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Husbandry and Feed Requirements for Experimental Lambs: Review

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Abstract: Laboratory animals used in experimental studies play a vital role in teaching / research as well as developing skills for diagnosis and prevention of various diseases. The commonly used laboratory animals in experimental studies are frogs, rats, mice, rabbits, guinea pigs, cats, dogs, monkeys and sheep. Different studies have indicated there are several reasons why sheep make excellent experimental subjects for physiological studies. Nevertheless, there remain specific welfare issues relating to the use of the sheep as an experimental animal. This review paper considers the particular feed and husbandry requirements of the experimental sheep and relates this to their housing, welfare, handling and general care. Thus, the objective of this paper was to review the husbandry and feed requirements for experimental lambs. The behavior, feeding, good practice, housing, diseases, lambs rearing, nutrient requirement and welfare of the experimental lambs were discussed. Sheep should deservethe same respect that is accorded to other laboratory animals. Thus, handlers and researchers should provide the same sympathetic bonds with lambs that they may more naturally do with other laboratory animals under experimental conditions. Housing and feeding of sheep should take cognizance of and make practical use of, extant knowledge from agricultural science as a guide. Careers should use, improve and update, their knowledge of sheep behavior, to make informed judgments of their welfare and to act upon these judgments. 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. Different studies have indicated that there are significant numbers of sheep currently used in scientific procedures and these numbers are likely to increase in the future.

Key words: Lambs · Sheep · Husbandry · Feed · Experimental · Laboratory · Animals

INTRODUCTION

Laboratory animals used in medical colleges play a vital role in teaching / research as well as developing skills for diagnosis. Here the animal is almost exclusively used as a substitute or model for man as most laboratory animals have the same set of organs heart, lungs, liver and so on which works in the same way as they do in humans. Knowledge gained from animal experiments enhances the understanding of the subjects like physiology, microbiology, pharmacology, biochemistry etc. Animal experiments give an insight to the students and researchers about the etiology, diagnosis, progression and methods of prevention of various diseases. Commonly used animals in medical colleges are frogs, rats, mice, rabbits, guinea pigs, cats, dogs, monkeys and sheep [1].

Use of defined animals in appropriate conditions will reduce the stress on the animals and will result in generating reproducible and reliable results. A thorough knowledge of the biological characteristics, husbandry and feed requirements of the species to be used is essential to ensure animal welfare. It is obligatory on the part of investigators/students to handle the animals gently, following the guidelines of ethical consideration for animal use[1].

Sheep *(Ovisaries)* have been domesticated for over 10,000 years and figure prominently in the story of civilization and human survival, as evidenced by numerous biblical references, religious practices and symbols and cultural rituals that involve this species, not to mention their importance to agriculture over several millennia. Sheep are widespread across the world, having adapted to many different climatic conditions and

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econiches[2]. During the past 40 years, sheep have also been the subject of considerable research from the viewpoint of physiological function and animal production, are now regarded as one of the most studied non-human, non-rodent species [2].

Sheep 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 [3]. In the UK, of 3 million animal scientific procedures in 2006, over 36,000 involved sheep. They are small as a proportion perhaps, but exceeded only by the number involving rats and mice, among mammals and chickens and all species [3, 4].

Sheep have been used as experimental subjects in such diverse fields of study as endocrinology and reproductive physiology, cardiovascular physiology, fluid and electrolyte homeostasis, immunology, neurophysiology and neuroanatomy, thermoregulation, haematology, ingestivebehaviour, nutrition and gastro-intestinal physiology [5]. In regard to the last, being ruminants with specialized four-chambered stomachs, sheep have been studied extensively in their own right, with much knowledge accruing in regard to ruminant nutrition and animal production. Another aspect of the sheep is the availability of post-mortem sheep tissues from abattoirs. This has enabled the collection vast numbersof organs such as the pituitary from the sheep, enabling the discovery and characterization of a number of new hormones for example, the various hypothalamic releasing hormones which control the secretion of a range of pituitary hormones [5].

Arney [4] indicated the numbers of sheep used in experimental procedures are increasing (up 24% on the previous year). Sheep 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 analogous digestive system. They are commonly used for testing for veterinary vaccines. They have a similar neuralaxial structure to humans, so have been used for analagous studies, such as drug testing for treatment of Huntington's disease [4]. They have traditionally been used in foetal physiological experiments and in alteringtheirgenetic component to produce compounds that may be harvested in their milk, such as insulin orclotting agents for haemohpilia [4]. Their use in fundamental genetic research has been well promoted. Otheradvantages are that they are highly domesticated and there is a substantial knowledge bank of work ontheirbehaviour. Nevertheless there remain specific welfare issues relating to the use of the sheep as anexperimentalanimal [4]. This presentation considers the particular feed and husbandry requirements of the domestic and experimental sheep and relatesthis to their housing, welfare, handling and general care. Thus, the objective of this paper wasto review the husbandry and feed requirements for experimental lambs

Why Sheep Are Used in Scientific Procedures: There are many and variedreasons why their use is of advantage in scientificwork [4]. In short, they have adaptedto thrive in the presence of humans, so should notbe as stressed in the company of humans as non-domesticatedanimals. Sheep have particular advantagesin animal science in having a relatively longlifespan (compared with small mammals) of up to15 years, they are relatively inexpensive to purchase,are easily available and inexpensive to feed. Thethousands of years of domestication of sheep andour general societal acceptance of their exploitationfor meat and wool, means that their use maybe viewed as more morally acceptable by society ingeneral than the use of other animals, particularlysuch species commonly kept as pets such as dogs and rabbits[6].

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 system to cows, yet they are much more manageable [4]. They are used for testing the efficacy of veterinary vaccines for the benefit of their conspecifics [7] and for otherspecies [8]. But they also haveuses in medical science, for the benefit of humanpatients. In medical drug testing, they have beenused as models for drugs to combat Huntington'sdisease, as they have a similar neural axial structureto humans. The hormone profiles of ewes are similarto those of women [9] and they havebeen used in trials of drugs for osteoporosis. Foetalphysiological experiments with applications tohuman medicine have involved in sheep [10].

Different research findings has indicated applied genetic research, altering the geneticcomponent of sheep to produce compounds that canbe harvested in ewes' milk has successfully provedto be a source for such valuable medical productsas clotting agents for haemophilia and insulin [11]. And perhapsone of the most publically-aware projects involvingfundamental genetic research, genetic cloning, tookplace initially with sheep [12].

Advantages of Using Sheep for Experimentation: There are several reasons why sheep make excellent experimental subjects for physiological studies.

Their body weight and size approximates to that of a human and they adapt rapidly and extremely well to a laboratory situation. In general they have a placid nature and relate positively to handlers and experimenters, possibly a result of their adaptation to domestication which has occurred over many generations. After an introduction of a sheep to the laboratory pen or metabolism crate and one to two weeks of regular daily handling, patting and food rewards, together with the company of other sheep, there results a confident, unstressed, healthy animal, with a strong bond often developing between sheep and experimenters. This enables experiments investigating physiological function in conscious, unstressed animals to be performed successfully [4].

The size of the sheep enables ease of introduction of catheters or cannulas (using either local or general anaesthesia) into various blood vessels, bladder, rumen, salivary duct or cerebral ventricles for the purpose of obtaining samples of blood or other body fluids for chemical analysis. Their size also enables sufficient blood to be withdrawn for chemical and hormonal analysis with minimal effects on cardiovascular function, which is not always possible in small rodents. Sheep recover robustly from anaesthesia and experimental surgery and provided appropriate care is taken are not usually troubled by post-operative or post-experimentation infection [5, 13].

Compared to rodents, sheep are long-lived and in this country are relatively inexpensive for their size. With the provision of adequate food and water, well-maintained and well-cleaned facilities and sympathetic handlers and experimenters, sheep can thrive in a laboratory and thoughtful, well executed experiments can yield a wealth of physiological information relevant to human and animal physiology and medicine [5].

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 [14]. 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 [14].

Sheep sleep for about four hours a day. Their reproductive behaviour is seasonal (with some breed exceptions), with oestrus being stimulated by shorter day length during the autumn. During this period ewes become more active and rams can display aggression. Lambs reach puberty at between seven and 12 months of age. The visual sense is of primary importance in sheep; they can recognize the faces of other sheep and can distinguish breed and sex as well as species from facial recognition [15]. Vocalization 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 certainly avoid moldy feed [16].

Common Abnormal Behavioursindicating 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 behaviors observed in sheep include: lethargy, becoming uninterested in feeding, increased vocalization, 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 endeavoring to solve the underlying causes effectively and rapidly [15]. But,Wemelsfelder [16]has found that, irrespective of professional expertise, observers' (including lay persons) interpretations of animals' behavioral expressions, including their emotional state, are in close agreement. This includes assessments of sheep. Different studies have shown thatthere is no excuse for not identifying a stressed animal [16].

Handling Practice of Sheep: The practice of handling sheep should minimize 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 [17]. As with all farm animals, frequent positive handling reduces fear of humans and other familiar objects[18]. 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 [18].

The foot pads of sheep are sensitive and painful feet are a common problem in sheep[19]. In this state sheep may behave unexpectedlyaggressively if handled without sympathy. To improvestress-reduced handling, the hooves should beregularly trimmed to avoid such foot problems. Ifproblemsoccur during handling, should arise, sheep willoften stop struggling if they have nothing to kick orpush against. A calm position in which to hold themis with the sheep turned over, with their back againstthe handler's legs and with the sheep's legs held outin the open space in front. Most importantly, thehandler should be calm; when panicked sheep canthrash around, jump over pens and damage themselves,other sheep and the handler [19].

Lambs Rearing: Rearing conditions influence behavior in sheep. A close maternal bond is important for the normal social and emotional development of sheep. It is very difficult to change behaviors that have been learned from the mother [20]. Lambs raised in a social environment tend to respond by interacting with a stimulus whereas lambs raised in isolation tend to withdraw. However there is no difference between the groups with respect to their adrenocortical response to the stress of a novel environment [21]. Every effort should be made to rear lambs in an environment that provides some social stimulation. This can be provided by rearing them with their peers [21]; however, young lambs do form strong social bonds with each other, humans or other animals. Lambs reared in artificial conditions can discriminate between their handler and an unknown handler [22]. They can also associate different handlers with different reinforcement histories [23]. Lambs are less disturbed by isolation from other lambs when in the presence of known handlers than with a stranger. This could help the known handler and increase handling difficulties for a stranger [23].

Housing: Being highly social animals, sheep must always be transported and housed in groups or at least in pairs so that they are always able to see another sheep. Without this 'social contact' sheep will quickly become agitated and distressed. If absolutely necessary, sheep may be kept in front of a full length mirror for short periods to prevent the stress of isolation becoming a problem, but it must be emphasized that this is only a short term (hoursmaximum) solution [5]. Sheep breeds vary widely in their capacity to adapt to heat and cold. Like all mammals, sheep are forced to increase heat production to maintain core body temperature as environmental temperature drops. The critical temperature at which this occurs varies from 0°C for adult sheep in full fleece to 20-25°C for newly shorn animals to 30-36ºC for new born lambs [5].

Sheep can be housed simply but require full protection against wind, rain, extremes of temperature and humidity. Timber, even though rough-cut bush timber can be used for construction and is probably superior to metal. However, it may not be acceptable for housing off-farm where presentation is important. Fittings must not provide injurious hazards when sheep are being moved. The commonly available metal floors are unsuitable for long term housing of sheep because sheep become footsore on them and show hesitancy in moving and lying down. Traditional slatted hardwood floors as used in shearing sheds are satisfactory and superior to concrete. Wooden floors may be considered more difficult to maintain in some situations where cleanliness of surfaces is paramount, so slatted hard plastic floors may be a suitable alternative. The plastic does have the disadvantage of becoming slippery when wet, however drop - through slats for urine and faeces can eliminate the need for regular washing down and provided the sheep are not scouring, the floor remains dry. One consideration is to have slats run opposite to and not parallel with, the direction in which sheep move in lanes. If sheep gain the impression of height, they baulk [5].

Space allowance should be determined from basic principles. Areas of 1.2 square meters per sheep are suggested as a guide. However, literal application of space allowances is an undesirable scenario for developing considerate animal care because it diverts attention from the animals themselves. Unless there are specific experimental requirements, sheep ought to be able to move around in an individual pen and be able to lie in an orientation they choose. Groups of more than 12 in a pen may lead to erratic results in experiments. Groups of eight may be acceptable. Experiments in which groups of 50-60 sheep are held in single large pens are probably invalid because of the behavioral tensions which occur. In spite of possessing a fleece, sheep have limits to their heat and cold tolerance. Roof extractor fans are important for the summer heat. Sheep should not be housed in contact with corrugated iron walls that face the summer sun. Even sheep which are fully fleeced will die if exposed to cold wet winds. Thought must be given to sleet and gales blowing up though slatted floors [5].

Different research findings have indicated group pens should provide enough space for the behavioral needs of animals to be met in terms of resting space and also allow space for animals to move apart from the group. Increased space allowance tends to be associated with a decrease in theoccurrence of interactions and potentially injurious events when groups of sheep aremixed, as they are able to move away to minimize aggression. Partitions may be included to break the space up [24].

Different studies have shown it is important to provide a well-drained area for sheep to rest and ruminate. They generally lie down to ruminate and the space should be large enough to accommodate all sheep in the pen to lie down at once as sheep have a strong social motivation to synchronize activities (for example, all graze or rest at the same time). A reduction ofsynchronization of lying can be regarded as a negative indicator of welfare [25]. Lying behavior decreases as space allowance is decreased [24, 25]. Sheep significantly reduced their lying time when lying spacewas decreased from 0.75-0.50 m^2 per ewe. Synchronization of lying was also reducedwith decreased lying space [25]. A space allowance of greater than 1m^2per sheep is required before most of the sheep in a group will lie down at the sametime [26]. Lying time is increased in pens which have their longest sideaway from a corridor as opposed to pens which have their longest side along thecorridor [25].

In designing pens for single housing of sheep, consideration should be given to ensure that the shape of the pen allows them to move around freely, lie down and engage in species-specific behaviors. Pens should be designed to accommodate the largest animal likely to be kept. It is commonly suggested that the minimum should be 1.5m long by 1.0m wide, however,Wolfensohn and Lloyd [27] recommend 2.1m by 1.05m and Reinhardt and Reinhardt [28] recommend that for a single sheep, a space of at least 2m^2 should be provided to allow an adult sheep to turn freely and to take a few steps in one direction. Different studies have indicated that there have been various recommendations given for space allowances for sheep (Table 1).

Nutrient Requirement: Apart from being adequate in amount and composition to meet requirements for protein and energy, feed for sheep must also satisfy a set of interrelated behavioral and physiological factors. Ruminants have cyclical activities which are geared to demands for water and food and rest periods necessary for the processes of rumination and digestion. Sheep apply an impressive array of behavioral adaptations to their herbivorous mode of life. For example, their exploration of feed and their learned and innate preferences and selectivities are being investigated but should be borne in mind in the laboratory environment [5]. Sheep possess a complex digestive system to deal with their mixed diet of digestible plant components and relatively indigestible cellulose. Feed takes 25-35 hours to pass through the gut and is exposed to microbial fermentation in the rumen during this time, which provides micro-organisms and the products of cellulose breakdown for digestion. Sieving processes are involved, with large particles being regurgitated for re-mastication by the process of rumination (or 'chewing the cud') and smaller particles of less than one to two mm passing into the stomach. Sheep ruminate for six to seven hours per day and this readily observable activity is a guide to health and well-being. Side benefits of ruminal fermentation include accessory food factors such as water-soluble vitamins and protein elaborated by microbes from simple nitrogen compounds [5].

Feeding standards for sheep have been published in the UK, the USA and Australia. The Australian treatise [29] has a comprehensive experimental and theoretical framework. Requirements of digestible organic matter, energy, crude protein and bypass protein, fibres, minerals and vitamins given in these standards are average values. Under practical conditions, however, individual responses of sheep must be accounted for and animals have to be fed according to effect [29].

Adams & McKinley [5] indicated two simple and well accredited rations for laboratory sheep are a 50% mixture of lucerne and wheaten chaff and a pelleted ration composed of lucerne chaff (50%), wheat grain (10%), bran (18%), pollard (20%) and crude salt (2%)(to control urinary calculi by increasing fluid intake). Although lucerne chaff is valuable for its high concentration of calcium as well as protein, its quality can vary considerably and is a factor to consider if performance is unexpectedly low. In most other rations, calcium demands have to be met by the addition of ground limestone. Nutritional deficiencies have not been observed with the two rations described above [5].

Investigators working with housed sheep must also be aware of the critical need these animals will have for physical fibre (rumen 'scratch' factor). The demand for rumination / salivation behavior is important and failure to provide physical fibre (i.e. roughage > 5cm) results in behavioral dysfunctions (wool biting and stereotypic bar chewing), some of which can result in pathology (wool 'balls') and serious stress to sheep that become the target of biting [5]. The nutrient requirements of experimental lambs are indicated in (Table 2).

Table 1: The various recommendations given for space allowances for sheep (values in square meters per animal [5]

Source	Group housed /sheep (m^2)	Ewe and lamb (m^2)	Singly housed (m^2)
Preusse *et al*. [32]	0.8	1.6	
Arny[4]	0.9 for < 8 sheep, 0.8 for 9-15 sheep	1.5	0.6 for a lamb, 0.9 for dry ewe or whether, 1.0 pregnant ewe
Adams and McKinley [5]	1.2		
Kim[26]	>1.0 needed for all sheep to lie down at once		
Loynes [33] in Slade and Stubbings [34]	0.5-0.7 (32kg hogget) Increased on straw by 0.2-0.3. Reduce by 10% if shorn.	1.2-1.7 Increased on straw by 0.2-0.3. Reduce by 10% ifshorn.	
Sevi *et al*. [35]		2.0 needed to maintain air quality	
Gilbert and Kendrick [20]	1.3 for sheep <35kg, 1.9 for sheep >35kg		2.0 for sheep <35kg, 2.8 for sheep >35kg
Reinhardt and Reinhardt [28]			At least 2.0
Romeyer and Bouissou [36]	1.8 for ewes <60kg; 2.1 for ewes >60kg; 3.0 for rams	Lambs up to 6 weeks 3.0 for ewes < 60kg; 3.3 if >60kg.	
Faervik *et al*. [36]	0.7 for sheep <20kg; 1.0 for sheep 20-35kg; 1.5 for sheep 35-60kg; 1.8 for sheep >60kg. Minimum enclosure size: for sheep <20kg is 1.0; for sheep 20-35kg is 1.5; for sheep 35-60kg is 2.0; and for >60kg is 3.0		

Table 2: Nutrient requirement of lambs [5]

Dry Matternutrients per Animal							
Body weight(lb)	Daily gain(lb)	Per animal(lb)	% live weight	TDN(lb)	Crude protein(lb)	Ca(lb)	P(lb)
Growing-lambs finishing 4 to 7 months old							
66	0.65	2.9	4.4	2.1	0.42	0.0146	0.0071
88	0.60	3.5	4.0	2.7	0.41	0.0146	0.0073
110	0.45	3.5	3.2	2.7	0.35	0.0123	0.0066
Early weaned lambs-moderate growth potential							
22	0.44	1.1	5.0	0.9	0.28	0.0088	0.0042
44	0.55	2.2	5.0	1.8	0.37	0.0119	0.0055
66	0.66	2.9	4.4	2.2	0.42	0.0148	0.0071
88	0.76	3.3	3.8	2.6	0.44	0.0170	0.0086
110	0.66	3.3	3.0	2.6	0.40	0.0154	0.0084
Early weaned lambs-rapid growth potential							
22	0.55	1.3	5.9	1.1	0.35	0.0108	0.0049
44	0.66	2.6	5.9	2.0	0.45	0.0143	0.0064
66	0.72	3.1	4.7	2.4	0.48	0.0159	0.0075
88	0.88	3.3	3.8	2.5	0.51	0.0190	0.0095
110	0.94	3.7	3.4	2.8	0.53	0.0207	0.01060
132	0.77	3.7	2.8	2.8	0.53	0.0181	0.0099

To convert dry matter to an as-fed basis, divide dry matter values by the percentage of dry matter in the particular feed [5]

Water Requirement: Water requirements range from 2.4 liters per day for growing sheep of 30 kg body weight to 12 liters per day for 60 kg ewes in early lactation. Water requirements for sheep in the laboratory are met by *ad libitum* access to clean water. The same imperatives apply whether troughs or self-drinkers are used. Water must be clean, free flowing and algae-free throughout the animal house.

Faecal contamination and faecal odors may inhibit drinking and predispose to urinary calculi. Water supply throughout a sheep house must be able to cope with peak demand on a hot day [5].

Characterization of Good Practice: Good practice may be taken to mean a standard of care that has a general level of acceptance among knowledgeable practitioners and experts in the field, is based on good sense and sound judgment, is practical and thorough, has robust experiential or scientific foundations and prevents unreasonable or unnecessary harm to, or promotes the interests of, the animals to which it is applied. Good practice exceeds the requirement to observe minimum standards and changes with the evolution of attitudes about animals and their care [30].

Diseases: Sheep may be affected by many different diseases of an infectious, parasitic, nutritional or neoplastic nature. It is beyond the scope of this article to examine these. Disease is not a major concern in well-housed sheep which have been vaccinated against the common clostridial diseases and are free of footrot and lice at the outset. However, sheep in sheep houses can become fly-blown. Infection with *Strongyloidespapillosus*can occur where animals are held on concrete which is hosed down and there is a reservoir of this nematode parasite in the cohabiting population of rats. Posthitis can be a problem and requires early intervention where it occurs. Urolithiasis occurs relatively frequently in some animal houses and should prompt a complete review and overhaul of the watering system to ensure that sheep have access to abundant clean, cool water [5].

Dietetic disorders can occur in housed sheep and are most commonly associated with high grain diets, which entail the risk of lactic acidosis, particularly if sheep unused to grain are allowed to engorge. Some animals appear to be incapable of adapting to pelleted rations with high grain content. Copper toxicity has been reported in housed sheep and can be controlled by access to soil to provide molybdenum [31].

CONCLUSION AND RECOMMENDATIONS

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 endeavor 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 agricultural science as a guide. Careers should use and improve and update, their knowledge of sheep behaviour, to make informed judgments of their welfareand to act upon these judgments. 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. Based on the above facts, the following recommendations are suggested:

- Fencing should be adequate and regularly checked and maintained to prevent unwanted entry of people or other animals
- Sheep should be monitored at least once daily so that changes in their condition are detected and appropriate action taken.
- Sheep should be closely monitored to detect the subtle changes in behaviour indicative of pain, fear, distress or signs of disease.
- Water bowls should be checked and preferably cleaned daily
- Care must be taken to avoid contamination of the animals' environment with any cleaning agents or other chemicals
- Sheep should be introduced gradually to new feeds, preferably in a familiar environment.
- Sheep must not be housed in isolation unless with the express permission of the Animal Ethics Committee.

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