used in production trials, especially as models for larger ruminants; they have an analagous digestive systems to cows, yet they are much more manageable. They are used for testing the efficacy of veterinary vaccines for the benefit of their conspecifics (*Sexton et al., 1990*) and for other species (*Lightowlers et al., 2008*). But they also have uses in medical science, for the benefit of human patients. In medical drug testing, they have been used as models for drugs to combat Huntington's disease, as they have a similar neural axial structure to humans. The hormone profiles of ewes are similar to those of women (*Turner, 2002*) and they have been used in trials of drugs for osteoporosis. Foetal physiological experiments with applications to human medicine have involved sheep (*Dodic et al., 2002*). Applied genetic research, altering the genetic component of sheep to produce compounds that can be harvested in ewes' milk, has successfully proved to be a source for such valuable medical products as clotting agents for haemophilia and insulin. This has been reviewed by Murray (*1999*). And perhaps one of the most publically-aware projects involving fundamental genetic research, genetic cloning, took place initially with sheep (*Campbell, 1997*).

Housing requirements for sheep

The requirements for housing for sheep are not necessarily similar to those for small mammals, and not just in terms of their larger size and requirement for more space. It should be borne in mind that the sheep has evolved from a mountain dwelling wild type. Ruminants have an internal fermentation chamber, the rumen, that produces large amounts of heat, and sheep are unlikely to suffer at low temperatures. The aim should be to provide an environment that is similar to that outdoors, but without snow, wind and rain. Ventilation should be provided, and it should be efficient. If there is poor air exchange this will lead to the build-up of deleterious air-borne organisms and possibly noxious gases, high levels of humidity and respiratory problems. However, draughts should be prevented, with pens that are windproof at ground level.

Insofar as it is possible, sheep should be kept in groups. They become very nervous if kept in groups of less than four, and more so if confined singly. Floor space provision should be around 1 m^2 per sheep, but this does depend on breed, age, size, and whether the ewe is in-lamb (*Bryson, 1984*).

There is evidence that enriching the environment can reduce fear reactions, at least in ewes (*Vandenheede and Boissou, 1998*). In this case the enrichment features used were models of humans and coloured mobiles, but it may be that other items might be equally effective.

Flooring is usually either of straw or on slats. Straw should be clean and dry, as indeed should slats. If slatted floors are kept clean, foot problems are much reduced. Lighting should be sufficient to see each animal clearly, with the facility to provide sufficient lighting to inspect stock during the hours of darkness. The recommended minimum light intensity has been proposed to be four watts per m^2 (*Bryson, 1984*).

Access to feeding should be such that all animals should be able to feed at the same time, and feeding troughs should be designed to allow this. The space should be about 450 mm per animal, but this depends upon breed and size. Sheep in experimental conditions should not need concentrates, unless they are approaching parturition, lactating or prior to tupping. A 60 kg sheep should need 1 kg Hay or 3 kg silage per day or 1.5 kg Straw, but if straw is the only fodder offered this would need to be supplemented with some concentrates (*Bryson, 1984*). Lambs feed less when isolated – maybe competition for feed is necessary to maximise intakes, although there is evidence that the profile of microorganisms is altered in isolated sheep, impairing intakes and digestion efficiency (*Faichney et al., 1999*). Clean water must always be available. It has been suggested that sheep prefer to drink from troughs rather than buckets (*Bryson, 1984*), although the current author hasn't observed a problem with this.

Sheep behaviour

Sheep are social animals; they flock, walk, run, graze, and bed down together. Such activities are usually initiated and led by the oldest ewe (*Bryson, 1984*). They are also grazing animals which would normally spend most of their time seeking and selecting food, eating and ruminating. Stressed sheep will stop ruminating, and observation of the time spent occupied in this behaviour is an indicator of good welfare. Grazing follows a predictable diurnal pattern with the most intense grazing in early morning and late afternoon.

Sheep sleep for about four hours a day. Their reproductive behaviour is seasonal (with some breed exceptions), with oestrus being stimulated by shorter daylength during the autumn. During this period ewes will become more active and rams can display aggression. Lambs will reach puberty at between seven and 12 months of age.

The visual sense is of primary importance in sheep, they can recognise the faces of other sheep and can distinguish breed and sex as well as species from facial recognition (*Kendrick et al., 1995*). Vocalisation and hearing are principally of communicative use between the ewe and her lamb and during periods of stress (the provision of feed or alarm). They can become stressed by loud noises. Smell may be more complex than human's: the identification of own-lamb is highly specific, and the smell of the ram leads to the onset of oestrous cycling. Sheep will certainly avoid mouldy feed.

Common Abnormal Behaviours Indicating Problems

Abnormal behaviour may be the first indicator that there is a problem with an individual sheep, or the whole flock. It is a more sensitive measure than other factors indicating poor welfare such as injury, disease and reduced intakes and is often used to assess welfare. Such abnormal behaviours observed in sheep include: lethargy, becoming uninterested in feeding, increased vocalisation, isolation of individuals from the flock, pica, restlessness and an increased respiration rate.

Training of staff involved in caring for sheep is important in identifying abnormal behaviour problems early and endeavouring to solve the underlying causes effectively and rapidly. But recent work by Wemelsfelder (*2007*) has found that, irrespective of professional expertise, observers' (including lay persons) interpretation of animals' behavioural expressions, including their emotional state, are in close agreement. This includes assessments of sheep. So there is no excuse for not identifying a stressed animal.

Handling

The practice of handling sheep should minimise the stress to the animals, and the risk of injury to the handler. Our differing attitudes to sheep, as farm animals, compared to those we hold towards pet animals, can impede the success of our care of such animals. The observation that touching, but also talking to and being close to, animals is important to their welfare might seem a commonplace when referring to pet animal species, but it is equally true of farm animals, including sheep (*Kiley-Worthington, 1990*). As with all farm animals, frequent positive handling reduces fear of humans, and other familiar objects (*English et al., 1992*). Such repeated positive contact encourages empathy in the human-animal relationship. It should furthermore be noted that if animals are stressed they become more difficult to handle, liable to display aggression or panic, attempt to escape and cause injury incidentally. Although sheep have a reputation for docility they can butt if roused, and handlers' feet unprotected by boots can be damaged by being trodden on.

The foot pads of sheep are sensitive, and painful feet are a common problem in sheep (*Wassink et al., 2005*). In this state sheep may behave unexpectedly aggressively if handled without sympathy. To improve stress-reduced handling, the hooves should be regularly trimmed to avoid such foot problems. If problems during handling, should arise, sheep will often stop struggling if they have nothing to kick or push against. A calm position in which to hold them is with the sheep turned over, with their back against the handler's legs, and with the sheep's legs held out in the open space in front. Most importantly, the handler should be calm; when panicked sheep can thrash around, jump over pens and damage themselves, other sheep and the handler.

Conclusion

There are significant numbers of sheep currently used in scientific procedures, and these numbers are likely to increase in the future. Sheep are deserving of the same respect that is accorded to other laboratory animals, and handlers should endeavour to form the same sympathetic bonds with sheep that they may more naturally do with laboratory animals that are common pet species. Housing and feeding of sheep should take cognisance of, and make practical use of, extant knowledge from agrcultural science as a guide. Carers should use, and improve and update, their knowledge of sheep behaviour, to make informed judgements of their welfare, and to act upon these judgements. Technicians should be reassured that they have the ability to reliably judge the emotional state of sheep even if they are unfamiliar with dealing with them.

References

Arney D. R. Welfare of Large Animals in Scientific Research. Scan J Lab Anim Sci. 2009, *37*, 97-101.

Bryson T. The Sheep Housing Handbook. Pub. Farming Press. Ipswich. 1984.

Campbell K.H.S., J. McWhir, W.A. Ritchie and I. Wilmut. Sheep cloned by nuclear transfer from a cultured cell line. Nature. 1997, *385*, 810-813.

Dodic M., E. Wintour, J.A. Whitworth and J.P. Coghlan. Effest of steroid hormones on blood pressure. Clinical and Experimental Pharmacology and Physiology. 2002, *26*(7), 550-552.

English P., G. Burgess, R. Segundo and J. Dunne. Stockmanship. Pub. Farming Press. Ipswich. 1992.

Faichney G.J., N.M. Graham and D.M. Walker. Rumen characteristics, methane emissions, and digestion in weaned lambs reared in isolation. Australian Journal of Agricultural Research. 1999, *50*, 1083-9.

Home Office. Statistics of Scientific Procedures on Living Animals Great Britain. The Stationery Office. London. 2006.

Kendrick K.M., K. Atkins, M.R. Hinton, K.D. Broad, C. Fabre-Nys and B. Keverne. Facial and Vocal Discrimination in Sheep. Animal Behaviour. 1995, *49*(6), 1665-1676.

Kiley-Worthington M. Animals in Circuses and Zoos. Little Eco-farms publishing. Basildon. 1990.

Lightowlers W., S.B. Lawrence, C.G. Gauci, J. Young, M.J. Ralston, D. Maas and D.D. Heath. Vaccination against hydatidosis using a defined recombinant antigen. Parasite Immunology. 2008, *18*(9), 457-462.

Murray J.D. Genetic Modification of Animals in the Next Century. Theriogenology. 1999, *51*, 149-159.

Sexton J.L., A.R. Milner, M. Panaccio, J. Waddington, G. Wijffels, D. Chandler, C. Thompson, L. Wilson, T.W. Spithill and G.F. Mitchell. Glutathione S-transferase. Novel vaccine against Fasciola hepatica infection in sheep. The Journal of

Immunology. 1990, *145*(11), 3905-3910.

Turner A.S. The Sheep as a Model for Osteoporosis in Humans. The Veterinary Journal. 2002, *16*, 232-239.

Vandenheede M. and M.F. Bouissou M.F. Effects of an Enriched Environment on Subsequent Fear Reactions of Lambs and Ewes. Developmental Sociobiology. 1998, *33*, 33-45.

Wassink G.J., L.J. Moore, R. Grogono-Thomas and L.E. Green. Footrot and interdigital dermatitis in sheep: farmers' practices, opinions and attitudes. The Veterinary Record. 2005, *157*, 761-766.

Wemelsfelder F. How Animals Communicate Quality of Life: The Qualitative Assessment of Behaviour. Animal Welfare. 2007, *16*(supp.) pp.25-32.

Wolfensohn S. and P. Honess. Laboratory Animal, Pet Animal, Wild Animal: Which Gets the Best Deal? Animal Welfare. 2007, *16*(supp.), 117-123.