

Poster Abstracts

Assessing animal suffering: choice tests — can we rely on them?

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Assessing animal suffering is fraught with difficulties. The idea of ‘asking’ the animals — and specifically the idea of choice tests — has been hailed by some as the way forward. As a hands-off, animal-centred approach, it would appear to have much in its favour. However, this paper questions whether choice tests are as useful as proponents claim. To begin with, assessing an animal’s preference (part one of the choice test) is not straightforward; there are several ways in which we may misinterpret what we see. These problems, it is argued, are not — as has been claimed — mere technical difficulties that may be solved by more careful attention to experimental design. They are flaws in the method of enquiry. Even where an animal’s preference could be ascertained, further difficulties arise when the strength of a preference is measured by ‘asking’ the animal how hard it is prepared to work for that preference (part two of the choice test). Once again, there is the risk of misinterpreting the results, and in a number of ways. There are deeper problems too, such as those that relate to how free an animal is to do the work it is asked to and whether it is legitimate to use motivation for food as a baseline for measuring suffering. The paper concludes that measuring suffering by interpreting animals’ choices must be viewed with great caution.

Behaviour, management and economic aspects of the Stolba family pen for pigs

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In the ‘Stolba Family Pen’, sows and their piglets live together in stable family groups throughout their production. Investigations over two years have shown the Stolba Family Pen to be a housing system that offers excellent animal welfare conditions and that can be operated economically on commercial farms. It is essential for an economic operation to keep the level of work requirement of the system at an acceptable level. The annual work requirement in the Stolba Family Pen is not considerably higher than in conventional systems. The system needs to be run by a

skilled farmer. Productivity of sows and fatteners is the same or better than in conventional systems. Investigations into animal behaviour show that the structure of the pen is very suitable for allowing essential behavioural patterns of pigs. Independent of the pigs’ age and outdoor climate, the structure of the pen is the main factor for the animals’ behaviour. It was shown that the natural behaviour of pigs can be used to direct defecation in confined environments to a certain area that can then be mucked out mechanically. Pigs never excreted in their sleeping nests, regardless of season and climate. The design of the family pen directs excretion to the exercise yard. During daytime, the pigs spent more than 30% of their time exploring the pen, straw or hay. Peat addition in the exercise yard was shown to be especially suitable for stimulating exploratory behaviour in pigs. The outside exercise yard is an indispensable part of the system; pigs spent 10% (winter) to 25% (summer) of their time there.

Welfare and animal husbandry — support of science and public policy making by use of the internet

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Animal welfare is an increasingly important factor to be considered when assessing procedures and methods of agricultural animal husbandry. Public interest in species-appropriate conditions of husbandry influences research on animal behaviour, animal welfare and the relationship of these with the farming process. It also leads to official regulations and rules for animal husbandry, the consideration of which is obligatory for farmers and enterprises. The preconditions which enable elaboration of these rules are knowledge about research results and the integration of the views of practitioners and agricultural administrators in the decision-making process. Increasingly, the internet gives support for these processes of knowledge dissemination and the exchange of experiences and practical information. It enables all kinds of users to find recommendations and regulations from the European Commission concerning conditions for the husbandry of cattle, pigs, sheep and poultry. Agricultural information systems such as the German Agricultural Information Network (dainet) offer access to national variations on these topics. Here, the responsible ministry provides information on animal health in an official capacity. This network also contains information on ongoing research projects, allows the publication of research results and provides a search facility for these. A number of national and international databases provide information about aspects of animal welfare in relation to animal health control, marketing processes, animal housing and breeding methods. Documents, facts and institutional addresses are offered by institutes, administrations or

societies. The presented poster describes important examples of such systems as well as databases and institutional internet sites.

The behaviour and welfare of captive corn snakes

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Reptiles and other so-called exotic species are becoming increasingly popular as pets in today's modern society. Unfortunately, this popularity boom has not been accompanied by increased research into the welfare requirements of these animals. This research has concentrated on the corn snake (*Elaphe guttata guttata*), which is a particularly popular choice as a 'pet' snake. Little is known, however, about its requirements and hence how to enhance its welfare. The first study examined the effect of cage size (small, medium or large) on the behaviour and physical characteristics of the young corn snake. After the relatively short period of four weeks, snakes housed in small enclosures gained significantly more weight and spent significantly more time in the open field than the other snakes in the study. These snakes accepted significantly more feeds than the snakes in the medium enclosures, but not the large enclosures. The second study undertook a series of preference tests for environmental factors commonly featured in snake enclosures. Four environmental factors were considered: substrate, climbing frame, water dish and hide box. The results revealed significant preferences for paper or woodchips as opposed to sand or artificial grass as a substrate; covered rather than uncovered climbing frames; large rather than small water dishes; and large rather than small hide boxes. These studies are beginning to build a picture of the preferences and needs of corn snakes in captive environments and will enable the welfare of these animals to be better catered for.

The effect of farming system and slaughtering on rabbit welfare

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An experiment was conducted to investigate the effect of transport and slaughter on rabbits reared in different conditions. Twenty-four New Zealand rabbits were weaned at 32 days of age and divided into two homogenous groups according to their different farming system, Group Cage (GC) and Group Pen (GP). The GC animals were reared two per cage (17 rabbits m⁻²) whereas the GP rabbits were reared together in a 2 m × 2 m pen (10 rabbits m⁻²). All subjects, at 90 days of age, were loaded onto a lorry and transported for a 1 h period to a slaughterhouse. Here they were unloaded one at a time and slaughtered. Blood samples were taken before transport and at exsanguination. Plasma samples were assayed for corticosterone, muscular and hepatic

enzymes, blood urea nitrogen (BUN), total protein, glucose, albumin, triglyceride, cholesterol, creatinine, calcium, phosphorus, magnesium, sodium and potassium. Transport and slaughter induced an endocrine-metabolic response to stress in both groups, but GC rabbits showed a greater response compared to GP. Muscular and hepatic enzymes were significantly higher in GC rabbits; this might be due to the reduced fitness of these animals, which would lead to greater muscular exertion during transport. In GP rabbits there were also increases in muscular glycogen and decreases in pH level, but these variations did not seem to be related to meat quality changes. In conclusion, transport and slaughter has been shown to have an adverse effect on rabbits, independent of the type of production system; however, pen-reared subjects seem to cope better with the physical stresses involved.

Weighting of natural behaviours: how modelling may support political decision making

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The animal's right to perform natural behaviour has been proposed as a key element in Dutch policy making on animal welfare (Animal Welfare Policy Memorandum, March 2002, LNV, The Hague). The concept of natural behaviour was intended to cover positive aspects of welfare. This paper deals with the question of how different natural behaviours can be weighted within a scientific conceptual framework for welfare assessment. This framework uses the concept of needs and is based on the idea that animals have evolved cognitive-emotional systems (needs) to deal with challenges in a variable environment. The animal's need states can be assessed based on scientific information about the relationship between design criteria and the intensity, duration and incidence of welfare performance criteria. In particular, the dimension of intensity can be derived from information about the magnitude and biological significance of the relevant welfare performance criteria. Welfare performance criteria can be classified into natural living conditions, preferences and demands concerning positive aspects; and for negative welfare aspects, reduction of biological functioning, stress, frustration, abnormal behaviour and aggression. All welfare needs must be assessed in order to assess welfare overall. With these general principles, the available empirical information can be applied to weight various natural behaviours. Examples are given of how this methodology works in the practice of supporting ethical and political decision making.

Laying hen welfare in the modified cage system Aviplus®

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The acceptability of modified cages with regard to animal welfare is heavily debated. We aimed to assess animal welfare preconditions of a modified cage system, based on physical and behavioural data (dustbathing and perching reported here). Some results are compared with data from a conventional cage and an aviary system with access to a free-range outside run. Flock size was about 1500 in each system, with all hens being of the same age and origin and under the same management. Instantaneous scan sampling of 18 Aviplus®-cages each containing 10 Lohmann Silver hens was carried out by 24 h video recordings, six times over 13 months. Dustbathing of 56 focal animals from the Aviplus®-cages and 20 from the free-range system was continuously observed either from video recordings or directly. Plumage and foot condition were scored in 100 hens from each system. The largest location-ID at dustbathing-in-cage-observations (n = 192) was 'in and at the dustbath' ('in' = 45.4%; 'at' = 11.4%), but 'dustbathing apart on the wire' still happened at ~41% ('feeder' = 37.8%; 'apart on wire' = 3.3%; 'nest' = 2%). In the cages, turning during dustbathing was limited compared to the free-range system, and the mean dustbathing duration was found to be 11 min 59 s in cage (n = 49) versus 20 min 13 s in free range (n = 20). Perches of the Aviplus®-cage were used, but only by 65–75% of hens at night. Results confirm that several preconditions for animal welfare in the Aviplus®-cage are better than in the conventional cage and worse than in the aviary. This was also reflected by feather and claw scores. However, the reverse applied to foot condition with no bumble foot in conventional cages and little in the aviary and Aviplus®-cages. Limited space, substrate, accessibility and competition appear to limit the usability of the devices of the Aviplus®-cage.

Modelling management strategies to improve cat welfare

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If the domestic cat population becomes too large then we can expect individual cat welfare to decrease. Population management can thus improve individual cat welfare, though some management strategies can themselves lead to a decrease in cat welfare. A matrix population model, developed for the domestic cat population of England and Wales, allows researchers to investigate the relative effectiveness of different management strategies. The model was used to explore principle management strategies, culling and neutering. Of these, neutering was found to be the most effective at reducing the rate of population growth. In addition, the age at which neutering occurs was shown to alter the effectiveness of any management campaign. Neutering is also linked to a reduction in problem behaviours potentially affecting the welfare of the animal. The model predicts that preventing a cat from having a first litter has twice the impact on population growth rate than neutering at any other age. Data from a well-studied

domestic cat population has been used to investigate the predictive power of the model, and to indicate which parameters are most important in terms of model accuracy. Validation of the model under different conditions is now being undertaken to demonstrate its general applicability and predictive power.

Matching horses for courses: development of robust tests of equine temperament to address equine welfare

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Robust tests of equine temperament are needed to match individual horses to their optimum career and training methods and as a welfare research tool in individual differences. Temperament is difficult to define but may be considered as an individual's basic stance towards continuing changes and challenges in its environment. Attempts to measure temperament by scoring an animal, known to the assessor, on a set of subjective scales allows for measurements of qualities not readily dissected into behavioural elements; however, this method suffers from a lack of reliability. Here I used inter-observer reliability to determine a reliable set of scales of paired-semantic-opposites and frequencies or likelihood of observed behaviour in riding horses and ponies. Principal components analysis revealed five independent dimensions that correspond to the Five Factor model of personality — extraversion, agreeableness, emotionality, openness to experience and conscientiousness — suggesting a valid tool for measuring individual differences in these animals. Attempts to infer temperament from an animal's response to specific behavioural tests are more objective but suffer from high individual-situation interaction and so may also suffer from poor reliability as well as validity. Here I found a set of reliable and discriminative behavioural tests from concurrence on test-retest and the range of responses observed to unexpected stimuli, novel object, tactile stimulation and unfamiliar substrate. However, their validity as measures of temperament corresponding to the Five Factor Model was not demonstrated, suggesting that the behavioural responses may reflect the animal's past experience more than its underlying temperament.

Microgravity compatible mice nests — development and testing

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Understanding the effects of microgravity on living organisms is a key issue in space exploration. If mice are to be used as research models for humans in a future habitat facility under microgravity conditions, their welfare must be ensured. Four nest models combining mouse biology and

scientific and engineering requirements were designed and ground models constructed. These models, using high performance fibres and fabric as bedding, were tested on the ground for animal preference and everyday use and from an engineering point of view. Testing results show that video observation of mouse behaviour and development only allows for general qualitative data collection and that improvement of models or other solutions are needed to obtain more detailed quantitative data. The use of fibres as bedding was accepted as delivery and sleeping locations by the mice; fabric was not. Additionally, fabric bedding is used as a defecation point by the mice. Animal preference tests showed higher mean dwelling times for loose fibre and tubular shaped models. Further testing indicated that loose fibre models may promote pup death and also render the observation of mice in the nest impossible. When animal and engineering results are weighted, we conclude that tubular shaped fibre nests constitute the best models from all those tested, ensuring a better well-being of the animals and better adaptation for microgravity conditions.

Capture stress in ostriches: a comparison between two methods

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An experiment was carried out to investigate the effect of two different methods of capture on the endocrine-metabolic response to stress in ostriches. Ten African blue neck ostriches, 13–18 months old, were divided into two homogeneous groups (each of five subjects) according to capture treatment. In the first group the animals were captured in their pen, after pursuit, by a long metal perch with an open hook at the top (Hook Capture Group: HCG), in the other group the animals were attracted into the pen by food, they were then manually captured (Food Attracted Capture Group: FACG). After capture, all subjects were loaded onto a van and transported for a 4 h period to an authorised slaughterhouse where they were slaughtered after a further 20 h period. Blood samples were taken by venipuncture at the jugular vein at the end of capture (T_1), at the end of transport (T_2) and at the time of slaughter (T_3). Plasma samples were assayed for corticosterone, muscular and hepatic enzymes, blood urea nitrogen (BUN), total protein, glucose and triglycerides. Ostriches captured by hook showed higher plasma corticosterone and triglyceride levels after capture. In both groups, the plasma concentrations of the other parameters increased soon after transport, but they were reduced by the time of slaughter.

Behavioural changes following remedial cataract surgery in a gorilla

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The purpose of this study was to compare the individual behaviour and social interactions within a group of captive Western lowland gorillas whilst one animal had very limited vision and after she had vision restored in one eye. A group of adult gorillas has been mixed together in the Gorilla Island complex at Bristol Zoo Gardens. The group consists of an adult female that has been at the zoo since 1998, an adult male and a second adult female (Romina) that arrived in November 2001. Romina had cataracts in both eyes but had some peripheral vision. She was functionally blind in bright light but had learned to shade her eyes with her fingers to see around the cataracts. After a period of settling in and learning about her new indoor environment Romina was assessed for remedial surgery in one eye which was performed successfully in March 2002. Vision is important for gorilla social interactions and surgery was undertaken on welfare grounds. Behavioural observations of the gorillas were made over a 6-week period prior to eye surgery and again 3 months after surgery, after she had become familiar with the external enclosure. Activity and location were recorded by scan sampling at one minute intervals. Prior to surgery Romina moved around more than the others and spent significantly more time manipulating objects. There were few interactions recorded between her and the others. The male spent more time in alert postures than the females. After surgery Romina interacted more with the others and spent less time moving from place to place. Romina (now aged 21) had learned to cope with her visual disability, which had been evident from birth, and was able to move around her familiar environment with ease. Coping behaviours included shading her eyes and moving around the enclosure. After remedial surgery to one eye she interacted more with the other gorillas, chasing and playing. The restoration of her sight has improved her social integration within the group.

A non-invasive stress assay for rainbow trout

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Stress in farmed fish is of considerable significance to both animal welfare and productivity as it is an indicator of suffering, and can affect behaviour, immune status, growth and reproductive success. Assessment of stress levels in fish typically involves measuring the level of the stress hormone, cortisol, in the blood. However, blood sampling is an inherently stressful procedure necessitating capture, handling and bleeding. Previous research on pheromones has shown that fish release free and metabolised hormones into the water. By injecting tritiated cortisol, we have documented release of free cortisol into the water by rainbow trout. We have further developed and validated methodology — solid-phase extraction and radioimmunoassay — to quantify the levels of endogenous free cortisol released into the water. We have carried out numerous studies to

check the reliability of the water sample storage and extraction procedures, and the recovery, variability and specificity of the radioimmunoassay. In experiments with live trout, we have shown that plasma and water cortisol levels are correlated, and that water cortisol levels are predictably related to the severity of stress, fish size, temperature, and tank water dilution. We believe that this novel methodology has great potential for use in welfare research into husbandry and transportation practices, with the advantages that sampling does not disturb the fish (allowing replacement of the stressful and harmful procedure of blood sampling and reduction of numbers of fish required for time-course experiments) and that it is suitable for all fish sizes, including those too small to sample for blood.

The Federation Research Group — working for animal welfare

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The Federation Research Group (FRG) plays an increasingly important role in zoo conservation, research and education by supporting and stimulating research activities in our member British and Irish zoos. The main aims of the FRG are to communicate the importance and benefits of zoo-related research, to act as stimulus and liaison with taxon advisory group (TAG) chairs on research issues and to raise the profile of zoo-related research within and outside the zoo community. The FRG holds an annual Zoo Research Symposium, which attracts an increasing number of academic and zoo professionals as well as students. Themed sessions and workshops are aimed at increasing understanding of the influences on the welfare of zoo animals, and topics have included measuring stress, improving diet and nutrition, and studying visitor effects. The FRG publishes a quarterly 'Research Newsletter', which is being distributed broadly to animal collections, academic institutions and collaborating individuals. The newsletter communicates about the types of research studies being carried out in zoos. The FRG also works to support students and zoo personnel by producing guidelines such as 'Research Sampling Guidelines for Zoos', and a new series of 'Zoo Research Guidelines' which will cover setting up projects in zoos and their planning on topics such as behavioural observation and dietary studies. The FRG produced a bibliography of 'Animal Husbandry Guidelines' and compiles comprehensive databases of research projects carried out in Federation zoos. A compilation of 'Plant Browse for Zoo Mammals' (available on CD) was also produced in collaboration with the Plant TAG. Throughout the FRG's work runs the theme of enhancing animal welfare and best practice in animal management through applied research in animal biology.

The efficacy of neutering stray cat populations as a control measure in urban areas and its contribution to human and feline welfare

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The issue of free-roaming domestic cats (*Felis catus L.*) in Israel has never been addressed academically, and local rather than national solutions are applied. The present study is the first attempt in Israel to evaluate control of urban cat groups via the trap-vaccinate (for rabies)-neuter-release method, for determination of a humane solution to cat overpopulation. Physiological, ecological and behavioural parameters were studied for seven cat groups located in densely populated areas in Israel. A mathematical model outlines various approaches (neutering, culling or no treatment) and the expected results of each approach. Ecological parameters, such as frequency and consistency of appearance at feeding sites were significantly higher ($P < 0.001$ and $P < 0.05$, respectively) in the neutered compared to non-neutered cats. Immigration rates were higher in the neutered than non-neutered groups (25% per year and 12% per year, respectively), suggesting decreased territoriality in the former. There was no apparent trend in neutered compared to non-neutered groups regarding change in group size over time. Significantly ($P < 0.001$) fewer negative conspecific interactions took place in the neutered groups. Neutered cats also showed significant increase ($P < 0.001$) in body weight, possibly indicating improved health. No faeces samples revealed *Toxoplasma gondii*; nor any overall difference in parasite frequency between neutered and non-neutered individuals. In conclusion, we report increased group stability and cat welfare in the neutered groups, and a decrease in certain behaviours considered to pose a nuisance to man. Conditional upon the target areas including both periphery (not fully attempted here) and group cats, neutering free-roaming cats may induce stabilisation and even a decrease in populations.

Should budgerigars be kept in aviaries or do large boxes suffice — a study of behaviour

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Budgerigar pairs from a large aviary were placed in 160 cm or 80 cm long boxes. They gained weight regardless of the size of the box. Weight gain was more pronounced in females. The frequency of flying from perch to perch depended on the size of the box; birds in smaller boxes flew significantly more frequently than birds in larger boxes. In the second part of the experiment, half of the budgerigar pairs remained in 160 cm long boxes, the other half was transferred to 2 m long aviaries. Birds in aviaries lost weight although their flight activity was lower than in birds kept in boxes. The kind of flight activity was more varied in aviaries than in large boxes and in large boxes it was more

varied than in small boxes. Changes in weight and behaviour patterns (especially flight behaviour) of budgerigar pairs kept in different sized boxes and aviaries, with regard to their welfare, is discussed.

Assessing the welfare of wild animals: is this an issue which science can address?

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Consideration of the welfare of wild animals has received relatively little attention compared to animals in managed situations, about which a considerable body of information is accumulating. This information allows us to begin to make informed decisions about the welfare of farmed animals, but how should the welfare of wild or range animals be evaluated? When human intervention occurs in an overt way, such as during translocation, the paradigms used to describe domestic animal welfare can be applied (for example by reference to the UK Farm Animal Welfare Council's 'Five Freedoms'). Under other circumstances, the five freedoms may not provide such a useful framework to describe the wellbeing of wild animals where we need to take, as the starting point, animals in an undisturbed natural environment. Here it may be more appropriate to consider 'restrictions' imposed upon animals as when, for example, human activity encroaches into their environment. If we are to adopt methods of inquiry which have been used to assess farm animal welfare, a complication is the need to employ those scientific methods that do not impose any sampling artefact on the wild subjects. This paper will discuss whether behavioural observations, measurement of faecal steroids, morbidity and mortality data (including biochemical measurements made *post mortem*) and information on population dynamics can form the basis for animal welfare assessments of wild subjects.

The reliability of qualitative assessments of individual differences in horses using repertory grid technique

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The qualitative assessment of behaviour is an integrative method for investigating individual differences between animals. In this study we employed 'repertory grid technique' (RGT) and tested the reliability of this method for the assessment of horse personality. Horses are used selectively for various purposes, such as riding for the disabled, racing, and the military. Their personality will affect how they cope in a working environment, and hence their welfare. The personality of 21 horses was assessed by 44 female observers, split into two groups, familiar with and unfamiliar with the horses studied. Familiar observers assessed the horses based on their previous experiences

with them; unfamiliar observers watched a video of the horses in a human-interaction test. RGT has two stages, the elicitation of bipolar constructs (eg 'bold-shy') and the scoring of horses. In stage one the observers individually generated their own descriptors and provided the opposites. From these constructs the experimenter composed a uniform scoring list of 30 items per observer group. In stage two this list was used by the observers to rate the horses on a 5-point scale. Calculation of Kendall's coefficient of concordance (W) indicated significant inter-observer agreement in both observer groups ($P < 0.001$). Agreement was higher for familiar than unfamiliar observers, and for constructs that had been provided by at least two-thirds of observers. This suggests that familiarity with animals and constructs is important for the reliable qualitative assessment of individual differences. The implications of these results for the study of animal welfare will be discussed.

Obstacles to the refinement of scientific procedures using living animals

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Last year, 2.6 million regulated procedures were performed on living animals in the UK. A regulated procedure means any experimental or other scientific procedure applied to an animal which may have the effect of causing that animal pain, suffering, distress or lasting harm. Inevitably, the needs of the scientist are in conflict with the needs of the animal. Humane experimentation, by the application of the concept of the 3Rs, replacement, reduction and refinement, is accepted by scientists and embedded in UK legislation, the Animals (Scientific Procedures) Act 1986. Scientists have both a moral and a legal obligation to minimise harm to the animals they use. This paper focuses upon the minimisation of harm (refinement) and asks how well scientists are doing and whether they can improve. The ways in which harm may be caused to the animals being used for science are discussed. This considers the choice of species, their breeding, husbandry, housing, transport, their experimental use and their killing. Interventions to reduce the risk of possible harm are then identified and a number of examples of refinement practices are given. Some of the obstacles to refinement are identified. This includes how the wider scientific environment and commercial pressures impact upon refinement. The importance of the design and construction of research animal facilities is stressed. Suggestions are given as to how some of the obstacles might be overcome.

Correlating cortisol with a behavioural measure of stress in rescue shelter cats

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Several authors have shown that admission to shelters may be stressful to domestic cats. The aim of this study is to

refine welfare measures by investigating how behavioural and physiological measures of welfare vary after admission. Twenty-three single-housed domestic cats were studied daily for the first eight days after admission to a rescue shelter. Behavioural data collected were the cat stress score (CSS, developed by S McCune, MR Kessler and DC Turner), which describes seven stress levels ranging from 1 (very relaxed) to 7 (terrorised), based on postural and behavioural elements. Cortisol to creatinine ratios (CC) were measured from daily urine samples collected from litter trays. The slopes of CSS and CC over the eight days were derived for each cat and for the whole population. CSS and CC declined over time (*t*-test of slopes against a mean of zero; CSS $t = -4.34$, $P < 0.001$; CC $t = -4.37$, $P < 0.001$). Within cats, CSS and CC were weakly positively correlated (Spearman correlations performed on daily data for each cat, *t*-test of correlations against a mean of zero; mean coeff = -0.192 , $t = 2.30$, $P < 0.05$). Slopes of CSS and CC were negatively correlated between cats (Spearman correlations; coeff = -0.477 , $P < 0.05$). CSS and CC declined over time as cats acclimatised to the shelter, and were positively correlated within cats. The negative correlation of CSS and CC slopes between cats may indicate different coping strategies; some cats showed little change in behavioural response but a rapid decline in urinary CC, and others the opposite.

Enrichment is not always enriching

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Concern over the welfare of animals has led to attempts to improve their well-being, often by enriching their environment. This study evaluates whether any enrichment provides global benefits to the animal or whether the benefits are specific to the type of enrichment received. Juvenile rats (28–58 days old) were provided with either object enrichment (novel objects in their environment), social enrichment (increased social contact), neither or both. Rats were tested at 60–62 days in an open field containing objects and an open field containing another conspecific. Rats enriched with extra objects performed better with objects, whereas those enriched with conspecifics performed better in social situations. There was little transfer between enrichment conditions. The results suggest that enrichment benefits those areas of behaviour specifically being enriched. Provision of enrichment should thus consider all the animals' requirements and attempt to enhance these.

Do Canadian horse owners follow national equine welfare guidelines? Stats from a small island

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In North America and the United Kingdom, there are few representative, horse-level data about equine management practices. The Canadian Agri-Food Research Council has published guidelines for equine welfare but, without data, we cannot know whether the guidelines are being followed. We therefore conducted a horse-level survey of 312 non-racing horses (ponies, miniature horses, draft horses, and others that are not racehorses) in Prince Edward Island (PEI), Canada. Owners were recruited by random phone-book search (response rate 68.4%) and completed a pre-tested questionnaire, part of which examined management practices with respect to national guidelines. A veterinarian examined each horse and faecal samples were taken. Results indicated that owners were experienced but several national guidelines were not being met; for example, 62% of horses had never had their teeth examined by a veterinarian and the prevalence of dental abnormalities was high (sharp enamel points 9.1%; molar hooks 13.5%). The mean faecal egg count \pm SE was 428 ± 57 eggs per gram and 76% of owners never removed manure from the pasture. Many horses had hoof defects; 26.8% of horses had excessively long hooves, 25.1% had hoof wall cracks, 32.0% had hoof wall breaks and 8.5% had white line disease. Also, 54.9% of draft horses had docked tails; cosmetic tail docking is unacceptable under national guidelines. These results suggest that owners of non-racing horses in PEI need education in parasite control, hoof and dental care and tail docking, and that research is indicated on cosmetic tail docking and on the significance of hoof defects.

'But is she suffering?' A novel instrument to assess pet dogs' quality of life

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Veterinary medical advances raise questions about dogs' welfare or quality of life (QOL). QOL comprises the state of an animal's mind and body, and the extent to which its nature is satisfied. There is no formal method for assessing the QOL of pet dogs. The present study addressed this, on the premise that optimal QOL involves satisfaction of basic needs (eg shelter), optimal biological functioning, satisfaction of the dog's nature (eg environmental control), opportunities for pleasure, and minimal distress. A questionnaire was developed to assess the latter three factors. There were 37 QOL questions, each with four mutually exclusive response options designated by four descending letter grades of QOL: O, A, B and C. The questionnaire was used

to interview 110 dog owners by telephone. A bar graph was drawn for each dog showing the distribution of grades assigned. By designating the grades as 4, 3, 2 and 1 respectively, a QOL score was calculated as the percentage of the total area of the graph that the bars occupied. Each dog was classified as 'sick' ($n = 73$) or 'healthy' ($n = 37$) using predefined criteria. The effect of health status and other variables on QOL score was examined using linear regression. The range of QOL scores was 67.0–93.8%. Preliminary analysis suggests that health status ($P < 0.15$, 95% CI -3.6 to $+0.5$), environment ($P < 0.017$) and duration of ownership ($P < 0.003$) affected QOL score. Further analyses will quantify reliability. The questionnaire has the potential to inform decisions that affect pet dogs' QOL (eg moving house, intensive medical treatment).

Dog training methods: their use, effectiveness and interaction with behaviour and welfare

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Most pet dogs receive at least basic training and we hypothesise that the methods employed may affect their welfare. Historically, dogs were trained using mainly negative reinforcement or punishment. However, positive reinforcement using rewards has recently become more popular. In this paper we describe the results of a questionnaire of dog owners, examining the relative effectiveness of different training methods and their effects upon a pet dog's behaviour and relationship with its owner. Questionnaires were distributed to 364 dog owners. When asked how they trained their dog on seven basic tasks, 66% reported using vocal punishment, 12% used physical punishment, 60% praise rewards, 51% food rewards and 11% play. Owners' ratings for their dog's obedience during eight tasks were positively correlated to the number of tasks which they trained using rewards ($Rho = 0.26$, $P < 0.01$), but not punishment ($Rho = 0.05$, $P = 0.5$). When asked whether their dog exhibited any of 16 common problem behaviours, the number of problems owners reported was correlated to the number of tasks for which the dog was trained using punishment ($Rho = 0.29$, $P < 0.001$), but not those using rewards ($Rho = 0.08$, $P = 0.17$). The exhibition of problem behaviours may be indicative of compromised welfare since they can be caused by, or result in, a state of anxiety, and may also lead to a dog being relinquished or abandoned. Since punishment was associated with increased problem behaviours, we conclude that it may represent a welfare concern that is unlikely to be balanced by concurrent benefits in obedience.

Using behaviour to assess welfare in captive amphibians

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Large numbers of amphibians are currently held in captivity, both in zoos and privately. There is great interest in them as exotic pets but relatively little guidance available to ensure their welfare. Some endangered species are part of captive breeding programmes. However, breeding is often unsuccessful and mortality may be high. Amphibians do not show the same stress responses as mammals, are less well understood and assessments of their welfare have rarely been attempted. The work presented here aimed to improve understanding of captive amphibian behaviour and its potential for welfare assessment, using a commonly kept species as a model in a series of experiments. Measures of behaviour were taken under 'low' and 'high' humidity and measures of reproductive success used as an approximate indicator of good welfare. Key results showed frogs moved significantly greater distances in the 'high' humidity condition than in the 'low'. A proximity index indicated (but NS) individuals were closer to others more often in 'high' humidity. Amount of time 'under cover' was higher (but NS) in 'low' humidity. Use of the vivarium varied with some individuals consistently using particular areas. A greater number of clutches (and eggs) were laid in 'high' humidity. Consistent differences in behaviour were measured for frogs under different conditions (and by individual) and these could be related to differential reproductive success. Further experiments examined the effects of stocking density on the behaviour of individuals. These simple first attempts provide a starting point for further development of assessment methods for amphibian welfare.

Some examples of critical issues to the welfare of small laboratory animals

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In the field of nutrition and in the name of standardisation, purified diets are often used in toxicology studies. From the point of view of wishing for better health and thereby better welfare, a purified diet will at first glance meet nutrient needs more precisely as compared to a natural ingredient diet (chow). Presently, from the point of view of better welfare, however, purified diets are debatable. The purified diet may lack unknown essential nutrients which are present as natural contaminants in natural ingredient diets. In a multi-generation experiment, a significant reduction in breeding results was seen that indicates that purified food is inadequate in the long term. The implication could be that the current nutrient guidelines have crucial inadequacies, which present a problem when making purified diets. As long as we are making food from natural sources, this is not a problem; however, the large variation in natural ingredients will give variability in experimental results that will increase the need to use more animals to prove significance. If optimised nutritionally and made in pellets, the purified diet might work as a health promoter, but in this case it seems that the application of a potential welfare promoter has preceded the scientific advances in the field. However,

the application of natural ingredient diets can also pose welfare problems. Recently, we have experienced that rabbit chows have a concentration of 0.6% P, whereas minimum needs have been set to 0.22%. In 40% of the rabbits used at our laboratory, kidneys were so heavily calcified, that these could not be used for the intended purpose of *in vitro* studies. This poses a welfare problem and a waste of animals and resources. The high incidence of kidney disease indicates that the levels of phosphorus in commercial animal diets are higher than recommendations, which indicates a lack of implementation of scientific advances by the chow producing companies. Genetic modification challenges the concept of what can be regarded as physiologically or behaviourally normal. What might be an indication of a welfare problem in one strain, can be a modification in another without any implication for welfare. At the moment we search in semidarkness; we need the use of tools and protocols that would help to identify physiological and behavioural parameters in animals that map welfare problems, as well as thorough channels to implement this knowledge to the user. Extensive protocols for phenotype characterisation, however, do exist and one asks oneself why these are not being implemented. Therefore, we need to focus on the successful development and implementation of practically useful and relevant welfare protocols, leading to the development of a welfare certificate. Maybe the most neglected area of animal welfare in laboratory animals is training the animals for procedures. Judged by the published literature on the subject, very important welfare promoters like handling and training of laboratory animals seems to be largely overlooked when it comes to smaller animals. Rats and mice have a spontaneous fear of people and avoid being handled. Ordinary animal husbandry procedures such as moving a cage to a different area or moving animals to a clean cage is known to induce transient, but significant, physiological, neuronal and behavioural changes. Our laboratory has designed a program for rats, a daily handling procedure for a short intensive period that will change rats from being difficult or even aggressive to becoming habituated to people. Not only do we get cooperative animals, but the animals themselves will have a diminished reaction when we are in contact with them, whether this is for an injection or moving the animal to a clean cage.

Assessment of species typical behaviours in captive chimpanzees

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Much debate exists on how we should assess well-being in captive primates, with suggestions ranging from the absence of abnormal behaviours to the presence of behaviours seen in free-living conspecifics. More often, species typical behaviours are cited as an acceptable indicator of well being. This paper will present data from several studies demonstrating various ways to assess species typical behaviours. The participants were five adult chimpanzees that

reside at the Chimpanzee and Human Communication Institute (CHCI). General activity budgets provide an overview of how residents spend their time. After a move from a 27.87 m² facility to a 587 m² facility, the chimpanzees spent more time travelling and less time eating. Structural design can inhibit or facilitate species typical locomotion. The chimpanzees at CHCI exhibited the same patterns of locomotion as their free-living conspecifics. Free-living chimpanzees are proficient tool users and objects in captivity can increase manipulatory behaviours. The chimpanzees at CHCI received 50 objects each day such as grooming objects, clothing, blankets, containers, tubing, toys, and paper. Some objects promoted species typical behaviours. Free-living chimpanzees encounter much diversity in their environment and this should be a component of captive environments as well. Diversity can be enhanced with a large number of novel and diverse objects. At CHCI the chimpanzees often use several objects at one time. Also, the chimpanzees prefer novel objects after 6 h of exposure. Species typical behaviours can be defined with data from the behaviour of free-living individuals and can be assessed with activity budgets, locomotion patterns, and object use.

Animal use and belief in animal mind

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Animals are used by humans in many ways, yet science has paid little attention to the study of human-animal relationships. In the present study, participants (n = 96) completed a questionnaire on attitudes towards animal use and individual differences were examined to determine which characteristics might underlie these attitudes (belief in animal mind [BAM], age, gender, experience of animals, vegetarianism, political stance, and living area). It emerged that participants held different views for different types of animal use, and that BAM was a powerful and consistent predictor of these attitudes, with BAM together with gender and vegetarianism predicting up to 37% of the variance in attitudes towards animal use. Thus future research should acknowledge the importance of BAM as a major underlying factor of attitudes towards animal use, and should distinguish between different types of animal use when measuring attitudes. We proposed that the large effect of BAM might be due to increasing interest in animal mind over the past decade.

Light quality and lameness of broiler chickens

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Lameness is a major welfare problem in modern broiler production and is affected by litter quality, activity and growth rate of the birds, amongst others. Light is a dominant exogenous stimulus, which may affect both the activity and growth pattern of broilers. Hence, the objective of this study was to investigate the influence of light quality on lameness of broiler chickens. We compared the lameness of 200 female ROSS 308 broiler chickens, reared in four different light qualities (two light sources, Osram biolux and Osram warm-white, each presented at two light intensities, 5 and 100 *clux*, adjusted to fowl-perceived illuminance). At 40 days of age, 50 birds from each light environment were assessed in terms of weight, gait-score, foot-pad dermatitis and hock-burn. Light intensity did not affect gait score, whereas more birds had gait score two in biolux than in warm-white light (Logistic analysis, $P = 0.0193$). There was a positive correlation between weight and gait score in that heavier birds were more lame than lighter birds (Spearman's correlation, $r = 0.49$, $P < 0.0001$). Light quality did not affect foot-pad dermatitis whereas hock-burn scores were significantly better in warm-white than in biolux light, irrespective of the light intensity (Ordinal logistic analysis, $P = 0.0319$). These preliminary results indicate that light source can affect the leg health of broiler chickens. This will be incorporated in a greater evaluation of light quality, to identify aspects of lighting that can improve the welfare of broiler chickens in the future.

Behavioural impact of food presentation: how to find an ideal number of weaned pigs per feeding place?

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During six consecutive trials, feeding behaviour of 480 weaned pigs grouped per 30 (G30), 40 (G40) or 50 (G50) was compared during the post-weaning period. The same model of tube feeder (four available feeding places; two integrated drinkers) was used delivering either pellets (G30p, G40p and G50p) or meal (G30m, G40m and G50m). Each treatment was repeated twice. Pigs used the feeder for a longer time when fed meal than when fed pellets (176.7 ± 10.8 min/24h.pig vs 112.4 ± 1.0 min/24h.pig, $P < 0.001$). There was no effect of the group size on this variable. The occupation rates (OR) of the feeder per 24 h were 87% (G30m), 124% (G40m) and 132% (G50m) with meal versus pellets 56% (G30p), 74% (G40p) and 90% (G50p) (diet effect: $P < 0.001$; group size effect: $P < 0.001$). As it is often reported, pigs preferred to eat during the day. For trials without overcrowding (daily OR $< 100\%$), $63.3 \pm 1.7\%$ of the feeder use time was observed during the 'days' (12 h light periods). Considered as behavioural needs, these results enable calculation of an ideal number of pigs per feeding place. With the tube feeder used in our

studies, 6.5 and 10.2 pigs per feeding place is recommended, if fed meal or pellets respectively. These norms imply that the OR of the feeder turns around 100% and 60%, respectively during the light and dark periods. Our results clearly show that food presentation has to be considered as an important variable, influencing technical standards and thus animal welfare.

Analysis of heart rate and heart rate variability for evaluating psychological stress induced by visual discrimination tasks in dwarf goats

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In order to examine visual learning in dwarf goats we employed three visual discrimination tasks. We tested groups of young males using a computer-based learning device integrated into the home pen of the animals. In each task, four visual stimuli were presented on a computer screen in a multiple choice design. To get a reward, goats had to choose the correct stimulus by pushing one of four buttons in front of the screen. Each individual trial was followed by an inter-trial interval (black screen) before the same stimuli were presented in a distinct pattern following a quasi-random series. On the basis of recorded actions at the learning device we analysed individual learning success on a daily basis. To indicate changes in the level of arousal and shift of sympatho-vagal balance related to psychological stress during learning, we telemetrically measured heart rate (HR) and heart rate variability (HRV) on the first two days and the last two days of each single task. HR and HRV were analysed separately for periods when the animals were inside or outside the learning device. HRV was analysed following the rules of the Task Force of the European Society of Cardiology. Learning success started at 25% of correct choices on day one of the first discrimination task. The animals did not reach a stable level of 70% of correct choices until day twelve. In tasks two and three, animals started at 45% of correct choices at day one and reached a stable level of success at day seven or eight, respectively. HR and HRV results indicated a changing level of psychological stress with rising learning success in each task as well as differences in the stress level between the three consecutive tasks. Moreover, results indicated different coping strategies used by the animals in the first compared to the two following learning tasks. Results of HRV suggest that changes in HR related to psychological stress during operant conditioning are primarily caused by withdrawal of vagal control of the heart.

Development of a welfare benchmarking protocol for laboratory mice

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To adequately provide a 'benchmark' for the welfare of laboratory mice requires their welfare to be comprehensively assessed using an objective and, above all, practical protocol. A Delphi consultation process was initially carried out to formulate measurements of welfare that can be used to assess both resource-based provisions and animal-based outcomes associated with husbandry conditions of laboratory mice. Using postal questionnaires, experts with wide ranging experience of laboratory animals were asked to assess laboratory mouse welfare in terms of the husbandry system in which they live and their attempts to cope with it. This involved assessing the relative importance of a list of commonly used welfare measures, as well as any additional measures that they identified. This systematic approach is designed to achieve a degree of consensus of opinion between the wide range of experts. A pilot study will then be carried out in several UK mouse units to assess the chosen measurements for their ease, effectiveness and repeatability for measuring welfare. After further refinement this expert-defined protocol will be finalised and used to profile the welfare of mice in a wide range of UK laboratory animal institutions.

Reducing dog return rates at rescue shelters: applying science for animal welfare

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An estimated 150,000 dogs are relinquished to rescue shelters in the UK each year. At the RSPCA, approximately 10% of the dogs that they re-home are returned within three months. Over two thirds of these new owners cite that it is because their new dog has a behaviour problem. This has implications for the welfare of unwanted dogs and represents the possibility of litigation, which threatens animal welfare charities. New procedures that aim to reduce the number of dogs returned to rescue shelters were developed and piloted at RSPCA dog re-homing centres across the UK. These procedures consisted of dog temperament tests to predict the behaviour dogs would display in their new homes, protocols to assess the needs and expectations of prospective dog owners and a process for matching assessed dogs with compatible owners. Seven treatment centres implemented the new procedures for between 3 and 5 months. Seven control centres received no such instruction and continued using their existing re-homing procedures. Return rates at the treatment centres reduced significantly by 27% compared with the previous year (Wilcoxon: $P < 0.05$). Return rates at control centres increased by 44% compared with the previous year (Wilcoxon: $P > 0.05$). The response of dogs to behaviour tests prior to re-homing corresponded significantly with their temperament in their

new homes. In conclusion, these owner-dog matching procedures have resulted in improved welfare through finding permanent homes for more dogs. These procedures will be implemented across all RSPCA dog re-homing centres.

Determination of welfare problems and their perceived causes in working equines

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Welfare assessment has become more widely used in farm animals, particularly cattle, pigs and hens. As these procedures become more established, further potential applications become apparent. The current project, funded by the Brooke Hospital for Animals, aims to assess the welfare of working equines (horses, donkeys and mules) in the countries covered by this organisation. A welfare assessment protocol will be developed using a process of expert consultation. Fifteen experts on working equines in developing countries were sent a preliminary questionnaire aimed at establishing the main welfare problems encountered. Experts were asked to highlight the 5 most important welfare problems, followed by a series of more specific questions under the headings 'General Health', 'Euthanasia', 'Behaviour', 'Limb' and 'Skin'. Nine experts responded to this questionnaire. The most widely reported problems were poor farriery and associated lameness and limb problems (9/9 respondents); galls and sores from ill-fitting or unsuitable harnesses (8/9); poor body condition and malnutrition (7/9); heat stress and related problems (eg reduced appetite) (3/9); and overworked animals (3/9). Other common problems included poor owner awareness of animal welfare and sentience; endo- and ectoparasites; respiratory problems; colic; using too young or old animals; taboos and religious sentiments regarding euthanasia. These results will be used to produce an in-depth questionnaire, refining the initial format to ensure important areas are covered in appropriate detail and in a way easily accessible for an international audience. The long-term aim of the project is to produce a welfare assessment protocol for monitoring the success of interventions, such as offering veterinary treatment or training local farriers. Once developed and field-tested, this protocol will have wide applicability in many countries where working equines form a vital part of the economy.

Bear farming in Asia: veterinary, behavioural and welfare implications

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Bile and the gall bladder from wild bears have been used as an ingredient in Traditional Chinese Medicine (TCM) for over a thousand years. Since the early 1980s bile has been extracted from caged live bears using permanent gall bladder cannulae or fistulae. Approximately 7000 bears are held in Chinese bear farms. Bear bile is used to treat a variety of ailments, including fever and inflammation, as well as liver and heart problems. However, there are both herbal and synthetic alternatives to the use of bear bile. In 1999 and 2000, the World Society for the Protection of Animals (WSPA) investigated 11 bear farms in China. This sample of farms held around 2580 bears, the equivalent of 37% of the total number of bears held in Chinese bear farms at that time. An assessment of the veterinary, behavioural and welfare conditions was carried out on information obtained in this survey, as well as information obtained in another independent survey of bear farms in China, Korea and Vietnam. The study examined acute and long-term stress effects on bear health and welfare, and found that the collective environmental challenges imposed by confined barren housing, poor hygiene and nutrition, improper surgery and veterinary care, early weaning and maternal separation, exceed the animals' adaptive limitations. Bear farming for bile extraction, which requires maintaining bears with permanent gall bladder fistulae or cannulae, is incompatible with modern husbandry practices designed to ensure the physical and mental health of bears. For these reasons, this practice should be abandoned.

Moving from animal welfare assessment into improvement

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Animal welfare assessment is the first essential step in improving animal welfare. It provides information about the magnitude of welfare problems, areas of successful welfare management and benchmarking data against which future improvements can be measured. However, understanding of the motivations of those with responsibility for the day to day care of the animals is also essential if society wishes to improve the living conditions of animals. Alongside efforts to quantify the influence of husbandry conditions on animal welfare, many studies have explored the important influence of stockmanship. In broad terms, motivating individuals responsible for animal welfare can consist of three elements, education, enforcement and encouragement. Enforcement via certification schemes or legislation has been widely used. Some form of farm assurance scheme now covers most UK farms. This means that more farms than ever before are working to conform to inspected standards which have legislative requirements as their basis. Education has an important role in raising awareness of a unit's welfare performance and then in providing individuals with the resources to identify potential solutions to

their own welfare problem. Encouragement by rewarding good welfare performance also has the potential to be a very powerful motivational tool. This has been demonstrated by producers' willingness to conform to those schemes which offer a premium price for their products. These elements have been incorporated into an RSPCA-funded initiative designed to reduce levels of lameness and discomfort in dairy cows.

Biostatistic and ethological issues in animal welfare: the case of the common marmoset (*Callithrix jacchus*)

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The improvement of welfare conditions of experimental animals, and the application of an appropriate biostatistical approach, are essential to preserve and improve the quality of experimental data, and to guarantee a more parsimonious and ethical use of animals. The rule of the 3Rs (Replacement, Reduction and Refinement), formulated by Russell and Burch in 1959, continues to be the inspirational principle for the evolution of biomedical experimentation, both from the bioethical and practical point of view. The present paper focuses on the concept of refinement of the biostatistical approach, and refinement of husbandry conditions. The animal model considered in the present paper is the common marmoset (*Callithrix jacchus*), a small New World monkey largely used in neurological and toxicological research. The biostatistical approach to refinement involves planning of the experimental design, control of the experimental variability, and definition of the statistical analysis. In terms of refining the husbandry conditions, we support the idea that 'Choice', referred to as the possibility for the animal to choose between two or more enrichments, and 'Control', intended as the possibility to control the access and time of exposure to the enrichment, can be two major factors to be taken into consideration when planning enrichment experiments. This method appears to us to be more effective than just imposing a particular enrichment on an animal, solely on our knowledge of the ecology and the ethology of that species. However, this etho-ecological notion must still guide us in devising the different options to be offered to the animals.

Odour cues as enrichment tools in primates: caution

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The study assessed the potential of various biologically relevant odour cues to promote well-being in six captive ring-tailed lemurs, *Lemur catta*, a species that relies heavily on olfactory communication. The experiment was a

repeated measures design comprised of seven, week-long consecutive phases. Scent was presented daily as follows: control scent during phases 1, 3, 5 and 7; scent from a natural predator, *Cryptoprocta ferox* during phase 2; scent from a closely related species, *Varecia variegata variegata*, during phase 4 and scent from unfamiliar conspecifics, *L. catta*, during phase 6. Behaviour was monitored daily 5, 60, 120 and 180 minutes following scent application. The scent stimuli caused significant changes in *L. catta* behaviour. In particular, the presence of unfamiliar conspecific scent promoted an increase in both desirable behaviours (ie locomotion and grooming troop members) and undesirable behaviours (ie auto-grooming and self-scratching). Scent from *C. ferox* and *V. v. variegata* was associated with a decrease in social behaviours. The study has important, novel implications for the well-being of captive primates and raises serious concerns about the appropriateness of odours as enrichment stimuli in *L. catta*. It is essential that further research be conducted in this field to ascertain which scents, if any, can achieve an optimal balance between positive and negative enrichment.

Accompanying pre-weaned Thoroughbred foals while separated from the mare during covering reduces behavioural signs of distress

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Some Thoroughbred stallion farms separate the mare from the foal during breeding, leaving the foal in its stable, often in a state of considerable distress. Behavioural signs of separation distress typically shown are vocalisations, pacing or moving about, pawing, and striking the body against solid objects. A total of 57 foals on an Irish stud farm were observed during this separation experience. Twenty-seven foals were accompanied for the duration and 30 discreetly observed from outside the stable. On average, the unaccompanied foals vocalised at significantly ($P < 0.001$) shorter intervals than the accompanied ones (14.8 s vs 26.8 s), and spent significantly ($P < 0.05$) more time pawing (29.6 s vs 6.8 s). In addition, 17 of the unaccompanied foals hurled themselves against a solid object on at least one occasion, while none of the accompanied foals did this at all ($P < 0.001$). Overall, the data provide clear evidence that accompanying a foal reduces its apparent distress. This procedure has obvious welfare benefits in the short term, in that the foal is both less distressed and has a reduced likelihood that it will injure itself, and it may have longer term benefits by reducing the chance of the foal developing a stereotypical behaviour.

Use of a force plate for objective assessment of broiler gait

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Broiler chickens are susceptible to lameness, due to their rapid growth and a variety of pathologies of leg bones and joints. Currently, the extent of lameness in commercial flocks is assessed with the so-called Bristol Gait Scoring System that is subjective and has provided inconsistent results. The aim of this work was to design a method for objective assessment of gait, based on measurement of forces applied by each leg as a bird walks. At a commercial farm, broilers were selected for testing at 4 and 5 weeks of age, on the basis of whether they were clearly lame or not. They were placed individually at one end of a 1.6 m long force plate and persuaded to walk along it, by squirting compressed air, clapping sticks, waving a bamboo cane and/or rustling a plastic bag, all behind the bird. The force plate incorporated four load cells to record forces in three dimensions from up to 20 foot placements by the bird. Rotation plus spatial positioning of the centre of pressure were derived from the collected data. Computer software was developed to automatically split up and analyse the data collected for each footstep. This had to accurately detect the time at which each footstep started and ended, detect which foot was on the plate at any particular time, and then collate data of relevant factors for each foot placement. The data obtained from the average of the left foot placements were compared to the average of the right foot placements. Significant differences between lame and non-lame birds were found.

Zoo animal welfare: challenging assumptions and misconceptions

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Zoo animal welfare is fundamentally impoverished. The type of research undertaken in zoos demonstrates that many researchers agree with this statement. Research comparing zoo-housed animal behaviour with data collected in the wild frequently shows significant differences between captive and wild conspecifics. These deviations are often thought to reflect the level to which the captive situation is restrictive and detrimental to animal welfare. Likewise, aesthetically pleasing naturalistic exhibitory is assumed, in many cases, to be inherently stimulating despite the lack of species-specific functionality. There are zoo enclosures that restrict and others that promote animal welfare. Defining these by the behaviour of their occupants, relative to their wild counterparts, or by the 'greenery' in their enclosure is limiting. However, these two criteria are the basis of most assessment of zoo-housed animal welfare. In this presentation I will address the short-falls of these two concepts but argue that they can still be used if consideration of their limitations is borne in mind. For example, the validity of both wild and captive behavioural data can be improved by using multiple groups in both situations. The terminology used to describe enclosures should reflect their usability for animals rather than their superficial appearance to humans. Overall, I

propose the undertaking of more multi-zoo research projects to provide a holistic or 'top-down' approach to the appraisal of zoo-housed animal welfare and the ability to quantify the influence of captive housing and husbandry regimes on behaviour.

Analysing censored data from time-limited behavioural tests: example of duration of tonic immobility

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For practical reasons, behavioural tests are often time-limited. When duration of a specific behaviour is considered, it leads to analysis of so-called 'censored data'. In our case, we studied the duration of tonic immobility recorded during a five-minute test. Therefore, for animals that were still immobile at the end of the test, data were censored at five minutes, as the exact duration of tonic immobility was unknown. We applied specific statistical methods that have recently been developed for the retrospective analysis of a divergent selection experiment on the duration of tonic immobility in quails. Three lines were selected for a short duration of tonic immobility (STI), a long duration of tonic immobility (LTI), and an unselected control line (C) was kept. At generation 26, half of the animals were in a state of tonic immobility at 73.1 s in C and at 28.6 s in line STI. In line LTI, the probability of being in tonic immobility at 300 s was 76%. Hazard functions (probability of stopping tonic immobility at a given time) were clearly distinct. This was in agreement with the high estimated heritability (0.50) of tonic immobility. On the contrary, traditional REML analysis with the same genetic model, but under the assumption of normality of the distribution of TI, provided an estimate of 0.21 only. This difference underlines the importance of taking into account censoring in the analysis of behavioural time-limited data.

Environmental enrichment for dogs

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In order to improve the quality of life for the experimental dogs at Novo Nordisk, an improved and enriched housing system has been developed and introduced to ensure that the dogs are housed in harmonious social groups within a stimulating environment. The basic needs for social housing are provided for by a flexible housing system, which allows individual adaptation of the indoor and outdoor pen size according to the group size or experimental situation. The environmentally enriched and functionally divided housing system with dog beds, changeable cushions and hanging spring chains, changeable bones and toys for playing and chewing, further stimulates various activities. In addition, the applied platforms offer the dog visual control of their

environment and possibilities for resting or playing. A socialisation programme has been introduced which is divided into three age-dependent stages and also allows for individual adaptation for specific individuals. The aim of this programme is to ensure a stimulating life with social interaction to humans and other dogs and a secure adaptation to future or ongoing experimental procedures. In addition to the steps which have been taken to enrich the housing environment and provide a complex socialisation programme, the dogs are also afforded daily access in harmonious groups to a large enriched outdoor enclosure. Such provision ensures adequate space for exercise, recreation and a varied daily life. The adaptation of the housing system for the dogs has proved to be highly successful both for the dogs and the people working with them.

The ability of laying-hens to negotiate upward and downward jumps

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Hens in aviaries have to jump between perches to gain access to resources. This requires accuracy to avoid injury. Jumping ability was assessed using digital video allowing detailed assessment of take-off, flight and landing behaviours. Seventy-two Lohmann brown layers were reared with perches from hatching. All were observed using their home perches. In Experiment 1, birds jumped for a food reward up or down between two perches separated by 60 cm at different angles (9.5° or 18.4°) and under different lighting conditions (5, 10 or 20 lux; incandescent or fluorescent). In experiment 2 the jump was increased to 80 cm and a contrasting background was introduced. Birds were tested individually in a separate room after peak of lay. Only 52 achieved the criterion for Experiment 1 (60 cm gap) of which 32 failed to be trained for experiment 2 (jumping 80 cm). Results of Experiment 1 showed that birds took off sooner, turned their heads further downwards relative to the landing perch, beat their wings more often during flight, readjusted their feet more often at landing and took longer to balance when jumping downwards rather than upwards. In Experiment 2, refusals to jump and clumsy or missed landings occurred more frequently on downward than upward jumps. For both experiments, these behaviours were unaffected by lighting conditions, or by the degree of contrast between the perch and its background. In conclusion, jumping down from one perch to another proved difficult for many birds. This has important welfare implications for hens housed in aviaries.

Temperament evaluation of dogs housed in an Italian rescue shelter as a tool to increase adoption success

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In Italy, large numbers of dogs are housed in rescue shelters. Despite many recent efforts to promote adoption, dogs continue to be abandoned and dogs placed in adoptive homes are often returned. Living in a shelter is stressful, and as a result the dogs' behaviour can be negatively influenced, and otherwise good companion animals can ultimately become aggressive, timid, or scared. The behaviour these dogs show greatly influences people who visit the shelter and can jeopardise their chance of being adopted. Moreover, prospective adopters often base their choice on empathy, which does not always guarantee a successful relationship. The purpose of the present study was to evaluate dogs' behaviour and temperament before adoption at the county shelter in Cella, Italy, in order to create files that might help prospective adopters to understand which environment and lifestyle would be the best for each dog. Forty-three dogs were observed in a variety of contexts: home cage, outdoors, interacting with a familiar person, interacting with an unfamiliar person, interacting with other dogs, and during leashed walks and free play. Dogs were trained with basic commands. Finally, responses to acoustic and visual stimuli were examined. These data allowed evaluation of their docility, learning capacity, sociality towards people and other dogs, exploratory activity, emotionality and reactivity. Some of the problems that cause the end of the dog-human relationship could be mitigated through education of people during the adoption process; helping them before adoption to consider if the dog will match their lifestyle and if they are aware of all the responsibilities and efforts that owning a dog involves.

Leukocyte activation as a measure of stress

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There is considerable evidence to support the notion that stress may reduce the effectiveness of the immune system, thus increasing the risk of infection or disease. Acute stressors can change the number of circulating leukocytes, as well as their levels of activation. Activated leukocytes can release a range of mediators that can potentially damage healthy tissue and organs. Assessing the level of leukocyte activation brought about by a stressor could therefore potentially provide a biologically meaningful measure of the stress response. Here we report on the effects of transport

stress on leukocyte composition and activation in wild European badgers (*Meles meles*), which were trapped and transported as part of an ongoing population study. We have previously used *in vitro* challenge with phorbol myristate acetate (PMA) to provide a rapid method of establishing the effects of stress on leukocyte activation. Here we show that transported (T) and transported and rested badgers (TR) respond differently to PMA challenge, and both T and TR badgers differ significantly from non-transported controls. Data on circulating leukocyte number and composition are also analysed. These data reveal that rest after transport allows leukocyte composition, number and activation to begin to return to pre-transport levels. We propose that leukocyte activation provides a rapid, quantifiable and biologically meaningful measure of the stress response in trapped and transported badgers.

Environmental enrichment during adolescence reverses the effects of prenatal stress on anxiety-related behaviours and stress reactivity in rats

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Profound and long-lasting perturbations of an organism's adaptive capacities, which can turn to an increased predisposition to behavioural disorders later in life, are a well-known consequence of a prenatal stress (PS) condition. Indeed, PS rats are reported to exhibit increased levels of anxiety and hypothalamus-pituitary-adrenal (HPA) axis disturbances. This study addressed the question of reversibility of such disturbances in Sprague-Dawley male rats that underwent PS and that were maintained from weaning either in standard or in enriched physical conditions. As expected, PS rats showed reduced play behaviour and increased anxiety in the elevated plus maze as well as prolonged corticosterone (CORT) secretion in response to restraint stress. Environmental enrichment (E) increased play behaviour while decreasing environmental exploration during the social interaction test. Enriched animals also exhibited low levels of risk assessment behaviour (ie indirect index of anxiety state) in the elevated plus maze. In response to restraint stress, PS rats maintained in enriched conditions showed a reduced peak of CORT and a return to baseline levels similar to controls, thus indicating an improved regulation of the HPA axis. Interestingly, basal CORT levels in the enriched control group were not affected. As a whole, these results indicate that the use of a physical enriched environment during the still plastic period of adolescence could represent a suitable model for the design and testing of new therapeutic strategies in behavioural disorders. There is in fact evidence that the long-term consequences of early life insults such as prenatal stress can benefit from the modulatory influence of an enriched environment.

Stocking density effects and the welfare of farmed rainbow trout

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The welfare of farmed fish is an area of growing public and governmental awareness and is considered to be an area in need of research. One area of welfare concern is the density at which fish are farmed. We conducted a pilot scale study whereby rainbow trout were reared in triplicate at three different stocking densities (10, 40 and 80 kg m⁻³) in circular tanks (2 m diameter, volume 1.8 m³). Fish welfare was assessed by sampling for a range of physiological and morphological indicators at monthly intervals. There was no effect of density on growth or mortality. However, a significantly greater variation in weight was seen in the lowest treatment (10 kg m⁻³) possibly indicating the establishment of a dominance hierarchy. Further evidence for this comes from higher plasma cortisol levels in the 10 kg m⁻³ than the 40 and 80 kg m⁻³ groups at five of the monthly sample points. There was some evidence to suggest a cumulative effect of stocking density on fin erosion with the extent of erosion increasing with stocking density, although there also appeared to be a confounding effect of water current direction. The results for haematocrit and lysozyme activity were more difficult to interpret due to temperature-related fluctuations, illustrating the difficulties of applying widely variable physiological indicators to a poikilotherm. This preliminary study has shown that the relationship between stocking density and trout welfare infringement is complex, and that welfare may be infringed by presumed low as well as high densities.

An investigation into consistent individual variation in behavioural strategies of pigs

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Consistent individual variation in behavioural strategies across different test situations has been demonstrated in

rodents. This study examined whether similar consistency is shown in the behavioural strategies of pigs. This consistency could potentially allow the selection of animals which behave in a certain way in response to environmental stress. Eighty pigs were reared under standard commercial conditions from birth to slaughter at 21 weeks of age. Each pig was individually subjected to a 'back test' at 1 and 2 weeks of age. This test was designed to measure coping strategy in pigs and involved restraining the pig on its back for 1 min and counting the number of escape attempts made. Aggressive behaviour towards unfamiliar pigs was recorded in a social confrontation test at 3 weeks of age. At 4 weeks of age each pig was individually exposed to a 'tail chew' test which involved isolating the animal with access to two lengths of rope and recording exploratory and manipulative behaviour directed towards the rope for 10 min. This test was repeated when the pigs were 6, 16 and 18 weeks of age. At 7 weeks of age the pigs were exposed to a group food competition test which involved assessing success in gaining access to feed after a period of deprivation. At 8 weeks of age the pigs were individually subjected to a novel object test designed to measure fear in response to novelty. The test involved exposing the pig to a novel object in a novel arena and recording its behaviour for 7 min. Principal components analysis (PCA) was carried out to examine relationships between behaviour in different tests. The PCA yielded four principal components which altogether accounted for less than 40% of the variation. The first principal component accounted for less than 12% of the variation. There was no evidence of principal components co-selecting highly weighted behaviours from different tests in a consistent manner. This study provides no evidence of consistent individual variation in the behavioural strategies of pigs. This suggests that it may not be possible to select pigs which behave in a certain way in response to environmental stress. The authors gratefully acknowledge funding from DEFRA.

Comprehensive view of the assessment quality of the Austrian Animal Needs Index TGI 35 I/I 1995 for fattening pigs

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There is an urgent need to find reliable, valid and feasible methods of assessing animal welfare on farms. In Austria the TGI 35 L Animal Needs Index is broadly accepted and in wide practical use. One part of an extensive research

project of ILUET aimed to investigate the assessment quality of the TGI 35 L/1995 for fattening pigs. TGI assessments of houses for fattening pigs gave a repeatability between assessors of 81% and within assessors of 82%; this can be designated as medium to high value. The error standard deviation between assessors was 1.81 TGI points and within assessors 1.77 TGI points. Those are 3.14% or 3.09% of the sum of all possible points of 57.5 respectively. There are clear correlations between the total TGI score and animal health and behavioural parameters. Manipulation of pen mates (tail biting, ear biting and anal massage) decreased significantly with an increase in the TGI score. Frequency of skin lesions and injuries decreased with higher TGI scores. Scratches on the back, croup, tail and root of tail, neck region and shoulder as well as abrasions on the lateral forearm region and callosities on carpal joint and metacarpal joint were reduced on farms with high TGI score. Dirty animals were less often found in pig houses with a high TGI score. The research project revealed clear correlations between the results of the TGI 35 L for fattening pigs and animal health and behaviour. From the present results it can be concluded that the TGI 35 L is a valid assessment system for animal welfare. Precision of assessment can further be improved by intensive training of the assessors and regular exchange of experience between the assessors.

The role of the veterinary surgeon in trials on animals: ethical aspects

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After enactment of Legislative Decree 116/92, implementing EEC Directive 86/609, it has been possible to impose nationwide regulations on the use of animals in scientific testing, recognising the role and competence of the veterinary surgeon with regard to the evaluation of animals' well-being, and the validity and real necessity of experimental procedures. The strict construction of Italian law in this matter, assigning the veterinary surgeon a primary role in scientific research, seems to highlight their competence on this matter. It appears to be more restrictive than the European directive which entrusted supervision of animals' well-being to a 'veterinarian or other competent person', a rather vague definition. This law seems to ethically place the veterinary surgeon as observers of a welfare-stateism, where the right, on the part of animals, not to suffer beyond any ethical limit, must prevail over that, on the part of researchers, to achieve new knowledge. The veterinary surgeon, in fact, must guarantee and verify the well-being of animals used in testing, ascertaining their state of health and preventing them from suffering any useless and permanent damage, evaluating every aspect

from an ethical, deontological point of view. The authors have, therefore, carefully analysed both European and Italian law, pointing out the necessity to introduce more severe criteria in laboratory experiments on animals, taking ethical aspects into account.

Impact of group housing on post-operative recovery in mice

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Laboratory animals are frequently submitted to a variety of surgical and other invasive procedures such as abdominal surgery, brain lesions or cannulation of blood vessels. Our study has focused on the effects of housing conditions, such as cage enrichment and social housing, on post-operative recovery in order to attenuate stress and discomfort caused by surgical procedures and to facilitate post-operative recovery in laboratory animals. The rationale for such studies comes from our previous data showing that environmental factors have long-term behavioural, physiological and neurochemical consequences in laboratory animals. It is known that cage enrichment and social housing can influence the stress response and increase the ability to adapt to novel situations in rodents. It is hypothesised that relatively simple measures such as environmental enrichment and social housing will positively influence post-operative recovery. In two pilot experiments we tested the impact of ovariectomy on home-cage behaviour, open-field activity, bodyweight, and food and water intake in two different setups. In the first experiment the animals were allowed to recover for two days without behavioural testing. In the second experiment, behavioural testing started on day one after the operation. Results of the open-field test after two weeks of recovery in group- or single-housing conditions showed significant changes in locomotion and rearing in ovariectomised and group-housed animals.

Physiological and behavioural responses of dogs to kennelling

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Dogs with little prior experience of kennelling may need to be housed in kennels for a variety of reasons, for example, on being rescued, during owners' holidays or, as in our study, following procurement for substance detection training by the military. Many dogs appear to have difficulty adapting to this environment, and the resulting stress levels may inhibit learning during training as well as affecting the dogs' welfare. We examined the behaviour and urinary cortisol/creatinine ratios (C/C) of 31 male Labrador Retrievers (aged 11–12 months) whilst in a home environ-

ment, and then observed them for ten days after reaching a UK military training establishment. Urine samples were collected daily and behaviour recorded for 30 min per day. Half of the dogs had no previous experience of kennels, whilst the others had been exposed to a gradual, controlled kennel habituation programme over 9–10 months. All dogs showed a pronounced increase in C/C upon reaching the training school (Wilcoxon Signed Rank test; $z = 4.60$, $P < 0.001$). However, in dogs that had been previously kennelled, this increase was significantly less (Mann Whitney U test: $U = 42$, $P < 0.005$). C/C at day 10 had decreased, though not to baseline ($z = 3.69$, $P < 0.001$). Behavioural measures showed complex patterns of correlation with C/C, indicative of differences in expression of stress between individual dogs. Trainers' rankings of ability following ten weeks of training were negatively correlated with C/C at day 10 (Spearman rank correlation = -0.46 , $P = 0.01$). These results suggest that, although prior experience of a kennel helps to decrease stress levels, even habituated dogs experience significant stress. Moreover, those dogs which do not adapt to the kennel environment are less successful in training. Therefore, we suggest that improvements to kennel design and environmental enrichment may help to ease this transition to kennelling, reducing stress levels whilst also enhancing the dogs' response to training and ultimate working ability.

Friends or foes? Farmers' attitudes towards primate crop raiders

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Human–wildlife conflict requires conservationists to make ethical decisions about animal and human welfare. How science can be used to formulate conservation policy is discussed here in relation to reducing the impact of primate crop-raiding on rural communities. Conflict between humans and crop-raiding wild animals can lead to negative perceptions of wildlife, reducing local support for conservation. Even when a crop-raiding species is not endangered (eg baboons) a general antipathy towards wildlife and protected areas may arise if damage is caused to crops. However, the need to protect crops must be balanced by consideration of animal welfare. Consequently we need to understand local community perspectives in addition to why animals raid crops and how this relates to their behaviour and socioecology. Using results from two African studies (Gashaka Gumti National Park, Nigeria and Budongo Forest Reserve, Uganda) we firstly evaluated the impact of crop raiding by primates on subsistence farmers' livelihoods, secondly explored how this influences farmers' attitudes and behaviour towards these animals, and thirdly highlighted animal welfare issues associated with different control techniques (hunting, trapping, poisoning, guarding, punishing and maiming animals, translocation and reducing

reproduction). This information is discussed in the context of primate behaviour and ecology, and used to develop a series of recommendations to ameliorate human-primate conflict taking into account welfare issues for people and primates.

Pain assessment in laboratory rats — evaluating a practical scheme for ensuring adequate pain relief

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We have recently demonstrated dose-related analgesic-induced reductions in the occurrence of seven behaviours indicating pain following midline laparotomy in mature Wistar rats. Since then, all our work has used rats already undergoing surgery as part of other unrelated studies, and the relevant behaviours have been developed to assess pain and the immediate post-operative analgesic effects of carprofen and meloxicam in another laparotomy model in young Fisher rats. Opiates have several non-specific effects that may interfere with behavioural assessments, so the aims of this study were to assess whether buprenorphine prevents accurate behaviour-based pain scoring, and to determine the duration of pain and the analgesic effects of buprenorphine, administered orally or subcutaneously, and carprofen. Four groups of nine Fisher rats received either saline (0.2 ml/100 g), carprofen (5 mg kg⁻¹ subcutaneously) or buprenorphine (subcutaneously [0.05 mg kg⁻¹] or by gavage [0.4 mg kg⁻¹]) one hour before isoflurane anaesthesia and laparotomy for tumour cell injection into the bladder wall. Thirty minutes after surgery they were housed singly for ten minutes of behaviour recording. This was repeated three times at 2 h intervals. Repeated measures ANOVA determined group differences in the cumulative frequency of back-arching, staggering and writhing between time periods. Saline controls showed a significantly greater behaviour frequency ($P < 0.01$) than all analgesic treated groups (mean 12 cf. 3 occurrences) at all but the final recording period ($t = 390$ min) when frequency declined from 15 ± 9 to 6 ± 4 (mean ± 1 SD; $P = 0.026$). There were no other significant group differences. Results indicated that pain in this laparotomy model lasted between 4.5 and 6.5 h and that this was alleviated by the analgesics used throughout its duration. The data also support use of these behavioural criteria as an accurate and practically useful approach to assessing post-operative abdominal pain in rats.

Ultrasound emission and the assessment of pain and stress in rats

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Adult rats emit ultrasounds which have been classified into several different types. Two of these, the so-called 50 kHz calls and 22 kHz calls, have been detected from rats in what

are thought to be painful or stressful situations. It has therefore been suggested that these calls could be used as an indicator of stress and/or pain. The evidence for the association of ultrasound emission by rats with pain and/or stress is reviewed and results of studies by the authors are presented.

Assessing animal welfare: what lessons can be learnt from human medicine?

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The practical application of the science of welfare and pain assessment is extremely difficult, but has strong parallels with the assessment of pain and health-related quality of life (QoL) in human medicine. In this paper, we will present our experiences in the development of pain and welfare scales, using as our model work in the human and psychometric fields but using observers as proxy raters (whether vets, companion animal owners, stockmen or farmers). The psychometric principle of the development of a scale or index for quality of life requires the identification of a potential set of items which could include behavioural, physiological and biochemical markers representing the different aspects of the phenomena under study. For the clinical acute pain setting in dogs, we have developed a questionnaire with 8 behavioural categories. We have used a Thurstone's matched pairs approach to evaluate the weights for each item. For the clinical chronic pain setting, we have used a questionnaire with over 100 items; the rater indicates degree of agreement with each item using a 7-point Likert scale. Recent work has focused on the application of these principles for development of a welfare scale in dairy cows, incorporating husbandry, behavioural and physiological/biological measures. It is noteworthy that in the welfare setting, causal variables, for example, the presence of disease or inadequate husbandry, may in themselves be sufficient cause for poor welfare and this must be taken into account in the overall assessment.

The importance of social opportunities in the life of horses

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The Icelandic horse has been genetically isolated from other breeds for more than 1000 years. Throughout the centuries these horses have lived in herds and have enjoyed great freedom. Today, foals and sub-adults usually grow up in herds with adult mares and geldings. In many places they spend their time over the summer in the mountains. In the autumn and the winter they are in enclosures close to farms where they have access to hay and water. In most places they get limited handling until they are housed for training,

which happens when they are 4–6 years old. In Iceland it is customary to give riding horses 'a holiday' in the autumn for 3 months. They stay outside from the beginning of June until Christmas or until they are stabled for 5–6 months. Studies of social interaction in different groups, both in spring, summer and the wintertime, show that the horses are playful and allogroom more than has been described for most other groups. They form friendly relationships (play and allogroom) with individuals of the same age group and associate spatially with the same horses. A survey on housing conditions and stable vices was carried out in March 2003. Horses are usually kept in stalls for two horses, which are half-open so that they can see in all directions and often touch other horses. Generally, stabled horses are let out at least once per day, usually in groups of more than three. Interestingly, a significantly higher proportion of the stables, which were free of stable vices (24%), were designed in such a way that the horses could groom over bars/walls between stalls. Wood-chewing is the most common vice (8.3% of horses) and crib-gliding comes second (7.2%). The most serious stereotypies, wind sucking (2.2%), weaving (0.6%) and circling (0.2%) are rare. In addition to improving mental health, opportunities to socialise have without doubt been a selective force shaping the temperament of the breed, which is known for being both amiable and cooperative.

An integrated approach to assess nociception and pain in the rainbow trout

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Many commercial and experimental procedures that fish are subjected to may be potentially painful. This presentation will review the recent research that has demonstrated the capacity for pain in the rainbow trout. An integrated approach was adopted, using techniques in neuroanatomy, neurophysiology and behaviour, to assess potential pain perception in a fish. The trigeminal nerve of the trout, which conveys pain information from the head in other vertebrates, was examined anatomically for the presence of nerve fibres that may be involved in nociception, the reflex response to a harmful stimulus. Electrophysiological measurements demonstrated the presence of nociceptors on the head and mouth area of the fish. These receptors had similar physiological properties to those found in vertebrates and they preferentially responded to mechanical, and noxious thermal and chemical stimulation. Behavioural experiments were conducted to assess the acute response of the fish to a noxious event. When noxious chemicals were administered to the lips of the trout these fish showed a dramatic rise in ventilation rate and performed pain-related behaviours that were not seen in control fish. Noxiously treated fish did not resume feeding for 3 h whereas controls began feeding after 1 h. To assess what impact pain had on attention, the noxiously treated fish were presented with novel objects to assess neophobic responses. Fish in pain did not show an

appropriate fear response and this suggests that pain dominated their attention. These adverse behaviours are not simple reflexes and, therefore, the trout may be capable of pain perception.

Animal care at the Indian Institute of Science

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Animal care at the Indian Institute of Science revolves around the animal care complex established during 1971. The Central Animal Complex caters to the needs of experimental investigators of the Division of Biological Sciences at the Institute. Its main activity is breeding and supply of standardised disease-free laboratory animals to the various investigators who undertake studies in Biochemistry, Physiology, Pharmacology, Microbiology, Genetics and Reproductive Physiology. To address the welfare needs and care of laboratory animals, several positive steps have been undertaken. The animal rooms have been modified and the animals are provided with good housing, nutritionally balanced feed and UV-treated water for drinking. The rabbits have been provided with a free ranging type of housing which has improved their health and breeding performance. A set of GLP rooms has been provided with temperature-controlled environments for breeding and experiments on specialised strains of mice. The advantages of changes brought about in the colony will be discussed.

Temperament and stress in kennelled dogs

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A pilot study was conducted with the RSPCA and Battersea Dogs' Home, revealing that 64% of dogs show at least one behavioural indicator of stress within their first two weeks in rescue kennels. Such behavioural cues increased in prevalence throughout an eight-week kennelling period. In light of many scientific reports on ways to reduce stress in kennelled dogs, why is this problem so extensive? In recent years, whilst scientific research has indicated ways in which stress can be prevented or alleviated in confined animals, the necessary resources are often too limited to be implemented on a comprehensive level. It may be more effective to identify which dogs are most likely to experience stress on entering rescue kennels so that targeted preventative measures can be implemented where they are needed most. It is hypothesised that temperament is an important predisposing factor. It is expected that fearful temperaments predispose dogs to be fearful in the short to long term, whereas sensation-seeking temperaments will predispose dogs to become bored and frustrated in the longer term. Using different techniques (temperament testing, owner report, staff opinion) we aim to assess 200 dogs entering

rescue kennels. The ability of these techniques to predict the incidence of stress in the short and long term will be ascertained. The results from this study will lead to the development of tailored programs for the husbandry and care of dogs as they enter kennels, so that individual variation arising from differences in susceptibility to stressors can be managed more effectively.

Foraging enrichment for stabled horses: practicality and effects on behaviour

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Multiple forage provision facilitated foraging behaviour in short-term trials. This work aimed to establish whether these effects persist over longer periods and to develop a practical methodology for maintaining stabled horses under forage-enriched conditions. Nine horses acting as their own controls participated in an 18-day cross-over Latin Square designed trial, receiving similar weights of a single forage (SF) (hay) and a multiple forage (MF) (six commercially available forages) diet. Following two days of acclimatisation, horses were maintained on the SF or MF diets for seven days and observed morning and afternoon on alternate days, during the 25 min following forage presentation. Horses then crossed-over onto their other treatment and following two days of acclimatisation were observed for a further seven days. Observations from video were analysed using The Observer 3.0® and SPSS (version 11). Horses on the MF diet foraged more frequently ($t = 0$, $P < 0.01$, Wilcoxon's test for matched pairs) and for longer periods ($t = 2$, $P < 0.05$) than horses on the SF diet. Searching behaviour was performed for longer periods ($t = 2$, $P < 0.05$) on the SF diet. Horses on the MF diet demonstrated preferences for particular forages but sampled all forages; the frequency ($P < 0.001$, Friedman test) and duration ($P < 0.001$) of foraging on the individual forages differed significantly. The results supported the findings of the earlier short-term trials. They suggest that a MF diet can form part of a practical management regimen for stabled horses. Furthermore, a forage-enriched environment facilitated expression of the horses' highly motivated foraging behaviour.

Non-invasive monitoring of stress hormones in mice: a technique opening new perspectives in biomedical and animal welfare research

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² Institute of Biochemistry, University of Veterinary Medicine Vienna, Austria

In small animals, the monitoring of endocrine functions is constrained seriously by the adverse effects of blood sampling. Therefore, the aim of our investigation was to establish a non-invasive technique to monitor stress hormones in mice. In a first experiment ³H-labelled corticosterone was administered to 16 animals and all urine and faecal samples were collected afterwards. Radioactive metabolites were recovered predominantly in the faeces and peak radioactivity was detected after a lag time of about 10 h. HPLC separations of faecal metabolites revealed that corticosterone was extensively metabolised and, regarding the types of metabolites formed, significant differences were found between males and females. Different enzyme immunoassays (EIA) were tested to assess the immunoreactivity of these metabolites. However, only a newly established EIA, measuring corticosterone metabolites with a 5 α -3 β ,11 β -diol structure, detected several peaks with high intensity. To validate this EIA, further experiments were performed with twelve mice each, monitoring faecal metabolites either at different times of day or after administration of ACTH or dexamethasone. Thus, our study provides substantial information about the metabolism and excretion of corticosterone in laboratory mice. Furthermore, the newly developed EIA proved a powerful tool to monitor adrenocortical activity by measuring faecal corticosterone metabolites. This non-invasive technique avoids blood sampling related stress effects and can reduce the total number of animals used for experiments. Since it also allows frequent sampling of individual animals over time, it contributes to implementing the 3Rs concept of Russell and Burch and opens new perspectives in biomedical and animal welfare research.

Animal sentience and farm practice: students' perceptions and the educational curriculum

JZ Turner

Compassion in World Farming Trust (CIWF Trust), UK

The subject of animals is one that draws some of the most interest from students at the pre-university level. Student perceptions of animals typically include assumptions of sentience, individuality, preferences, intentions and basic emotions. However, there is often a discontinuity between these perceptions and the knowledge of farming practices and the welfare of farm animals that is provided by educational courses. The use of farm animals is included directly or indirectly in a number of educational courses in the UK's National Curriculum (KS 3 and 4), in the Advanced Level (UK) syllabus and in college courses. Examples will be taken from Science, Geography, Food Technology and catering/hotel education. The paper reviews the knowledge of farm animal use and welfare provided by educational curricula (including controversial practices such as use of battery cages, broiler farming, selective breeding and farrowing crates) and suggests ways in which such curricula could provide more information and opportunity for evaluation. Examples are given of materials for discussion groups

and 'attitude tests' developed at CIWF Trust and of an interactive Ethical Matrix developed at Nottingham University.

Suitability of microclimate in reconstructed loose-housing cowsheds

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The standard project (type TP801-254, 96 × 24 m) for 292 tied cows was one of the most commonly used cattle sheds for large farms in Soviet Estonia. For the promotion of animal welfare, a reconstruction project has been devised to permit them to be used as loose housing cowsheds. The objective of the present paper was to establish the suitability of the microclimate of reconstructed cowsheds for cattle. The distribution of temperature, humidity and the concentration of ammonia and air velocity were measured at 20 measurement points throughout the cowshed at the height of the animals' bodies over a 24 h period. The location of the cows in the cubicles was registered at the same time (the number of cubicles was 25% greater than the number of cows during the experiment). The two-week dynamics of temperature and humidity were estimated within and outside the cowshed. The spatial variability of microclimate parameters in the cowshed was greatest in temperature and humidity (in winter, 0.1–9.7°C and 68–99.9%; in summer, 12.8–28.6°C and 39.7–75.4%). The cubicles were evenly used. Microclimate variability did not significantly influence the welfare of cows in the reconstructed cowshed.

Differences in the levels of canine urinary 5-hydroxyindoleacetic acid between sexes, breeds and in relation to some behavioural traits

J Venturi Rose, S King and C Raymond

Department of Animal Management, Brinsbury Campus, University College Chichester, UK

Levels of urinary 5-hydroxyindoleacetic acid (5-HIAA), a principal metabolite of serotonin, was measured in 12 Labradors and 10 German Shepherd Dogs (GSDs). Levels were significantly different between males (13) and females (9) whether neutered or not (Mann Whitney $U = 25$, $P = 0.025$), and between entire males (7) and all females ($U = 11$, $P = 0.030$). There were insufficient entire females to determine significance with entire males. The mean in $\mu\text{mol/litre}$ of both male and female Labradors (12.5 and 24) was lower than the sex means in GSDs (17 and 31) but this was not significant. All neutered females had higher means than other groups. A basic questionnaire on owner perceptions of their pet's behaviour suggested that GSDs with low 5-HIAA levels were more likely to display guarding

behaviour than those with higher levels. In both breeds, lower levels were more likely to be associated with dominant behaviour and higher levels with nervous behaviour. Labradors perceived as being more submissive were more often associated with higher levels. Further analysis is needed on this data and a larger sample and more detailed questionnaire are necessary. However, results of this preliminary study suggest that within-breed differences are greater than between breeds. Levels of 5-HIAA can also be affected by certain carcinomas, stressful situations, diet and day length. This would need to be considered in any future studies.

Christmas comes once a month! Feeding fully feathered turkey carcasses to felids at Chester Zoo

S Wehnelt¹ and A Roth²

¹ Chester Zoo, North of England Zoological Society, Chester, UK

² Royal Veterinary College, London, UK

Chester Zoo promotes and supports conservation by breeding threatened animals, excellent animal welfare, high quality public service, recreation, education and science. Large cats are among the most popular animals at the zoo. Many felid species are of high conservation importance. Felids tend to be largely inactive and to display pacing which is perceived as negative by the public. Behavioural changes due to a restricted environment raise welfare concerns and zoos implement enrichment methods to counteract and prevent undesired behaviours. Once a month, felids at Chester Zoo receive intact, fully feathered turkeys instead of their conventional diet, consisting of skinned, chopped meat. We investigated if the behaviour of the felids differed between the two feeding conditions. The changes were assessed in relation to animal welfare and visitor perception. The behaviour of ten individuals of four species of felids was recorded. Feeding whole turkey carcasses had a significant positive effect on the felids' behaviour. The enrichment technique encouraged natural, food-related behaviours rarely seen with conventional feeding methods. The behavioural changes indicate health improvement and provision of important physical and mental stimulation. Undesired behaviours such as inactivity and pace-walking decreased. Zoo exhibits with feeding enrichment are likely to have a higher education and entertainment value. In conclusion, turkey carcass feeds are recommended to be included in zoo diets for felids. Environmental enrichment can be a successful tool to help zoos fulfil their mission of high standards in animal welfare, visitor education and entertainment and it assists in the conservation of species and their behaviour.

The effect of auditory stimulation on the behaviour and public perception of sheltered dogs

DL Wells, L Graham and PG Hepper

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Rescue shelters provide temporary housing for thousands of dogs every year. Finding a suitable means of enhancing the captive environment of such animals is of utmost importance since the environment can have a significant impact upon both canine welfare and visitors' perceptions of dog desirability. This study explored the effect of auditory enrichment on the behaviour and public perceptions of sheltered dogs. Fifty dogs were exposed to five conditions of auditory stimulation including a control, human conversation, and classical, heavy metal and pop music. Dogs were exposed to each condition for 4 h on five separate days. For each condition, the dogs' vocalisation, activity and position in kennel were recorded for 4 h. One hundred visitors to the shelter during each condition were also surveyed to assess their perceptions of the dogs and their environment. Auditory stimulation significantly influenced both the dogs' behaviour and visitors' perceptions. Classical music encouraged dogs to spend less time barking and more time resting, whilst heavy metal music resulted in dogs spending more time barking and less time resting. Visitors exposed to classical music and human conversation rated both the behaviour of the dogs and their environment as more attractive than visitors exposed to the other conditions. It is suggested that the welfare of sheltered dogs may be improved through the provision of appropriate auditory stimulation. Providing sounds that have a calming influence may be particularly advantageous, resulting in reduced animal stress, enhanced perceptions of dog desirability and an increase in the number of dogs that are re-homed.

HACCP principles: transferring technology to assure animal welfare

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The Hazard Analysis Critical Control Point (HACCP) program originated in the food processing industry to assure the safety of food at the point when it reached the consumer. Evaluation of the existing food safety assurance systems highlighted that no amount of testing of the end product could guarantee total food safety. What was needed was a system which identified critical points throughout the food processing chain where risks to the safety of the end product could be controlled. This provided the framework for the HACCP program which is now very widely used throughout the food processing industry. When put into effective practice this system of assuring the whole process could virtually eliminate the need for intensive inspection of the end product. The concept has extended beyond processing plants as it has become apparent, for example in the dairy industry, that Critical Control Points begin on farm in terms of cow health and milking/dairy hygiene. It is now becoming recognised that all food animal production processes require identification of risks and points of control for health factors as they have a direct bearing on food quality. However, the process involved in assuring that

the risks within a system and the points at which they can be controlled can also be applied to assuring welfare outcomes, not only through the management of health but through the supply of behavioural needs and stockman/animal care provision. The application of this process to assure animal welfare is potentially equally valid for laboratory animals as it is for food-producing animals. This is an area where a well developed existing process has the potential to serve animal welfare. As interest in the potential application of the HACCP process increases, care must be taken to ensure that it deals not only with those factors which are relatively easily monitored, such as health, but all the aspects of contributing to an animal's welfare. Work at the University of Bristol is using this philosophy to apply HACCP principles to controlling the risks of lameness in dairy cattle.

The development of a valid measure of chronic pain in dogs

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Significant progress has been made in the assessment of chronic pain in humans using health-related quality of life (HRQOL) measures, which concern themselves with a range of domains such as mobility, physical activity, eating, sleeping, anxiety, alertness, depression and social activity as

well as sensory pain. The development of an HRQOL instrument was considered an appropriate approach for assessing chronic pain in dogs, since there currently exists no validated clinical assessment tool for this purpose. Preliminary interviews with 17 owners of dogs suffering from chronic and painful orthopaedic conditions indicated that chronic pain in dogs is associated with a wide range of behavioural disturbances (32 types), and that owners are a valuable source of detailed information about these changes. This study describes subsequent steps in the development of the HRQOL. Surveys of over 200 dog owners produced a comprehensive collection of descriptive terms associated with chronic pain and with good health in their dogs. 109 of the most commonly used terms were found to be associated with the behavioural disturbances already identified and were incorporated into a structured questionnaire designed for completion by owners. Questionnaires were completed by the owners of 175 dogs, 151 suffering from chronic conditions likely to be associated with pain, and 24 healthy dogs. Detailed demographic data were also collected along with pain scores (using a numerical rating scale from 0–10) awarded by the clinician handling the case. Preliminary analysis of a subset of these data using factor analysis has revealed two principal factors, one of which appears to reflect the affective components of pain, and the other, emotional disturbances. These preliminary data suggest that this instrument will form the basis of a suitable tool for the assessment of chronic pain in dogs. Lesley Wiseman gratefully acknowledges the financial support of the Ronald Miller Postgraduate Scholarship and Pfizer Animal Health.

Animal Welfare

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Universities Federation for Animal Welfare



Science in the Service of Animal Welfare

The UFAW SAWI fund for promotion of animal welfare in Israel

As UFAW members and supporters will know, for many years the UFAW Council has been the board of trustees also for two other charities – the Humane Slaughter Association (HSA), and the Society for Animal Welfare in Israel (SAWI) – which share with UFAW the premises at The Old School, Wheathampstead, and some staff including the Chief Executive.

SAWI was established by veterinary surgeon Miss Marguerite Silverman in 1958 to promote animal welfare in Israel and, in due course, became a registered charity (No. 206494). In 1986, Miss Silverman felt that she could no longer shoulder the burden of the charity's administration and she approached the UFAW Council about UFAW taking SAWI under its wing. This was agreed and the Council became the trustees of SAWI on 1 January 1987.

During a recent review of strategy for SAWI, the SAWI Trustees/UFAW Council decided that it would be advantageous to bring SAWI (which, unlike UFAW, was not a company limited by guarantee) within the umbrella of UFAW's limited liability. Hitherto, SAWI's activities had been administered by UFAW staff, and the new arrangement would open the door to being able to use SAWI funds to employ someone to assist in developing SAWI's activities. As the Chairman explained at the AGM in October 2003, after taking legal advice and following meetings with some of SAWI's founders and consultation with the SAWI membership, the trustees voted unanimously on 7 October 2003 to transfer SAWI's assets to a restricted fund – the UFAW SAWI fund – within UFAW. This fund will be used to promote activities in line with SAWI's original objectives:

- (a) To assist in the protection of animals in Israel, by encouraging and promoting education in the humane treatment of animals, by providing treatment for sick and injured animals, and by providing facilities for humane destruction;
- (b) To collect funds for the purposes of the Society;
- (c) To do such other lawful things as are conducive to the attainment of the Society's objects.

Through this SAWI fund held by UFAW, it will be possible to further develop initiatives for animal welfare in Israel in the coming years. Plans are underway to begin to take this forward during 2004.

Zoo Outreach Organization news

For several years, UFAW has been sponsoring the work of the Zoo Outreach Organization (ZOO), based in India. Over the past year, the organisation has been actively promoting zoo animal welfare in several countries in Southern Asia, India, Bangladesh, Nepal and Sri Lanka. UFAW funds have been put to good use to cover travelling expenses associated with the provision of training in zoo education and animal welfare and in promoting new and/or improved zoo legislation, and to prepare and distribute educational materials to other South Asian welfare, zoo and wildlife organisations. ZOO has also produced welfare-awareness materials for use by zoos, non-governmental organisations and other institutions when conducting welfare programmes in schools for Wildlife Week, Animal Welfare Fortnightly, Earth Day and World Environment Day. In addition, ZOO has developed an archive of current zoo legislation, standards and licensing information. The regular meetings, teaching and dialogue, as well as the provisioning of information through magazines, journals, compendiums and specific training materials, make a valuable contribution to promoting animal welfare and conservation in zoos in this region.

RSPCA/UFAW rodent welfare meeting

A joint RSPCA/UFAW rodent welfare meeting examining ways of refining the procedures carried out on rats and mice was hosted by Cancer Research UK on 6 October 2003. The meeting was well attended by scientists, veterinarians, technicians and representatives from animal welfare organisations. These meetings provide an opportunity to spread good practice and, as they are cheap to attend, provide an excellent opportunity for those on small budgets. Seven papers raising topical issues were given at the 2003 meeting. Dr Georgia Mason, a former UFAW Research Training Scholarship supervisor, presented a paper on the possibility of using the phenomenon of 'red tears' or chromodacryorrhoea as a measure of stress for laboratory rats. Scores using this method were observed to correlate with disturbance caused by building maintenance work, and inter-observer correlation was good. Two reports on which UFAW staff have served as experts were also presented: Dr Laura Playle from the MRC Centre for Best Practice for Animals in Research (CBPAR) described the progress of a working group developing standards for assessing the welfare of genetically modified mice; and Dr Penny Hawkins (RSPCA, and convener of the meeting) presented some of the major points of the new Joint Working group (BVA/WF/FRAME/RSPCA/UFAW) on refinements in telemetry procedures for mice. Infection studies may cause considerable suffering; however, one study presented at the meeting demonstrated how choosing a particular mouse strain could significantly reduce adverse effects. In the same presentation, the use of shelter tubes as enrichment for rats in metabolism cages was described. These cages can be barren environments and it was therefore useful to learn that the tubes were an effective enrichment that did not affect experimental outcomes.

Notification for Election to Council at the 2004 AGM

In accordance with Article 46 of the Constitution, nominations for election to membership of the Council at the 2004 AGM must reach the UFAW Secretary between 27 July and 17 August 2004. Further information is available from the UFAW Secretary.

2004 Annual General Meeting

This year's AGM will be held on the afternoon of Tuesday 5 October 2004 in Wheathampstead. Full details of the time and business of the meeting will be sent to members in due course.

Council changes at the 2003 Annual General Meeting

We welcome Professor Vincent Molony BVSc MSc PhD MRCVS, Head of Preclinical Veterinary Sciences at the Royal (Dick) School of Veterinary Studies, University of Edinburgh, and Mr Michael Bird FCA, Finance Director of the Zoological Society of London, who were elected to fill two vacancies on Council. Mr John Pratt was re-elected to Council and has succeeded Mr Norman Reed as Honorary Treasurer.

UFAW Spring Appeal: Advances in the welfare of fish

In recent years there have been many developments in fish farming and in the keeping of fish as companion animals. A very wide range of species is kept and the scale of both of these industries has increased around the world. UFAW has been involved in a variety of initiatives for fish welfare in recent years: supporting several vacation scholarship studies into aspects of fish welfare, supporting a workshop in 2003 on tackling spinal disease in farmed fish, and publishing key papers on fish welfare in *Animal Welfare*.

Starting this year, UFAW is supporting, as the industrial partner, a BBSRC CASE PhD research project based at Bristol University and the Silsoe Research Institute, on the humane slaughter of sea fish. Many farmed sea fish (eg sea bass and bream) are killed in Europe each year using methods that have been criticised as inhumane such as immersion in slush ice. This new project aims to extend the electrical stunning/killing technology that has been developed recently for the humane killing of fresh water species, for use in sea fish. UFAW is collaborating with the Humane Slaughter Association in providing support for this project.

We would be most grateful if you would help support the charity's initiatives for fish welfare by responding to the 2004 Spring Appeal or through remembering UFAW in your will.

Donations and legacies

We appeal to every donor, who has not already done so, to complete the new Gift Aid scheme form which enables UFAW to claim tax back on your donation or subscription providing that you are a UK taxpayer. Higher rate taxpayers can personally claim relief on the difference between their higher rate tax and basic rate on the self-assessment form. UFAW relies on such generosity and income from legacies to fund its ongoing charitable work. An advice leaflet on how to leave a gift to UFAW in your Will is available upon request.

We hope also that all those who have contributed to SAWI in the past will continue to support our efforts to promote welfare in Israel in the future by making donations to the UFAW SAWI fund.

Response to the Autumn Appeal

We are extremely grateful to everyone who supported our Autumn Appeal, which raised £1495 to support our new award scheme to fund initiatives to improve the welfare of wild animals. We have had a good response to the call for applications for this new award, and judging of these is underway.

Stationery and promotional products

The brochure enclosed with this News-Sheet displays a number of promotional products available from UFAW. To order, please complete and return the enclosed reply form with payment to UFAW.

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Universities Federation for Animal Welfare

News-Sheet, March 2004



Science in the service of animal welfare

Letter from the Chairman

In this issue we sadly report the deaths of three of our more prominent members. Each has made a significant contribution to the work of our charity and we remember them with gratitude.

As announced at the last AGM, the Society for Animal Welfare in Israel has now become part of UFAW as the UFAW SAWI Fund. This change will allow a more progressive approach to animal welfare in that country without detracting from the support traditionally given to the animal shelters.

October was marked by the presentation of the first UFAW 'Tesco' award to Monica Winstanley, recognising the importance of promoting public awareness of animal welfare science. The award was made by Professor Lord Winston at a reception held at The Royal Society.

In December the annual vacation scholars meeting provided an opportunity for recipients to present and discuss their projects. These scholarships give students an excellent opportunity to experience the satisfactions and frustrations of animal welfare research at an early stage in their careers.

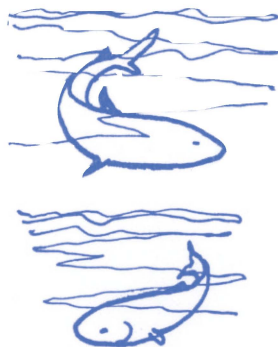
We are particularly proud to congratulate two of our Research Training Scholars on gaining PhDs during the year. In these and other ways UFAW fulfils a valuable educational role at undergraduate and postgraduate levels. Our association with universities will be strengthened by the recently introduced 'links' scheme. In the past, membership of a UFAW group was an established part of life in several universities and it is intended that the scheme will revitalise the connection implied by the title of our charity.



BBSRC Case Studentship Research into the humane slaughter of sea fish

UFAW and the Humane Slaughter Association (HSA) are assisting, as industrial partner to Silsoe Research Institute and the University of Bristol, in providing supervision for a BBSRC CASE PhD research project on the humane slaughter of sea fish.

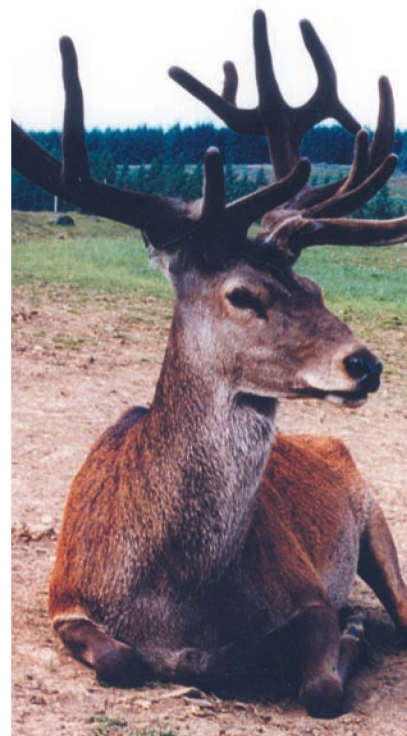
Many farmed sea fish (eg sea bass and bream) are killed in Europe each year using methods that have been criticised as inhumane, such as immersion in slush ice. This new project aims to develop the electrical stunning/killing technology that has been developed (with support from HSA) recently for the humane killing of farmed trout, for use in sea fish. The challenge of this project will be to find ways of achieving a sufficiently powerful electrical field despite the complications posed by the much greater conductivity of salt water.



The PhD Studentship has been awarded to Mr Ambrose Tinarwo and his work has just started this January (2004). Ambrose, who comes from Zimbabwe, graduated from the MSc course in Applied Animal Behaviour and Animal Welfare at Edinburgh University in the Autumn of 2003. During his three-year PhD research, Ambrose will spend several weeks with UFAW and HSA at The Old School. Ambrose received a UFAW vacation scholarship in 2003 for studies on discrimination of temporal events by domestic hens.

Deer Commission Workshop

James Kirkwood was asked by the Deer Commission for Scotland (DCS) to Chair and facilitate a workshop, held in Stirling on 15 October 2003, on the welfare of free-ranging deer. The DCS is currently producing best practice guidance on various aspects of deer management and one of the aims of the meeting was to discuss welfare matters relevant to this. The other aim was to discuss general principles about the scope and extent of responsibility for the welfare of free-ranging deer in order to inform the DCS response to the Scottish Executive/Defra consultation on their proposed animal health and welfare strategy for Great Britain. This interesting and constructive meeting addressed, among many other matters, the position of managed wild animals such as deer, which fall somewhere along the spectrum at the extremes of which are farmed animals (for whose welfare owners are responsible) and truly wild animals (for whose welfare no one has a legal obligation). UFAW's Scientific Officer Samantha Mills, who had been planning to work with James at the meeting, was unfortunately unable to attend due to illness, and we are grateful to Natalie Simmonds of the HSA staff who kindly stepped in to fill the breach.



New UFAW Wild Animal Welfare Award Scheme

With the global human population now exceeding six billion and continuing to grow rapidly, we are unavoidably in competition with wild animals for food, space and other resources. It has become clear that human changes to the environment often compromise the welfare of large numbers of individuals of many species.

In order to encourage improvements in the welfare of wild animals, the new 'UFAW wild animal welfare award scheme' was launched in the latter part of 2003. The aim of the scheme is to recognise innovations which alleviate or prevent unnecessary anthropogenic harm to the welfare of animals in the wild and/or which recognise innovations relevant to improving the welfare of wild animals in captivity.

The competition has been open to those working with captive or free-living wild animals; for example, those working in wildlife management and conservation, those undertaking research on wild animals, those working in zoos, or those working in wildlife rehabilitation. It is easy enough to make changes to animals' circumstances, but it is not always so easy to be sure that these changes are actually to the welfare advantage of the animals themselves. Applicants must present in their applications the evidence for believing that their innovation is a benefit to the animal from the animal's point of view.

There has been a good response to the new award scheme with many applications coming in from various fields of wild animal work. The applications are currently under review and if the judges believe they are of sufficient merit, UFAW will give two awards, each of £1000: one for the best innovation for the welfare of captive wild animals in the UK, and the other for the best innovation for the welfare of free-living wild animals in the UK.

Recent UFAW-supported PhD theses in animal welfare science: Ros Clubb (2001, University of Oxford, 'The role of foraging niche, rearing conditions and current husbandry on the development of stereotypies in carnivores'); Emma Harding (2002, University of Bristol, 'Novel methods for assessing mental states and animal welfare'); Kenneth Rutherford (2003, University of Edinburgh, 'Investigating fractal analysis of animal behaviour as an indicator of stress'); Emma Smith (2003, University of Bristol, 'Effect of the visual environment on avian welfare').

Winner of the UFAW 'Tesco' award for promotion of the public understanding of animal welfare science announced

The winner of the first UFAW 'Tesco' Award for promotion of the public understanding of animal welfare science was announced on Wednesday 22 October 2003. Professor Lord Winston presented the prize to Dr Monica Winstanley of the Biotechnology and Biological Sciences Research Council (BBSRC) at an evening reception organised by UFAW at The Royal Society, for her booklet entitled 'Science and Animal Welfare'.

The welfare of animals has become a matter of great public concern and, not infrequently, public controversy. Society expects high standards, and to provide these requires a proper understanding of animals' physical and psychological needs and of how these needs can be met. A scientific approach is essential and there have been many advances in the science of animal welfare in the last 20 years. UFAW, with

support from Tesco, launched this prize to encourage the publication or broadcast of work which best communicates to a wide audience the importance and value of the scientific approach, the ingenuity of the scientific methods, and the relevance of the findings.

Lord Winston said: "Although a small organisation, UFAW, by championing the scientific approach, has had an enormous influence in the development of animal welfare standards around the world. I congratulate UFAW and Tesco for this excellent initiative, and it gives me great pleasure to present the 2003 award to Dr Monica Winstanley for her review of recent advances in this fascinating branch of science."

In 'Science and Animal Welfare', Dr Winstanley outlines a variety of recent research approaches in the UK aimed at advancing our understanding of what is important to animals for their welfare and at developing methods to tackle welfare problems.

Standards for keeping animals, which set minimum limits for parameters such as cage/enclosure sizes, tend these days to be established by committees in Brussels. Since no hens, pigs, cattle or mice sit on these committees, one of the great challenges of animal welfare science is to find ways to gain insight into the views and preferences of these animals themselves, so that their interests can be properly represented. Dr

Winstanley's booklet reviews some of the ingenious methods being used to explore animals' minds for this reason.

Michelle Waterman, Tesco Agriculture Manager, said "Animal welfare is very important to Tesco and our customers, and we believe that awards such as this, which recognise research in this field, are important to improve standards throughout the industry".



Obituaries

Harry V Thompson BSc CBiol FIBiol

Harry Thompson studied at Oxford under Sir Charles Elton. After leaving Oxford, he took up a post at the Ministry of Agriculture (which later became MAFF) and rose to become Head of the Land Pests and Birds Research Laboratory at Worplesdon. During his career he worked on humane methods of control of rabbits, badgers and other species and gained wide respect for his very extensive knowledge of the biology of British mammals. Among his publications were *The Rabbit* (Collins, 1956) which was co-authored by Alastair Worden, and *The European Rabbit: the History and Biology of a Successful Colonizer* (Oxford Science, 1994) which he edited with Carolyn King. He was a great supporter of UFAW throughout his career, first serving on the Scientific

Advisory Council in 1947, then on the Council from 1962 to 1973 and again during the early 1980s. He was elected President in 1985 and maintained a close interest in the Federation's activities throughout his life. He died on 24 November 2003. Harry will be remembered very fondly by all at UFAW for his generous encouragement and loyal support over the years.

Marguerite R Silverman MRCVS ACIS

Marguerite Silverman graduated from the Royal Veterinary College in 1935 and spent some time in companion animal practice before the Second World War. She then changed career and developed a successful business in verbatim recording (before the invention of the tape recorder). In 1958, following a holiday visit to Israel during which she had been distressed by the scale of the animal suffering she had seen, she founded the Society for Animal Welfare in Israel (SAWI). As described elsewhere in this News-Sheet, in 1986 she approached UFAW about the possibility of SAWI being taken under its wing so as to ensure that the donations and general support provided by the Society's members would continue to be properly handled. Miss Silverman generously supported SAWI and followed the activities of both SAWI and UFAW with interest. She was pleased with the new arrangements made during 2003 for SAWI to be brought within UFAW as the UFAW SAWI fund. She died peacefully at a nursing home, near her home in Catcott in Somerset, on Friday 5 December 2003, aged 89. Through her efforts in founding and developing SAWI and in her generous support for its activities, Marguerite Silverman had a tremendous impact on improving the welfare of animals in Israel.

Thomas G Field-Fisher TD QC

Thomas Field-Fisher was educated at Peterhouse College, Cambridge, and joined the Queen Victoria's Rifles in 1939. He was called to the Bar in his absence in 1942 whilst a prisoner for the duration of the war, following his capture, as a member of the British Expeditionary Force, in Calais in 1940. In addition to pursuing a very distinguished legal career, being appointed QC in 1969, he worked also for animal welfare. These interests came together in his book *Animals and the Law* which was published in 1964 and when, between 1980 and 1989, he served on the Home Secretary's Advisory Committee on Animal Experiments. He joined the UFAW Council in 1950 and served right through to 1965, during one of UFAW's most highly productive eras. After further periods on Council during the late 1970s and mid 80s, he was appointed Vice-President in 1985. He died on June 8 2003, aged 87.



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Research Training Scholars' update

We were delighted that UFAW's Research Training Scholar, Emma Smith, successfully completed her PhD during 2003. As a result of this, Emma has published several papers in the scientific press on her work on avian vision. Furthermore, as a direct result of her work, some practical changes will be made to the way that animal husbandry is conducted in zoos in the USA. Several US zoos have agreed to change the artificial light environments and make them more natural: non-flickering lighting, natural photoperiods and ultraviolet-containing lights will be provided. Emma says that 'whilst we might not have solid evidence that this change will promote a significant increase in welfare, it certainly will do no harm, and the provision of UV will form an environmental enrichment in terms of providing a greater range of visible colours to the birds'.

We were also delighted to hear that another of our Research Training Scholars, Kenneth Rutherford, was awarded his PhD during 2003. His thesis was entitled 'Investigating fractal analysis of animal behaviour as an indicator of stress', and his first paper resulting from this work has now been published in the scientific press¹.

Vacation Scholars' meeting

The sixth annual UFAW Vacation Scholars' meeting was held in the Great Hall of the Royal Veterinary College, Camden, on 10 December 2003. The switch to a pre-Christmas meeting proved popular, with a record number of people expressing interest in attending. The meeting started with Professor Mac Johnston, Chair of Veterinary Public Health and HSA's Vice President and Chief Veterinary Adviser, welcoming UFAW and the scholars to the RVC. Appropriately, the first talk was given by Lucy Percival, recipient of the 2003 HSA Dorothy Sidley award, which is similar in nature to the UFAW vacation scholarships. Lucy presented her work on developing an objective method of assessing the welfare of horses at auction markets.

For the rest of the morning, the talks focussed on the assessment of the welfare of captive wild animals, including cheetahs, rhinos and chimpanzees. After lunch, Dr Chris Sherwin presented an update of his work for the UFAW Hume Research Fellowship. This work, which has focussed on improving the design of laboratory mouse housing, has been very productive over the past three years. Some of his most recent studies into self-administration of anxiolytics as a means of assessing anxiety levels in laboratory mice have shown that mice living in small, barren standard cages self-administer more frequently than mice living in larger enriched cages, suggesting that mice may find the former environment more aversive. The results also show that standard laboratory accommodation for mice can result in high levels of anxiety, which is likely to influence the results of any laboratory tests being carried out on them.

In other talks, the scholars looked at the assessment of stress in cattery-housed cats, the possible welfare benefits of farmer-mediated artificial insemination in dairy cows over more commercial systems, and the effectiveness and validity of

commercially used temperament tests for dogs. We would like to thank the staff and students of the RVC for their welcome and for their help in organising the meeting, and all those who supported the meeting. Applications for the 2004 vacation scholarships have now been received and are currently under consideration.



on scholars' meeting, December 2003. From left to right: Sherwin, Daisy Berthoud, Emily Ward, Elizabeth nent, Helen Ashby, Helen Broadbent, Ambrose Tinarwo, Buckley, Lucy Percival, Sheila McKay, Josephine Archer, Burrell, Simon Finnegan.

News of two of the 2003 UFAW Vacation Scholarships: novel methods of monitoring stress in cats

Finding and validating new, objective ways of monitoring and measuring stress is an important step in assessing the welfare of any species. During their projects, UFAW vacation scholars Emily Ward (Harper Adams University College) and Louise Buckley (University of Lincoln) separately sought to validate a non-invasive physiological measure of stress in cats that could be used in place of, or in conjunction with, existing behavioural measures such as the Kessler-Turner scoring system^{2,3}.

In her study, Emily assessed whether measurement of salivary immunoglobulin A (IgA), a method successfully used in assessing the response of the human immune system to stress, could be similarly used for cats newly arrived at a rescue shelter. Emily found that the cats differed significantly from one another in both their Kessler-Turner (KT) behaviour score and their salivary IgA scores, indicating that some cats seemed more able to cope with the new shelter environment than others. No significant change in these scores occurred during the week-long observation period. She also found a very significant positive correlation between salivary IgA concentration and KT behaviour score. That this correlation between IgA and stress was not negative – as is the case in humans, where long-term stress compromises the immune system and leads to a reduction in the amount of salivary IgA produced – was surprising; further investigation of the link between salivary IgA levels, other physiological parameters and stress in cats is required before this result can be more fully explained.



Louise's study took a slightly different approach. Starting from the premise that chronic stress causes physiologically damaging changes to an animal, she investigated whether it was possible to detect such changes in the urine of cats, using the well-known biomarkers of free-radical oxidative damage known as thiobarbituric acid reactive substances (TBARS). She compared urinary TBARS and cortisol (another physiological marker of stress) concentrations and KT behaviour scores in recent arrivals at a boarding cattery with those of a control group over a seven-day period. Perhaps as a tribute to the level of care in the boarding cattery, no significant difference could be detected in the mean level of urinary TBARS between the two groups of cats, although the cattery group exhibited significantly more variability in daily TBARS levels than did the control group. This variability did not, however, correlate with variability in cortisol or KT behaviour scores, although cortisol levels did differ significantly between the two groups. Further work needs to be carried out to determine whether this observed variability in daily TBARS levels is a useful additional measure of stress in cats.

University links scheme

The UFAW university links scheme, which aims to strengthen links between UFAW and the staff and students of UK universities and colleges, is now up and running. During the initial piloting of the scheme, four universities have been co-opted. Dr Hannah Buchanan-Smith (Department of Psychology, University of Stirling), Dr Toby Carter (Department of Life Sciences, Anglia Polytechnic University), Dr Daniel Mills (Department of Biological Sciences, University of Lincoln) and Dr Natalie Waran (Royal [Dick] School of Veterinary Studies, University of Edinburgh) have all kindly agreed to help promote UFAW's objectives at their establishments and to further raise the charity's profile. To this end, the UFAW (and HSA) annual reports and other literature have been distributed among the students. Further developments and activities in these universities during the academic year will be reported in due course.

¹*Applied Animal Behaviour Science* 83: 125-139; ²*Animal Welfare* 6: 243-254; ³*Animal Welfare* 8: 259-267