Recent advances in animal welfare science
UFAW Animal Welfare Conference
York Merchant Adventurers' Hall, 30th June 2010

Timetable

8.30 – 9.30 Registration and poster set up		

9.30 – 9.40 Introduction to meeting		
	JK Kirkwood UFAW, UK	Welcome and Introduction

9.40 – 10.30 Session 1		
9.40	**Burton K, Hall C, Wells C and Billett E** Nottingham Trent University, UK	The Validation Of Infrared Thermography As A Non-Invasive Tool To Assess Welfare In The Horse *(Equus Caballus)*
10.05	**Sherlock L, Cheng Z, Wathes CM and Wathes DC** Royal Veterinary College, UK	Using Microarrays To Examine Production-Based Stress And Associated Welfare Problems In The Broiler Chicken

10.30- 11.10 Break: Refreshments		

11.10 – 12.40 Session 2		
11.10	**Hänninen L, Hokkanen AH, Pastell M, de Passille AM, Rushen J, Hepola H and Raussi S** University of Helsinki and MTT Agri-Food Finland, Agriculture & Agri-Food Canada	Sleep As A Welfare Measure?
11.35	**Hothersall B, Caplen G, Murrell J, Nasr M, Nicol C, Waterman-Pearson A and Weeks C** University of Bristol, UK	Development Of New Techniques To Assess Pain In Domestic Chickens
12.00	**Gover N, Jarvis JR, Abeyesinghe SM and Wathes CM** Royal Veterinary College, UK	Spatial Acuity Of Domestic Fowl (*Gallus g. domesticus*) In Dim Light Environments
12.25	**Ribó O, Candiani D and Alpigiani I** European Food Safety Authority, Italy	Development Of The EFSA Guidance On Risk Assessment For Animal Welfare

12.40 – 14.10 Lunch – poster session from 13.10		

14.10 – 15.25 Session 3		
14.10	**Natoli E, Cafazzo S, Lai O, Maragliano L, Cerini N, Guarducci M, Carlevaro F, Di Paolo M, Carlevaro L, Scholl F, Bucci E and Scarcella R** Azienda USL Roma D and Istituto Zooprofilattico Sperimentale delle regioni Lazio e Toscana, Italy	Evaluation Of The Effects Of The Italian National Law 281/91 On Free-Ranging Dog Management (Enforcing The 'No-Kill' Policy) In The Lazio Region; Determination Of Management Standards For Public Shelters
14.35	**Douglas C, Bateson M, Walsh C, Bédué A, and Edwards S** Newcastle University, UK and ENITA de Clermont Ferrand, France	Tests Of Cognitive Bias Can Inform On Pigs Subjective Affective State
15.00	**Bethell EJ, Holmes A, MacLarnon A and Semple S** Roehampton University and Birkbeck College, University of London, UK	Extending The Cognitive Bias Model Of Animal Psychological Wellbeing: Attentional Bias In Non-Human Primates

15.25 – 16.00 Break: Refreshments		

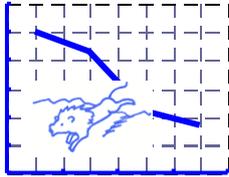|		
16.00 – 17.50 Session 4		
16.00	**Silva C, Laing N, Mellor DJ and Ellis K** University of Glasgow and Clyde Veterinary Group, Lanark, Scotland	Using Abattoir Surveillance To Quantify Welfare Problems Associated With Tagging Sheep's Ears
16.25	**Sandercock DA, Gibson IF, Rutherford KMD, Donald RD, Scott EM and Nolan AM** University of Glasgow and Scottish Agricultural College, Scotland	Maternal Stress And Tail Docking In Juvenile Female Pigs: Effects On Mechanical Force Sensitivity And Responses To Acute Inflammatory Challenge
16.50	**Buckley LA, McMillan LM, Sandilands VS, Tolkamp BJ, Hocking PM and D'Eath RS** Scottish Agricultural College, The Roslin Institute and University of Edinburgh, Scotland	How Hungry Is Too Hungry? Impaired Learning Leads To Poorer Payoffs In Hungry Broiler Breeders
17.15	**Davis AC, Sherwin C, Friel M, Gale E, Nasr M, Petek M, Wilkins L and Nicol C** University of Bristol, Zagazig University, Egypt, University of Uludag, Turkey	The Welfare of UK Free-range Layer Hens Prior to Depopulation: Using Data From Captured Hens

17.50 End		

THE VALIDATION OF INFRARED THERMOGRAPHY AS A NON-INVASIVE TOOL TO ASSESS WELFARE IN THE HORSE *(EQUUS CABALLUS)*

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Domestication has removed horses from their natural environment and placed them into situations they may find distressing. As a prey species horses have an innate behaviour to flee from anything they perceive to be dangerous. When combined with physiological adaptations this response has a protective role however research suggests that if these changes become repetitive or chronic, stress related disease and behavioural problems may emerge. Recent studies using infra-red thermography (IRT) have shown that eye temperature may be an indicator of distress in humans, monkeys, cows and wapiti. The principle aim of this study was to investigate the thermal response to a short term aversive stimulus when compared with a currently accepted measure (cortisol response) in order to validate this as a measure of negative emotion in the horse.

Horses (n=10) were exposed to a known routine husbandry stressor for ten minutes. Thermal images of the eye and core temperature were taken at the start of the stressor and every five minutes throughout until thirty minutes post stressor. Saliva was swabbed every ten minutes for cortisol (stress hormone) analysis. Core temperature remained constant for all horses for the duration of the study. There was a significant increase in both eye temperature ($p<.001$) and salivary cortisol ($p<.005$) in response to the aversive stimulus with a positive correlation between the two measures ($p<0.5$).

Work is ongoing to further validate IRT as a non-invasive measure of chronic distress. This study will compare thermal, hormonal (cortisol) and behavioural responses of 16 horses to four different housing conditions.

If proven reliable IRT could be utilised to establish the emotional impact of training techniques and management practices. The non-invasive nature of IRT would allow studies to be carried out with minimum disturbance to the horse and avoid confounding results seen with existing measurement techniques.
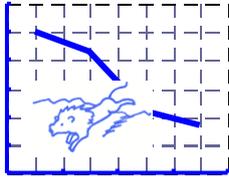
USING MICROARRAYS TO EXAMINE PRODUCTION-BASED STRESS AND ASSOCIATED WELFARE PROBLEMS IN THE BROILER CHICKEN

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The physical and social environments in which farm animals are reared can affect their physiology, behaviour and immune system with direct consequences for production and health. Measures from blood plasma can be difficult to obtain and may not tell the full story about any underlying physiological changes. Microarrays provide a means to examine alterations in gene expression caused by stress in specific tissues.

Samples from the livers of broilers were used to investigate the changes in response to an acute stressful event (the process of commercial catching, transport and slaughter (CTS) – total of 11 hours, first 7 being food withdrawal) (n=12) in comparison to controls (6 hours without food, killed on site) (n=12). RNA was extracted and sent to ARK-Genomics (Roslin, Edinburgh) for microarray analysis, where ten samples from each group were chosen based on RNA concentration and purity. RNA was hybridised on an ARK Genomics 20K chicken oligo array using a dye swap design. The data were analysed using S-Plus ArrayAnalyzer 2.1 and normalised by the LOESS (locally weighted linear regression) method. Paired t-tests, with Benjamini-Hochberg adjustment, were performed to find the significantly differentially expressed genes (DEG) between the two groups. Ingenuity Pathway Analysis was used to construct key pathways involving DEG. Results were validated using qRT-PCR.

In response to CTS, 738 genes were differentially expressed of which 469 could be mapped onto the genome. The top 4 molecular and cellular functions affected were lipid metabolism (56 DEG), small molecule biochemistry (94 DEG), carbohydrate metabolism (34 DEG) and gene expression (40 DEG). The 3 top pathways affected were synthesis and degradation of ketone bodies (DEG: 6 upregulated), pyruvate metabolism (DEG: 7 upregulated, 4 downregulated) and glycolysis/glyconeogenesis (DEG: 2 upregulated, 9 downregulated). The metabolism of CTS broilers moved from glycogen to lipid and lactate based, with a key gene involved in gluconeogenesis, *PCK1*, upregulated. There was also significant differential expression of genes associated with cell cycle regulation and immune function, with downregulation of genes promoting cell division (*MCM2, HHEX, CDC2*) and T cell adhesion and activation *(CD276, CD99*) and upregulation of transformation repressors and negative moderators of the cell cycle (*RHOB, CDC73*) and anti-inflammatory related genes (*IL10RB*, *NFKIB*, *IL1RL1).*

In summary, the stressful events prior to and during transport of broilers dramatically altered their energy system. It is clear that this acute stress significantly affected the welfare of the bird as stored energy became exhausted, changing not only metabolic pathways, but also affecting the immune system and cellular regulation.
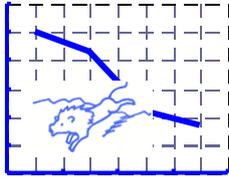
SLEEP AS A WELFARE MEASURE?

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Adequate sleep is important for the health and well-being of humans and animals. Effects of housing or management on the sleep of farm animals are therefore, of concern regarding the animals' welfare. However, we have few detailed studies of sleep in cattle mainly because we have been lacking a validated, non-invasive method for recording sleep states in group-housed, freely-moving animals.

We have recently shown in calves that sleep could be recorded non-invasively using ambulatory EEG technique. We also showed that the calves´ sleeping behaviour is a good measure of the total daily sleeping rhythm and the time spent daily in different sleep phases. In addition, we have developed a light-weight wireless actigraph for measuring sleep in calves.

Using the methods described above we have run series of experiments to study how production factors affect calves' sleep. We assessed the capabilities for 30 newborn calves to cope with the colostrum feeding method (bucket or rubber teat) or rearing environment (with the dam or singly). We found that sucking colostrum from a teat bucket compared with drinking from an open bucket increased calves´ sleepiness and the amount of NREM sleep. Individually housed, teat-bucket-fed calves slept more fragmentarily than dam-reared calves. To study how flooring, social company or relocation will affect calves´ sleep we kept 48 3-month-old Holstein bull calves singly on bedded concrete floors, on rubber mats, or in pairs on concrete and relocated hald of the calves to an identical, but unfamiliar room. We found that calves kept on concrete floor had more fragmented sleeping patterns, and longer sleep duration than calves on rubber mats. Social company decreased the proportion of REM sleep. Relocation to a new room decreased calves' NREM-sleep. We have currently successfully tested the non-invasive EEG registering technique also on adult cattle. We conclude that changes in the frequency or duration of sleep episodes offer a method for assessing how well farm animals are adapted to changes in their physical or social environment or diet.
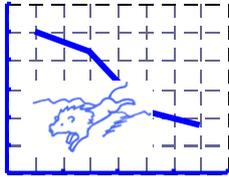
DEVELOPMENT OF NEW TECHNIQUES TO ASSESS PAIN IN DOMESTIC CHICKENS

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In the UK, 840 million meat chickens and 10 billion eggs are consumed every year. Selection for high productivity to meet this demand is associated with high prevalences of health problems such as lameness in broiler chickens and bone fractures in laying hens. While we can measure the effects of such conditions on mobility and musculo-skeletal pathology, there is currently no simple way to determine how painful they are. Previous work at Bristol found evidence that lame birds preferentially consumed food containing analgesic, suggesting that lameness causes pain and that chickens are capable of complex decision-making processes involved in regulating their own analgesia. However, interpreting the results is complex, partly because lameness affected even 'sound' control birds, and because the same degree of lameness may have had various underlying causes that resulted in different severities of pain. Our study will build on and expand this work, initially by quantifying the pain experienced by 'in pain' birds and by determining appropriate 'pain free' control groups. It will also examine new drug models in detail and explore two different pain models (lameness in broilers and keel bone fractures in laying hens).

We will report initial results from the first stage of the project: examining how a bird's performance on a range of standardised behavioural tests relates to its underlying pathology and how these tests correlate with each other. We will use groups of birds with similar type and severity of pathology and the tests showing the best consistency and repeatability will be used to develop a "pain index". This will provide a new, objective tool with which to select homogeneous groups of birds suffering a similar pain experience. This tool will be used to examine the effects of analgesia on pain, and later in the project, to explore whether chickens are able to reduce or even eliminate their pain by selecting painkilling drugs.

If we find that chickens are able to select analgesia to manage their own pain, the technique could allow animals to 'tell' us which common conditions are painful and thereby compromise welfare. The results will also provide fascinating new insights into the cognitive capacities of birds that will inform debate on their welfare requirements.
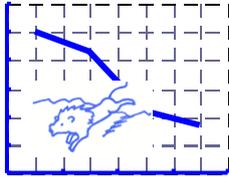
SPATIAL ACUITY OF DOMESTIC FOWL (*GALLUS G. DOMESTICUS*) IN DIM LIGHT ENVIRONMENTS

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In poultry farming illuminance is commonly reduced to 5 lux or less to control outbreaks and prevent the recurrence of injurious feather pecking and cannibalism. This practice may impede the ability of domestic fowl to discriminate between one another, thereby inhibiting the maintenance of peck-orders that can be well defined and are thought to be important in their social behaviour. An environmental illuminance of 5 lux corresponds to mesopic viewing conditions for humans; however it is unknown what viewing conditions it corresponds to in domestic fowl. An operant conditioning technique was used to determine the minimum separable acuity of six hens of a commercial laying strain over a range of stimulus luminances from 0.06 to 57.4 cd m^{-2}, equivalent to a range of illuminances from under 1 lux, to 52 lux. The hens were trained to discriminate high contrast, sine wave grating stimuli from uniform grey stimuli of the same space-averaged luminance, simultaneously presented on two monitors presented behind clear pecking panels. Pecks to the panel behind which the grating was presented were rewarded with maggots (FR3); incorrect responses resulted in 10 s time out (FR1). Acuity was measured directly at any one luminance by adjusting the frequency of the grating using a stepwise approximation procedure until it was high enough that the hen could no longer discriminate it from the mean grey image. Domestic fowl had a much lower overall visual acuity than the human at all luminances, e.g. an acuity of 6.42 and 60.0 c deg^{-1} at the highest luminance of 57.4 cd m^{-2}; and 3.20 and 20.5 c deg^{-1} at the lowest luminance of 0.06 cd m^{-2}, respectively. Overall, the relative intra-species variation of acuity was similar; acuity was fairly constant at medium to high luminances, but reduced rapidly at low luminance in both domestic fowl and humans. An interesting finding, however, was that over the photopic luminance range 1.79 to 57.4 cd m^{-2} the change of acuity for the hen was 1%, compared to 32% for humans. This confers less of a decrease in visual ability of domestic fowl at mesopic levels compared to humans, which correlates with the crepuscular behaviour of the ancestor species of domestic fowl, red jungle fowl. At a stimulus luminance equivalent to an illuminance of 5 lux, acuity of domestic fowl is still at its maximum so there should be no decrease in spatial visual ability under typical poultry house conditions.
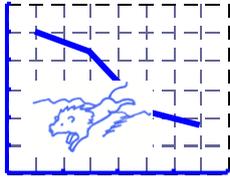
EVALUATION OF THE EFFECTS OF THE ITALIAN NATIONAL LAW 281/91 ON FREE-RANGING DOG MANAGEMENT (ENFORCING THE 'NO-KILL') IN THE LAZIO REGION; DETERMINATION OF MANAGEMENT STANDARDS FOR PUBLIC SHELTERS

E Natoli[1], S Cafazzo[1], O Lai[2], L Maragliano[1], N Cerini[3], M Guarducci[2], F Carlevaro[3], M Di Paolo[2], L Carlevaro[3], F Scholl[2], E Bucci[2] and R Scarcella[3]

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Among European countries, only in Italy, Austria and some regions of Spain, the law forbids the euthanatization of free-ranging dogs, unless they have an incurable illness or proved to be dangerous. The Italian National Law 281 of 1991 makes compulsory the registration of owned dogs and supports spay/neuter programs, essential for prevention but, unfortunately, not thoroughly enforced. Therefore, in spite of an average of 1000 adoptions over 1500 new intakes per year (considering only the public dog shelter), the no-kill policy has brought about a stable overpopulation in shelters and, as a result, higher costs of management and welfare problems since some dogs remain in the shelter for life.

In 2004-2008, the Istituto Zooprofilattico Sperimentale del Lazio e della Toscana carried out a study to verify the effects of the Italian National Law 281/91 on free-ranging dog management in the Lazio Region. One of the aims of this study was the dog welfare level assessment in a shelter sample. Out of 47 shelters in the Lazio Region, we have analysed 8 shelters in details, 7 of which were traditional shelters, and 1 was a sort of "dog park shelter" where dogs lived all together in big fenced areas. 79 dogs were tested for a total of 395 hours of behavioural observation (5 hours/dog). A blood sample was taken for each dog in order to determine the individual blood concentration of cortisol and of oxidative damage molecules, as well as the individual total blood antioxidant capacity. The dogs were selected at random among dogs aged between two and seven years and with a permanence in the shelter between two and three years.

Dog density influenced neither dog behaviour nor cortisol and oxidative stress level in the blood; on the contrary, regardless box size, the possibility to go out of the box for a regular walk did influence both behavioural and physiological parameters; in fact, dogs that had the opportunity to go out of the box showed lower displacing activities, in particular frequency of scratching and body shaking (Kruskal-Wallis Test: $H = 7.90$, $N = 76$, $p = 0.02$; $H = 10.03$, $N = 77$, $p = 0.01$, respectively) and had lower haematic level of cortisol (Anova: $F_{3,93} = 3.77$; $P = 0.01$) and a better ratio between dROMs and total blood antioxidant capacity (Anova $F_{3,93} = 15.04$; $P = 0.001$). Behavioural and physiological results in terms of blood concentration of cortisol, but not for what concerns oxidative stress, suggest that dogs housed in the "dog park shelter", despite a fairly high density, showed a good level of welfare.

In conclusion, in the Lazio Region there were over 11,000 dogs, censused during this study, living in shelters sometimes for the entire life. In our opinion, the no-kill policy deserves a wider debate about costs of management and level of welfare of sheltered dogs, based on data coming from countries where it has been enforced by law.
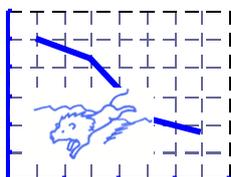
DEVELOPMENT OF THE EFSA GUIDANCE ON RISK ASSESSMENT FOR ANIMAL WELFARE

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The European Food Safety Authority (EFSA) provides independent scientific assessments on risks associated with food and feed, plant health, environment, animal health, and animal welfare by using, whenever possible, a Risk Assessment (RA) approach. EFSA's tasks also include the promotion of the development of uniform RA methodologies in the above-mentioned fields.

Since 2003, the Animal Health and Welfare (AHAW) Panel of EFSA adopted, 32 scientific opinions on Animal Welfare (AW) dealing with breeding and fattening pigs, laboratory animals, animal transport, fish welfare, stunning and killing of animals including fish, calves and dairy cows welfare and stunning and killing of seals. Several RA approaches have been followed in these scientific opinions.

In December 2005, the EFSA Scientific Colloquium "Principles of Risk Assessment of Food Producing Animals" concluded that, although different guidelines for RA related to food microbiological (Codex) and animal health issues (OIE) are available, no specific standardized RA methodology exists in the field of AW. The need to set up and harmonise such a methodology was therefore evidenced.

A self mandate was launched in September 2007 (EFSA-Q-2007-168) to develop guidelines and working procedures for AW RA. The guidelines will be specially focused on four main AW issues: housing, management, transport, stunning and killing. For each AW issue, the species and animal categories will be firstly identified together with all possible scenarios (e.g. transport of pigs during long journeys: different temperatures, humidity conditions, air speeds and qualities, resting periods, feeding and watering schedules, animal densities). Afterward, for each scenario, risk factors (hazards) and consequences (adverse effects) will be identified. The methodology applied in the previous EFSA Opinions on AW should be considered as a first approach.

The scope of the Guidance is to provide a harmonised and broad methodology for RA applied to the field of AW. It is aimed to give the scientists of the various working groups the modelling instruments to apply RA methodology to the different AW scenarios. The release of the EFSA Guidance is expected for 2011.
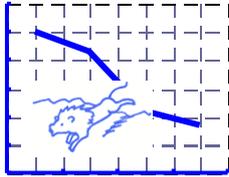
TESTS OF COGNITIVE BIAS CAN INFORM ON PIGS SUBJECTIVE AFFECTIVE STATE

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Affective (emotional) state is accepted as affecting judgement in humans. The aim of this study was to extend previous work using cognitive bias as a measure of affective state in non-human animals to a farm livestock species by validating this methodology for use with the pig (*Sus scrofa*) and examining changes in affective state based on quality of housing environment.

Two groups, each of five gilts, were housed in either an enriched environment, with solid floor, extra space, clean straw, and a variety of toys, or a barren environment, a part-slatted pen conforming to minimum UK legislative standards. The consequences of change in environment were evaluated in a balanced 7-day cross over design. Pigs were initially trained to associate one auditory cue with a pleasant outcome (food) and another auditory cue with an unpleasant outcome (visual/auditory startle). Evidence of differentiation between the sounds was demonstrated in a go/no-go response (approaching a hatch for the pleasant outcome or not approaching when anticipating the unpleasant outcome). The pigs were then tested on two occasions following each housing change (into enriched or barren) using a novel ambiguous auditory stimulus to assess their cognitive bias. The hypothesis was that pigs in an enriched environment would demonstrate an "optimistic" bias, and pigs in a barren pen would show a pessimistic bias. A scan sample of behaviours in the home pen was conducted on day 2 in each housing environment.

The mean proportion of approaches to the hatch varied little between test days and showed a high degree of differentiation, irrespective of housing conditions (0.96 for positive stimulus, 0.12 for negative stimulus, p<0.01). All group 1 pigs showed a reduced proportion of approaches in response to the ambiguous stimulus after moving from the enriched environment to the barren environment (P= 0.031, one tailed sign test), and increase to original response levels after return to the enriched environment   Group 2 pigs, which experienced the environments in the opposite sequence, showed mirror-image changes in response. Behavioural data from the home pen showed that pigs in enriched conditions exhibited more play and exploratory behaviours than those housed in the barren environment, who demonstrated more aggressive behaviours.

This is the first study in farm livestock to successfully demonstrate a significant fluctuation in cognitive bias, reflecting the animals' affective state, as a result of housing conditions. Measuring cognitive bias is a useful (non-invasive) method of assessing an animal's subjective welfare experience.
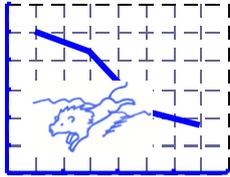
EXTENDING THE COGNITIVE BIAS MODEL OF ANIMAL PSYCHOLOGICAL WELLBEING: ATTENTIONAL BIAS IN NON-HUMAN PRIMATES

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Recent advances in animal welfare research have resulted in the cognitive bias model of animal psychological wellbeing. Cognitive bias describes the way in which changes in affective state are characterised by changes in cognitive processes. Cognitive biases are widely associated with psychological wellbeing in humans, and are implicated in the onset and maintenance of human psychological disorders. To date, studies have demonstrated affect-mediated cognitive bias in birds, rats and dogs. We present data on an aspect of cognitive bias that has not previously been tested in a non-human animal (specifically, attentional bias), together with the first use of a primate model of any form of affect-mediated cognitive bias. Eight rhesus macaques were shown pairs of pictures of conspecific faces, and their gaze towards the faces was coded. Following a veterinary inspection, which served as a stressor, macaques showed a different pattern of gaze towards face pairs compared with when no stressor had been given. We discuss our findings in terms of existing vigilance and avoidance theories of attentional bias for threatening information in humans, and suggest the method presented provides a valuable means of measuring psychological wellbeing in animals.
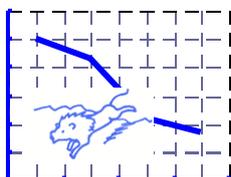
USING ABATTOIR SURVEILLANCE TO QUANTIFY WELFARE PROBLEMS ASSOCIATED WITH TAGGING SHEEP'S EARS

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European Council Directive 92/102/EEC (amended by Regulation number 21/2004), lays down the requirements on identification and registration of animals in the EU to ensure traceability throughout the food-chain. Consequently, sheep born on, or after, the 11th of January 2008, not intended for slaughter within the UK by 12 months of age, are required to be identified by means of a tag in each ear (double tagging) or a tag and a tattoo. If tags are lost, replacement match-up tags or a new set of double tags must be inserted.[1] It is proposed that individual animal recording will improve traceability of animal movements, which is considered a matter of great importance, particularly during a disease outbreak. The UK has the largest sheep population in the EU totalling just under 34 million animals in June 2005, of which half were adult breeding ewes[2] and, in 2005, over 1 million batch movements of sheep took place. The introduction of double tagging is expected to have a greater impact on the UK sheep industry than in other Member States. Concerns regarding the welfare implications of additional tagging procedures have been raised. This study aims to quantify the welfare problems associated with the implementation of the new legislation. A total of 1,028 lambs were assessed *ante-mortem* at abattoir lairages for signs of tag-related discomfort. A total of 897 lambs' heads were examined in detail *post-mortem* from which data were collected on farm identification, animal age, number and type of tags present and presence of lesions associated with tagging. Results show that signs of discomfort were observed at a very low prevalence *ante-mortem*. Lambs' heads examined *post-mortem* originated from 59 different farms. Most (85%) were single tagged, 15% were double tagged, and 1% were slaughtered without any identification tag. Tags were either plastic loop (91%) or two-piece rigid type (9%). Of heads inspected, 14% presented ear tag-associated lesions, with 3.4% of those being of an acute inflammatory nature, 49.5% chronic inflammation and 44% showing suppuration. Double tagged lambs were more likely to have a tag-associated ear lesion (Chi-squared; P<0.01). Data are currently being collected from adult animals and factors associated with tagging injury investigated. Best-practice guidelines will be developed for the industry to minimise welfare compromise, whilst maintaining a traceable system of food production. These preliminary results contribute to an informed and evidence-based discussion on the impact that double tagging requirement might have on sheep welfare.

Reference List

1. **Defra (2008a)** Livestock movements, identification and tracing: Sheep and goats - Key documents http://www.defra.gov.uk/animalh/id-move/sheep-goats/eid/key-docs.htm Accessed September 2008.
2. **Defra (2008b)** UK EID Evidence Report Electronic identification of sheep and goats: Commission report in connection with article 9(4) of Regulation (EC) No 21/2004.
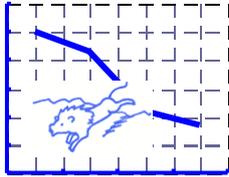
MATERNAL STRESS AND TAIL DOCKING IN JUVENILE FEMALE PIGS: EFFECTS ON MECHANICAL FORCE SENSITIVITY AND RESPONSES TO ACUTE INFLAMMATORY CHALLENGE

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The objective of this study was to identify whether an *in-utero* pre-natal stress (PNS) challenge (social mixing of gilts during 2nd trimester of pregnancy) and early life tissue trauma (tail-docking) caused long-term alterations in nociceptive responses in juvenile pigs (aged c. 8 weeks). Robust and reliable methods for measuring nociceptive responses in juvenile pigs were developed based on mechanical stimulation of the tail base (von Frey filaments) and hind foot (plantar stimulator). In addition, a model of acute inflammatory pain (intradermal injection 0.2ml capsaicin into tail root) was used to establish if the maternal and neonatal treatments affected nociceptive responses to inflammatory challenge. These approaches were used in a 2x2 study on sixty-one female pigs from four treatment groups: control intact [CI]; control tail docked [CD]; mixed intact [MI]; mixed tail docked [MD].

PNS pigs had higher (p<0.05) response thresholds (lower sensitivity) to punctate mechanical stimulation of the tail root than control pigs, either tail-docked or intact. Baseline punctate mechanical thresholds were 37% and 24% higher in the MI and MD pigs than in their respective control groups. PNS pigs also showed significantly higher (p<0.05) plantar mechanical thresholds following noxious mechanical stimulation of the foot. PNS piglets had significantly attenuated (p<0.05) responses to acute inflammatory challenge with capsaicin, whether intact or tail-docked. Integrated nociceptive threshold responses vs. time (AUC_{0-240} min) were significantly higher (p<0.05) in both PNS groups than in unmixed control groups after inflammatory challenge (MI vs. CI 54%, MD vs. CD 38%). Plantar mechanical thresholds did not alter over time within any of the treatment groups in response to capsaicin injection into the tail root.

Tail-docking had no long term impact on baseline threshold sensitivity to punctate mechanical stimulation measured local to the site of tail injury or on noxious mechanical sensitivity measured on the plantar surface of the hind foot. Tail-docking did not alter the duration or intensity of capsaicin-induced mechanical hyperalgesia. These findings suggest that gilts subjected to stress during gestation produce an offspring phenotype with higher thresholds to noxious mechanical stimulation than those from non-stressed gilts.
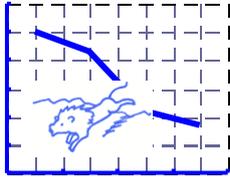
HOW HUNGRY IS TOO HUNGRY? IMPAIRED LEARNING LEADS TO POORER PAYOFFS IN HUNGRY BROILER BREEDERS

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Giving an animal what it wants can contribute to the animal's welfare. Choice tests are one way of identifying what an animal wants. However, stress may affect the cognitive capacities of the animal, which can lead to spurious results within choice test apparatus. Hunger can be seen as both a motivator and a stressor and is a serious welfare problem for chronically food deprived broiler breeder chickens. Conventionally feed restricted broiler breeders are expected to be highly motivated to obtain additional feed but does the degree of hunger affect their ability to learn to use cues to identify more rewarding dietary options?

This was investigated by using a closed economy Y-maze task to determine the effects of feed restriction on broiler breeder ability to learn a food quantity discrimination task. The task was to associate black and white arms with large and small quantities of feed. Birds were reared to three different growth curves by means of severe (n=12), moderate (n=12) or very mild feed restriction (n=12). Absence of learning maintained the birds on their respective level of feed restriction. Learning the task and selecting the larger food option allowed birds to increase their feed intake. Time taken to traverse the Y-maze was also measured.

Birds from all treatment groups traversed the Y-maze more quickly over time irrespective of group indicating that they had learnt that running down the Y-maze arms was associated with a rewarding outcome (food) (p<0.001). However, feed restriction had a significant negative affect on the birds' ability to learn to associate the black and white training cues with differences in food quantity (p=0.014). Consequently, both relative and absolute increases in average payoffs in terms of daily feed gains disproportionately accrued to the less feed restricted treatment groups.

It is concluded that hunger affects the ability of broiler breeders to learn hunger-relevant environmental cues, perhaps by narrowing their attention such that they ignore potentially relevant contextual cues. However, low overall group success rates demonstrate that this task was difficult to learn even for less hunger-stressed birds. Therefore, Y-maze choice tests may not be the most appropriate method for determining hungry broiler breeder preferences between conventional and alternative diets (e.g. added fibre) designed to alleviate hunger.
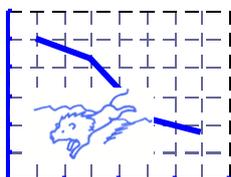
THE WELFARE OF UK FREE-RANGE LAYER HENS PRIOR TO DEPOPULATION: USING DATA FROM CAPTURED HENS

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The welfare of layer hens remains an issue for the food industry, consumers, lobby groups and legislators. Impacts on animal welfare can have cumulative effects, suggesting that indicators might be best measured toward the end of the hen's commercial life, although this will inevitably skew the data as some animals will have died or been culled prior to this. On-farm welfare examinations of layer hens are usually conducted at a distance from the hen - here we report data from captured hens which allows a more detailed and accurate welfare assessment.

We visited 23 free-range layer farms throughout the UK within 5 weeks prior to the flock being depopulated at approximately 72 weeks of age. On each farm, we captured 30 hens indoors and 20 outdoors and examined these for a range of welfare indicators including evidence of beak deformation, soiling, cannibalism, damage to the skin, feathers or vent, and prolapse. These were all scored on a 4 point scale from 0 being 'no damage' to 4 being 'very much damage'. We palpated the keel bone to assess breaks or deformities and scored these as 0 being 'no damage', 1 being a 'single break or deformity', or 2 being '2 injuries or one severe injury'. We also counted the number of swollen toes, and examined 100 eggs on each farm for evidence of calcification, blood or deformation.

Overall, 20.6% of hens had a beak deformity, 81.2% had damage to the head or comb most likely from pecking, 99% had feather damage, 30.8% had been vent pecked, 19.4% had prolapsed, 30.5% had 1 or more swollen toes (other foot problems were also evident), and 62.1% had a broken or deformed keel. Flock means were calculated for each of the welfare indicators and from these means, an overall mean score was calculated, as presented in the Table.

	Overall mean of flock-means score (SEM)
Beak deformation	0.247 (0.044)
Plumage soiling	0.295 (0.067)
Cannibalism	0.012 (0.005)
Comb or head damage	1.152 (0.065)
Mean plumage damage*	1.413 (0.095)
Vent pecking damage	0.642 (0.162)
Prolapse	0.304 (0.051)
Number of swollen toes	0.592 (0.087)
Keel damage (score 0-2)	0.926 (0.067)
% eggs with calcification spots	6.565 (1.149)
% eggs with blood stains	4.000 (0.744)
% eggs with deformities	7.261 (1.504)

*The mean score of 5 body areas scored for plumage damage

The indicators scored here have a range of possible welfare consequences. Some indicate potentially minor welfare concerns (e.g. plumage soiling, minor feather damage) however, others indicate a likely much greater welfare compromise (e.g. vent pecking). Moreover, some of these greater welfare concerns (e.g. prolapse, keel damage), although clearly prevalent in the UK national flock, are unlikely to be recorded during on-farm assessment protocols which do not require capture of the hens for close inspection.