# Recent advances in animal welfare science VII

## Virtual UFAW Animal Welfare Conference

**30th June -1st July 2020**

#VCUFAW2020

UFAW
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*Science in the Service of Animal Welfare*

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# Welcome to the Virtual UFAW Conference 2020

Welcome to the 2020 UFAW conference. We are delighted to be welcoming delegates from over 46 countries to this, our first ever online conference. One of the few upsides of the global coronavirus pandemic is that although we have had to cancel our planned symposium which was to be held in Birmingham in the UK we are now able to bring the programme from that meeting to a much larger global audience, albeit in virtual form.

The field of animal welfare science is a cross-disciplinary area of study that seeks to offer guidance and find solutions to the challenges raised by our caring for and interactions with both kept and wild animals. As part of its on-going commitment to improving animal welfare through increased scientific understanding of animals' needs and how these can be met, UFAW is holding the seventh of its series of one day conferences on 'Recent advances in animal welfare science'.

This symposium is intended to provide a platform at which both established animal welfare scientists and early career researchers can discuss their work and a forum for the broader community of scientists, veterinarians and others concerned with animal welfare can share knowledge and practice and discuss advances. We hope that it achieves these aims and fosters links between individuals and within the community.

We would like to thank all those who are contributing to the meeting, as speakers or as poster presenters and whose willingness to take part in an on-line meeting made this conference possible.

Thank you all for registering and thanks especially to those who donated to help UFAW run this conference. UFAW is a charity and without your support we couldn't continue our work to support 'Science in the Service of Animal Welfare'.

If you haven't already, please do consider supporting our work.

- **Become a Member**
  If you would like to stay up to date with all of our activities and also to support our work please consider becoming a member of UFAW if you aren't already – http://www.ufaw.org.uk/membership.

- **Donate**
  If you would like to donate to help us continue our work please visit www.ufaw.org.uk/donate

We look forward to a thought-provoking and engaging couple of days.

**Stephen Wickens and Huw Golledge**
UFAW

# General Information

**Organisers:**
**UFAW,** the Universities Federation for Animal Welfare, is an UK based registered charity that works with the animal welfare science community worldwide to develop and promote improvements in the welfare of farm, companion, laboratory, captive wild animals and those with which we interact in the wild, through scientific and educational activity. To this end, UFAW:

- Promotes and supports developments in the science and technology that underpin advances in animal welfare, including the funding of research through its programme of grants, awards and scholarships.
- Promotes education in animal care and welfare.
- Provides information, organises symposia, conferences and meetings, publishes books, videos, technical reports and the international quarterly scientific journal *Animal Welfare*.
- Provides expert advice to governments and other organisations and helps to draft and amend laws and guidelines.
- Enlists the energies of animal keepers, scientists, veterinarians, lawyers and others who care about animals.

UFAW is an independent organisation, and throughout its history, its work has primarily been funded by donations, subscriptions and legacies.

**UFAW's philosophy: The importance of science to animal welfare:**
Ensuring good welfare is about more than ensuring good health. Animal welfare is about the quality of animals' lives: their feelings. It is now widely agreed, although it is not yet possible to prove absolutely, that many species are sentient - they have the capacity to feel pain and distress, they can suffer and, conversely, be aware of pleasant feelings - and that this matters morally. But how do we assess, from the animal's point of view, what matters to them and how much?

*"Science informs, motivates and facilitates advances in animal welfare by providing a strong evidence base for changing attitudes and practices, and by creating practical and effective solutions to welfare problems."*

UFAW promotes and supports a scientific approach aimed at finding ways to gain insight into what matters to animals, assessing their welfare and improving the quality of their lives through practical developments in all aspects of their care.

Change for the better depends on knowledge, understanding and practical solutions. UFAW believes that good science can inform, motivate and facilitate that change - whether through developments in legislation, professional 'best practice' or the actions of other organisations and individuals.

In promoting and supporting this scientific approach to improving welfare, UFAW's work is wide-ranging and undertaken with many other organisations and individuals - enlisting and informing the energies of animal keepers, scientists, veterinarians, lawyers and others who care about animals.

For more details visit: www.ufaw.org.uk

# SCIENTIFIC PROGRAMME:

# Timetable and Speaker Abstracts

## Programme

**Day 1. 30th June 11.00am – 15.20pm**

**11.00 -11.10 Introduction to meeting**

- **Huw Golledge** (*UFAW, UK*)
  Welcome and Introduction

**11.10 – 12.50 Session 1**

- **Cathy Dwyer** and S Burgess (*SRUC and Moredun Institute, UK*)
  Assessing the welfare impacts of disease: an example with sheep scab
- **Abigail Liston** and S Wolfensohn (*University of Surrey, UK*)
  Welfare study using the animal welfare assessment grid to measure Quality of Life of breeding and experimental Rhesus macaques
- **Andrew Crump**, K Jenkins, EJ Bethell, CP Ferris, H Kabboush, J Weller and G Arnott (*Queen's University Belfast, Liverpool John Moores University and Agri-Food and Biosciences Institute, UK and Purdue University, USA*)
  Integrating behavioural, cognitive, and physiological welfare indicators: An example using pasture access to improve emotional state in dairy cows
- **Lauren Finka**, DS Mills and MJ Farnworth (*Nottingham Trent University and University of Lincoln, UK*)
  Has anthropocentric breed selection disrupted animals' abilities to communicate?

**12.50- 13.20 Break**

**13.20 – 15.20 Session 2**

- **Mariann Molnar** (*Central European University, Hungary)*
  Producer perspectives on farm animal welfare and the intensification of farming in Hungary
- **Elena Armstrong**, JH Guy, V Sandilands, T Boswell and TV Smulders (*Newcastle University and SRUC, UK*)
  Adult hippocampal neurogenesis as a marker of cumulative experience in laying hens
- **Sanne Roelofs** and TD Parsons (*University of Pennsylvania, USA*)
  Measuring judgment bias in group-housed sows
- **Dan Weary** (*University of British Columbia, Canada*)
  A Bayesian conception of animal welfare
- **UFAW Award Presentations**
  UFAW Medal for 'Outstanding Contribution to Animal Welfare Science' / UFAW 'Young Animal Welfare Scientist of the Year'

**15.20 End**

**Day 2. 1st July 11.00am – 15.40pm**

**11.00 – 12.50 Session 3**

- **Elske de Haas**, BT Rodenburg and FA Tuyttens (*Utrecht University, The Netherlands and ILVO, Belgium*)
  Ranging behaviour in organic layers and broilers and the relationship with welfare
- **Laura Kubasiewicz**, J Rodrigues, SL Norris, TL Watson, K Rickards, N Bell, A Judge, Z Raw, and F Burden (*The Donkey Sanctuary, UK*)
  The Welfare Aggregation and Guidance (WAG) tool: A new method to summarise global welfare assessment data for equids
- **Chanakarn Wongsaengchan**, RG Nager, DJ McCafferty and DEF McKeegan (*University of Glasgow, UK*)
  Surface temperature reveals magnitude of restraint stressor, sex differences and lateralisation in rats
- **Irene Camerlink** (*Polish Academy of Sciences, Poland*)
  The importance of micro-expressions in animals' social interactions
- **Adrian Smith**, E Lilley, RE Clutton, KEA Hansen and T Brattelid (*Norecopa, Norwegian University of Life Sciences and Western Norway University of Applied Sciences, Norway and University of Edinburgh and RSPCA, UK*)
  Improving animal welfare and scientific quality: Guidelines for planning animal studies

**12.50- 13.20 Break**

**13.20 – 13.45 Session 4. Workshop**

- **Adrian Smith**, E Lilley, RE Clutton, KEA Hansen and T Brattelid (*Norecopa, Norwegian University of Life Sciences and Western Norway University of Applied Sciences, Norway and University of Edinburgh and RSPCA, UK*)
  Workshop: Improving animal welfare and scientific quality: Guidelines for planning animal studies

**13.45– 14.00 Break**

**14.00 – 15.40 Session 5**

- **Colline Poirier**, H Adriaensen, H Siddle, D Chesneau, C Porte, F Cornilleau, A Boissy, L Calandreau and M Keller (*Newcastle University, UK and INRA Nouzilly and Theix, France*)
  Neuroimaging assessment of chronic stress in sheep
- **Joshua Woodward**, EL Buckland, REP Da Costa, JK Murray and RA Casey (*Dogs Trust, UK*)
  Owner-reported behaviour of rehomed dogs in the first 14 days of adoption
- **Dayane Teixeira**, L Boyle and DE Hidalgo (*Universidad de O´Higgins and Pontificia Universidad Católica de Chile, Chile and TEAGASC, Ireland*)
  Skin temperature of slaughter pigs with tail lesions
- **Dan O'Neill**, H Craven, D Brodbelt, D Church and J Hedley (*RVC, UK*)
  What's up Doc? – Exposing pet rabbit welfare issues using VetCompass veterinary clinical records

**15.40 End**

## ASSESSING THE WELFARE IMPACTS OF DISEASE: AN EXAMPLE WITH SHEEP SCAB

**CM Dwyer [1] and S Burgess [2]**

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Good health, and the absence of disease, is a key component of good animal welfare. Many welfare assessment schemes assess this in a binary way (disease presence or absent) although some do include a means of assessing the severity of disease (e.g. locomotion scoring for lameness). In farm animal medicine the economic cost of a disease (e.g. loss of production, cost of treatment) is frequently considered in prioritising which diseases are the most important targets for industry. The welfare cost to the animal, such as pain, discomfort or malaise, is generally not part of these assessments. However, our recent research suggests that, for sheep, diseases (lameness, mastitis, sheep scab and gastrointestinal parasites) were prioritised by welfare experts as being among the most important welfare issues for sheep. As sheep are most commonly managed extensively in the UK, the risks of diseases being undetected or untreated is greater than for more intensively managed animals, and treatments commonly focus only on tackling the cause of the disease, with disease symptoms remaining untreated. For example, the use of analgesics and anti-inflammatory drugs is very rare for sheep, even though lameness and mastitis are associated with significant amounts of pain. Sheep scab, or psoroptic mange, is a form of allergic dermatitis caused by infestation of the skin surface with the scab mite, *Psoroptes ovis*. It is a highly contagious and endemic disease in UK, and has significant financial impact on sheep farmers. The disease causes intense itchiness, irritation, restlessness and scratching by sheep, which can overwhelm other activities, and lead to significant fleece loss, inflammation, and injuries caused by rubbing. The disease is generally treated with acaricidal drugs, i.e. macrocyclic lactone injectables or organophosphate dips, which kill the mites, but the skin damage and irritation may take a number of days/weeks to resolve fully. We investigated behavioural and physiological welfare indicators of infested sheep and identified behavioural markers (rubbing, biting body, scratching, shaking and head rolling) present from early infestation. The behaviour 'biting body' was still expressed at levels significantly higher than pre-infestation even after treatment. We then investigated the impact of also treating the inflammatory response of infestation alongside killing the mites on indicators of sheep welfare. These data will be discussed as a model for understanding the welfare impact of disease and treatment.

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# WELFARE STUDY USING THE ANIMAL WELFARE ASSESSMENT GRID TO MEASURE QUALITY OF LIFE OF BREEDING AND EXPERIMENTAL RHESUS MACAQUES

**AL Liston and S Wolfensohn**

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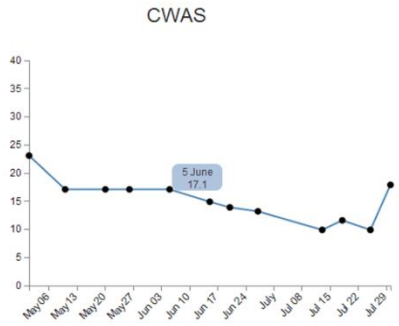
The Animal Welfare Assessment Grid (AWAG) software is a web-based application designed to improve the perception of animal welfare by offering an objective tool for measuring the effects of environmental stressors and welfare for individuals or groups of animals. Welfare is scored using four parameters: physical, psychological, environmental and procedural, which reflect the five freedoms including positive welfare states. Within each of the four parameters are species and situation specific factors, which are scored on a scale of 1-10, where lower scores indicate better welfare. During observational data collection, each factor is scored to reflect the behaviours, clinical condition, contingent events and environment of that animal or group of animals, which is represented as an AWAG score. The software recognises the temporal component of any suffering, which is shown as a graph of the cumulative welfare assessment score (CWAS) (Fig 1) and offers visual representation of welfare at specific time points using a Parameter Radar Chart (Fig 2). The AWAG has potential to be developed into a smartphone app where it can be used to assess the welfare of various animal species. The AWAG has already been validated in experimental primates, a variety of zoo species including birds, highland cattle and laboratory cattle and pigs.



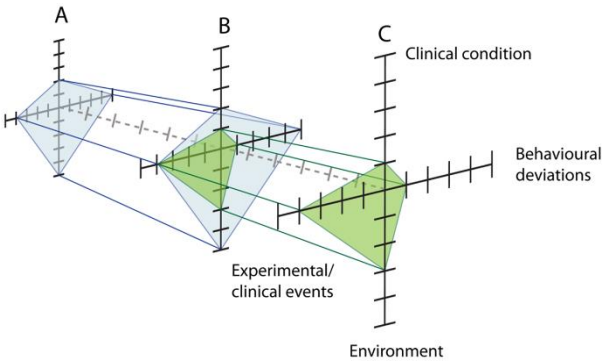




Fig 1. Cumulative Welfare Assessment Score (CWAS) graph. Fig 2. Parameter Radar Chart.

During a six-week pilot study the software was validated in breeding Rhesus macaques. One higher and one lower ranking were selected from four different breeding groups (two high impact and two low impact) and were observed for seven minutes twice daily, respectively. The subsequent study observed the same individuals and aimed to identify stressors and the effect of introducing novel enrichments on their welfare scores. Assessments were taken before, during and after new enrichments were introduced. Data sets from the pilot study were compared to the subsequent study to identify how the introduction of new enrichment impacted the AWAG score. The CWAS graph allowed analysis of specific time points throughout the six-week study which correlated to events that potentially influenced that AWAG score. The CWAS graph helps forecast effects of future interventions and analyse the effects of past events. We hypothesised that the introduction of novel enrichments would result in lower AWAG scores and stressful events or veterinary interventions would result in a higher score, the data supported the latter. There were consistent themes unique to lower or high-ranking individuals. This project has the realistic aim to provide data facilitating delivery of objective improvements to the welfare of breeding groups of Rhesus macaques.

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# INTEGRATING BEHAVIOURAL, COGNITIVE, AND PHYSIOLOGICAL WELFARE INDICATORS: AN EXAMPLE USING PASTURE ACCESS TO IMPROVE EMOTIONAL STATE IN DAIRY COWS

**A Crump [1], K Jenkins [1], EJ Bethell [2], CP Ferris [3], H Kabboush [1], J Weller [4] and G Arnott [1]**

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Dairy cattle are increasingly housed indoors, either year-round or for long stretches of the year. Pasture access is associated with natural behaviours and health benefits, but the effects on cows' psychological wellbeing are poorly understood. Although animals' subjective "feelings" are inaccessible, welfare scientists can measure the behavioural, cognitive, and physiological components of emotion. Adopting an integrative approach, we assessed all three components to compare wellbeing in cattle either with or without access to pasture. Using a crossover design, we gave 29 Holstein-Friesian dairy cows 18 days of overnight pasture access and 18 days of indoor housing. Accelerometers recorded lying disruption and synchronisation. We measured cognitive ("judgement") biases as the latency to approach probe bucket locations intermediate between trained rewarded and unrewarded locations. Shorter latencies indicated a higher expectation of reward, an "optimistic" bias associated with positive emotional states. To quantify sympathetic nervous system activity, we extracted eye temperature from infrared photographs. We analysed the data using linear mixed models. Cows at pasture had longer lying durations ($\chi^2_1$ = 27.51, $p < 0.001$), fewer lying bouts ($\chi^2_1$ = 22.53, $p < 0.001$), and longer lying bouts ($\chi^2_1$ = 25.23, $p < 0.001$), as well as more synchronous herd lying behaviour ($\chi^2_1$ = 230.25, $p < 0.001$). These results are consistent with pasture increasing comfort, decreasing competition, and facilitating internally motivated behaviours. In the judgement bias task, there were no treatment differences in latency to approach the probe or unrewarded locations. However, cows at pasture were slower to the rewarded bucket ($\chi^2_1$ = 22.57, $p < 0.001$). We attribute this to reduced reward anticipation, rather than pessimistic judgement biases, as the indoor treatment encountered fewer positive events. Eye temperature was also lower at pasture ($\chi^2_1$ = 25.11, $p < 0.001$), suggesting greater physiological arousal outdoors. These data are consistent with pasture offering more positive (i.e. excitatory) events. Taking this integrative approach using multiple welfare measures, our results indicate that pasture access induces more positive emotional states than indoor housing. This adds to growing evidence that pasture is important for dairy cow welfare.

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# HAS ANTHROPOCENTRIC BREED SELECTION DISRUPTED ANIMALS' ABILITIES TO COMMUNICATE?

**LR Finka [1,2], DS Mills [2] and MJ Farnworth [1¶]**

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[2] School of Life Sciences, Joseph Bank Laboratories, University of Lincoln, Lincoln, UK
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During their domestication and artificial selection, humans have substantially modified the morphology and thus visual appearance of non-human animals. While research highlights the negative impact of these modifications on physiological functioning, very little is known about their impact on signalling and communication. Facial expressions form an important part of non-verbal communication, although in companion animals, the face is one of their most diverse features. Investigation into the consequence of this diversity relative to facial musculature and the production of visually distinct expressions is therefore important and timely. Using the domestic cat as our model, we applied a new analytical technique in order to understand the impact of breed variation on relative positioning of important landmarks. We then assessed the extent to which expressions known to be associated with a specific underlying state (i.e. pain) could be reliably detected in a morphologically diverse population. A series of x-y facial coordinates were extracted from unique images of 'neutral' domestic cat faces (n = 1888), across 19 breeds. Key sources of shape variation were identified via Principal Components Analysis (PCA) and visualised using geometric morphometrics. The nature and degree of PCA variability within the population was subsequently assessed via a series of non-parametric permutational ANOVAs, Kruskal-Wallis and *post hoc* tests. Significant baseline variation in landmarks were identified at both the cephalic (e.g. brachycephalic, dolichocephalic, mesocephalic) and breed level. We then extracted facial data from images of Domestic Short Haired cats (DSH) (n=25) across two validated conditions; when in pain (post-op, pre-rescue analgesia) and not in pain (post-op, post-analgesia) and combined these with a balanced subset of data from the 19 breeds. All images were given a 'facial pain score' (FPS, based on a single pain-validated PC). The degree to which FPSs varied at both the cephalic and breed level was assessed via Kruskal-Wallis and *post hoc* tests. FPSs could successfully differentiate between 'pain' and 'no pain' in DSH cats, however there was considerable overlap between FPSs in the 'pain' population and the neutral faces of other breeds. Additionally, for several paedomorphic-looking breeds, their neutral expressions produced FPSs indicative of greater pain, compared to most other breeds, including DSH cats in pain. This highlights the degree to which anthropocentric breed selection has potentially disrupted the communicative content of the face, at the same time selecting for negatively valenced facial forms that might elicit greater caring tendencies at a subconscious level.

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## PRODUCER PERSPECTIVES ON FARM ANIMAL WELFARE AND THE INTENSIFICATION OF FARMING IN HUNGARY

**MSZ Molnar**

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While most previous research on animal welfare and intensification involving farmers as participants has occurred in Western Europe and the English-speaking countries where the shift to confinement production is far advanced, Hungary presents a valuable study opportunity because it still has a mixture of emerging intensified systems, plus a resurgence of non-confinement systems, and is part of the European regulatory system. Farmers perceptions were explored in 24 in-depth semi-structured interviews with Hungarian pig farmers operating either confinement or alternative systems, to understand the values they apply and how they deal with regulatory systems designed for the more uniformly confinement systems in western Europe. Confinement and alternative farmers are found to share fundamental "core values" and believe that welfare is better in traditional farming systems. This belief is consistently applied in the case of alternative farmers when producing for the market and their own consumption. In the case of confinement farmers, small- to medium-scale producers (around 400 sow operations) applied their principles consistently for what they consumed, but were ready to move away from "ideal" conditions for products sold on the market, while large scale producers (above 1000 sows) did not pursue ideal conditions for producing for the market or their own consumption. These "context specific" values of farmers are found to represent the immediate concerns of farmers, rather than their true ethical principles. Confinement producers also reported intense economic pressures induced by competitive pressures and fluctuating prices of finished pigs on the mainstream market. Producers using confinement systems also reported "technological lock-in" whereby a large investment in facilities prevented them from making major changes in production methods, and small- to medium-scale confinement producers felt forced to increase their scale of operation in order to maintain income amidst low profit. Alternative farmers, on the other hand, were economically more resilient because they sell into niche markets, use inexpensive technologies, and typically produce a diversity of agricultural products which buffer periods of low profit in any one commodity. The data suggest that a successful livestock welfare reform will depend on extending current problem-solving approaches to incorporate external factors such as economic pressures, plus a regulatory system that is developed with greater consultation with producers, and find incentives to encourage farmers to act on their core values.

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## ADULT HIPPOCAMPAL NEUROGENESIS AS A MARKER OF CUMULATIVE EXPERIENCE IN LAYING HENS

**EA Armstrong [1,2], JH Guy [2,3], V Sandilands [4], T Boswell [2,3] and TV Smulders [1,2]**

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Adult hippocampal neurogenesis (AHN) is a process whereby new neurons are produced and integrated in the hippocampal area of the brain throughout an animal's lifespan. AHN in mammals and birds is responsive to environmental factors. Specifically, the number of new-born cells generated is decreased by chronic negative stress and pain, but increased by experiences generally associated with positive mood, such as exercise, environmental enrichment and antidepressant treatment. Applying this objective biomarker of affective state to laying hen welfare has revealed several findings with implications for commercial management. Firstly, reduced AHN in hens with severe naturally occurring fractures to the keel bone suggests that this injury is sufficiently painful to constitute a source of chronic stress and associated negative affect. Secondly, whilst overall AHN did not differ between birds from a colony group-cage system and those from a multi-tiered system with a range (run by the same UK production company), birds of poor physical condition had lower AHN levels than birds of good physical condition within both systems. This highlights the importance of variation present within commercial housing systems, and suggests that systems producing fewer poor condition birds are associated with greater overall welfare.

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## MEASURING JUDGMENT BIAS IN GROUP-HOUSED SOWS

**S Roelofs and TD Parsons**

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Judgment bias has been proposed as a cognitive measure of animal welfare, allowing for assessment of both positive and negative emotional states. However, there are potential limitations to judgment bias tasks' suitability for animal welfare assessment. Discrimination training prior to judgment bias testing can be extensive, limiting ease of data collection. Additionally, it may result in learner bias, where only the welfare of animals that completed training can be assessed. Based on previous work in our group, we evaluated an improved judgment bias task for group-housed sows, focusing on its practical applicability as a welfare measure and investigating social rank as a potential confounding influence.

Fifteen group-housed gilts, selected on stage of gestation, were trained in a spatial discrimination paradigm. A row of five equally spaced goal-boxes was used to provide spatial cues. An open goal-box at either end of the row served as either a positive cue signaling a food reward, or a negative cue signaling non-reward. Gilts were trained to approach an open positive goal-box and to not approach an open negative goal-box. After completing training, a gilt's response to an open goal-box at the intermediate locations was scored as indicative of judgment bias. A logistic regression model was used to assess effects of cue type and social rank on optimistic (approach) responses. Social rank was characterized as feed order, i.e. the daily order in which gilts entered the feed station.

All gilts completed discrimination training, requiring 4.27 ± 1.03 training sessions (mean ± SD). Cue type affected optimistic responding, with gilts showing a gradual increase in optimistic responses from negative to intermediate to positive cues ($\chi^2$ = 505.48, *df* = 1, *P* < 0.001). The task successfully captured individual variation in judgment bias, with mean optimistic choice percentage ranging from 33.5 to 72.5%. Social rank, as measured by feed order, did not affect the gilts' performance in the task ($\chi^2$ = 1.54, *df* = 1, *P* = 0.214).

Our results confirm that judgment bias can be assessed in sows after only a short period of discrimination training. Furthermore, the high success rate of animals completing training suggests learner bias does not have to be a limiting factor of judgment bias tasks. Finally, based on our results social rank need not be a confounding influence when capturing judgment bias in group-housed sows. Further studies incorporating additional measures of social hierarchy are encouraged.

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## A BAYESIAN CONCEPTION OF ANIMAL WELFARE

**DM Weary**

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In this presentation I will argue that the way animals perceive and understand welfare-relevant stimuli is affected by their expectations, and vice versa. According to Bayes' theorem, beliefs about the probability of an event are based on prior expectations, updated by new data as this becomes available. This consideration of Bayesian processing provides a number of useful insights into animal suffering, shifting the focus from afferent inputs to how the expectations of the animal direct attention and change the way that these bottom-up inputs are evaluated. The expectations of animals are shaped by what they are exposed to and what they learn from these exposures, as determined by process including stimulus generalization, fear conditioning and social learning. A Bayesian perspective reinforces the importance of understanding the interplay between affective experiences and cognitive processing. I suggest, for example, that acute pain or fear can interfere with other perceptual inputs and prevent cognitive processing, and that this perceptual and cognitive 'shutting down' will in turn interfere with the processes of updating and accessing beliefs and expectations about future events (in effect 'blinding' the animal). The practical value of this perspective is that it allows us to better identify conditions under which otherwise unpleasant sensory inputs may be perceived as neutral and otherwise neutral inputs may be perceived as unpleasant. It also points to importance of the summative effects of previous experiences, including how the mismanagement of these experiences may result in substantial (and perhaps under recognized) animal suffering, and alternatively, how the provision of positive experiences can be used to shift current expectations, such that a negative procedure becomes less unpleasant. This approach highlights the importance certain approaches to welfare assessment. For example, it reinforces the value of directly assessing expectations in animals, including work on cognitive bias and mood, and suggests that new work should focus on changes in perception, recall and other aspects of cognitive functioning that interfere with Bayesian processing. I conclude that a Bayesian conception of animal welfare provides a useful basis for reformulating scientific approaches to reducing suffering in animals.

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## UFAW MEDAL FOR 'OUTSTANDING CONTRIBUTION TO ANIMAL WELFARE SCIENCE'
## UFAW 'YOUNG ANIMAL WELFARE SCIENTIST OF THE YEAR'

The **UFAW Medal for Outstanding Contributions to Animal Welfare Science** is a prize that recognises the exceptional achievements of an individual scientist who has made fundamental contributions to the advancement of animal welfare over a number of years. The award is open to individuals whose research, teaching, service and advocacy has had international impact and significantly benefited the welfare of animals. Previous winners have been:

- 2019 Professor Paul Hemsworth (University of Melbourne, Australia)
- 2018 Professor Paul Flecknell (Newcastle University, UK)
- 2017 Professor Sandra Edwards (Newcastle University, UK) and Professor Jeff Rushen (University of British Columbia, Canada)
- 2016 Professor Donald Broom (University of Cambridge, UK) and Professor Christopher Wathes (The Royal Veterinary College, UK)
- 2015 Professor David Mellor (Massey University, New Zealand) and Professor Georgia Mason (University of Guelph, Canada)
- 2014 Professor Mike Mendl (University of Bristol, UK) and Professor David Fraser (University of British Columbia, Canada)
- 2013 Professor John Webster (University of Bristol, UK) and Professor Peter Sandøe (University of Copenhagen, Denmark)
- 2012 Professor Christine Nicol (University of Bristol, UK) and Professor Marian Stamp Dawkins (University of Oxford, UK)
- 2011 Professor Ian Duncan (University of Guelph, Canada)

The **UFAW Young Animal Welfare Scientist of the Year Award** is a prize that recognises the achievements of young scientists who have made significant contributions to improving the welfare of animals. The award is open to students who are currently studying for a doctoral degree and to individuals who are within six years of the end of their PhD work.

Previous winners have been:

- 2019 Dr Marisa Eramus (Michigan State University, USA)
- 2018 Dr Rebecca Meagher (University of Reading, UK)
- 2017 Dr Pol Llonch (Universitat Autonoma de Barcelona, Spain)
- 2016 Dr Rowena Packer (The Royal Veterinary College, UK)
- 2015 Dr Jasmeet Kaler (University of Nottingham, UK)
- 2014 Dr Lisbet Pluym (Ghent University, Belgium)
- 2013 Dr Nuno Franco (Institute of Molecular and Cell Biology, Porto, Portugal)
- 2012 Dr Charlotte Burn (The Royal Veterinary College, UK)
- 2011 Dr Lucy Asher (University of Nottingham, UK), Dr Emma Baxter (Scottish Agricultural College, UK) and Dr Lisa Collins (Queen's University Belfast, UK)

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## RANGING BEHAVIOUR IN ORGANIC LAYERS AND BROILERS AND THE RELATIONSHIP WITH WELFARE

**EN de Haas [12], BT Rodenburg [1] and FA Tuyttens [2]**

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Offering chickens the possibility to roam outdoors aims to improve their welfare in the chicken industry. But, not all chickens use to range to the full extent. Whether variation in ranging behaviour of chicken is related to their welfare is not fully understood, partly because ranging behaviour of individuals in a flock is difficult to record. At the ILVO research facility in Belgium, we housed 400 slow growing broiler Sasso chicken in 4 mobile houses (n=100 per house) in 2016 and 202 organic Novogen layers in 2 mobile house (51 per department of the house) from 2018-2019. The range consisted of a forest-like area and a grassland area. We assessed ranging patterns of slow growing broilers and layers by automatic tracking recordings. Ten out of 100 broilers were tracked with Ultra wide band tracking, whereby we were able to monitor their exact location every 6 minutes. All 202 layers were tracked with RFID tracking, whereby we could monitor their presence at current located antennas spread over the range. All animals were assessed for welfare scoring based on development of physical injuries and on fear responses. Physical injuries entailed presence of hock burns, food pad dermatitis and walking disabilities in the broilers. Physical injuries in the layers entailed presence of comb lesions, food pad dermatitis, feather or integument damages and keel bone damage. Our preliminary analysis, does not show relationships between ranging and development of welfare problems in the slow growing broilers or in the layer birds. For both groups, the majority of our birds score relatively low on welfare issues as compared to the scale of severity (e.g. max of 2 gait score for the broilers in a scoring system to 5). We did, however, find variation in ranging patterns over time, with some birds ranging far and often, while others remained close and sporadically ventured further out. Continuing our analysis, we hope to provide answers to the variation in ranging and its relationship with welfare, and the change in preference for certain areas in the range over time.

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## THE WELFARE AGGREGATION AND GUIDANCE (WAG) TOOL: A NEW METHOD TO SUMMARISE GLOBAL WELFARE ASSESSMENT DATA FOR EQUIDS

**LM Kubasiewicz, J Rodrigues, SL Norris, TL Watson, K Rickards, N Bell, A Judge, Z Raw, and F Burden**

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Animal welfare is complex and can be represented by an array of different indicators. There is, however, increasing demand for concise assessments of welfare that can be easily communicated and compared. Methods to aggregate welfare assessments have previously focused on livestock systems and produce a single welfare score, which may not be representative of all aspects of welfare or may incorporate aspects that are not comparable. We propose method to aggregate equid welfare assessments (namely the Equid Assessment Research and Scoping, or 'EARS' tool), which results in grades for five welfare categories: housing conditions, working conditions, health, nutrition and behaviour. The proposed method overcomes the problems associated with existing approaches by using a single aggregation method (decision trees), maintaining a transparent process that incorporates the most important indicators of welfare into each category using a single aggregation step. Through use of the WAG tool, we allow stakeholders to identify locations or groups of equids with the poorest welfare status, provide guidance for the decision-making process when allocating resources aimed at improving equid welfare, and enable changes in welfare as a result of these resources to be measured.

We present the methodology behind the WAG tool, and illustrate its use through two case studies: firstly, a broad scale assessment of global equid welfare to identify the countries with equids in greatest need, out of those with existing welfare data. Secondly, a more detailed comparison of welfare in the brick kilns of Nepal to identify the specific, applied intervention work needed to improve welfare.

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## SURFACE TEMPERATURE REVEALS MAGNITUDE OF RESTRAINT STRESSOR, SEX DIFFERENCES AND LATERALISATION IN RATS

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To assess and improve animal welfare, we need objective welfare indicators that are sensitive to both arousal and valence dimensions of the affective response. Acute stress triggers peripheral vasoconstriction, causing a rapid, short-term drop in skin temperature which can be detected non-invasively with infrared thermography (IRT). Work in birds has shown that IRT captures surface temperature changes reflecting the intensity of acute stressors. Furthermore, IRT detects thermal lateralisation in chickens which could indicate valence since the right hemisphere of the brain is dominant in the processing of predominantly negative emotions while the left hemisphere is dominant when processing reward. However, little is known about surface temperature responses to different intensities of stress in mammals. We used IRT to collect continuous surface temperature measurements of 18 male and 18 female rats (*Rattus norvegicus*) to investigate the sex differences since female rats are underrepresented in studies of stress. Each rat was exposed for one minute to one of three stressors (wire mesh caging, encircling handling or placement in a restraint cone). For the thermal imaging, the rats were placed in a test arena to which they were habituated and filmed for 30 seconds before and 30 minutes after being exposed to the stressor, to obtain individual baseline temperatures and thermal responses to stress respectively. To control for multiple influences (e.g. position, body mass, head angle), we used generalized linear mixed models to determine the effects of stressor intensity, sex, lateralisation and time on tail, eye and ear temperatures. The response over time predicted stressor magnitude, and in general, tail temperature dropped initially then recovered towards the baseline. Final tail temperatures were sometimes higher than baseline. However, the response differed between male and female rats, with the order of the intensity of stressors in female rats being opposite to that in males. Additionally, after the initial cooling of the tail, the temperature never recovered or exceeded baseline in female rats during filming. Eye and ear surface temperatures increased post-stressor with a significantly stronger response in the right side. The results suggest that IRT can capture stressor intensity and has the potential to become a validated, non-invasive and continuous method of animal welfare assessment in unrestrained mammals. Further, it has the potential to be sensitive to both arousal and valence. The marked difference in the response of male and female rats emphasizes the importance of using both sexes in stress-related research.

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## THE IMPORTANCE OF MICRO-EXPRESSIONS TO ANIMALS' SOCIAL INTERACTIONS

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Animal communication predominantly consists of subtle minute movements, which often only become more overt during high arousal, e.g. when there are imminent threats. As animal welfare research increasingly investigates potential indicators of positive emotional states, there is a need to better understand animals' day-to-day subtle communication and body language. In most species, this knowledge is largely absent. The study of micro-expressions, originating from human psychology, may offer new ways to discover and understand subtle communication. Micro-expressions, including among others facial expressions and minute movements, are typically measured as actions occurring in fractions of a second, up to 4 seconds. The aim of the current work is to provide an example of how micro-expressions can be included in ethograms and how this can contribute to the study of social interactions. Thirty-two free-ranging male and female growing pigs (*Sus scrofa*) and 17 sows on pasture were each observed for 30 minutes. The ethogram included 25 *micro-behaviours* (as subclass of the broader *micro-expressions*) related to positive and neutral social interactions. For the growing pigs, 967 micro-behaviours related to social interactions were recorded, equaling to, on average, one micro-behaviour per minute. The most observed micro-behaviour was nose-head proximity (25.8% of the observations), followed by nose-snout proximity (12.4%), sniffing the other within a distance of <30cm (12.1%), avoidance (12.5%) and approach (9.8%). The frequency of close proximity (<30 cm) towards the head, and especially face and snout, was 8-14 times greater than the frequency of contact to the face or snout. In contrast, when pigs nosed the body of another (excluding the head) there was approximately 1.3 times more contact (i.e. touch) as compared to proximity. The behaviours nose-nose press, nose-eye contact, grooming body and nose-in-mouth were not seen in this population. For the sows, 500 micro-behaviours related to social interactions were recorded, showing similarly on average one micro-behaviour per minute. The main micro-behaviours in the sows were nose-snout proximity (23.9%), nose-head proximity (15.1%), approach (15.1%) and sniffing (11.8%). These results from free-range pigs show that they adjust their behaviour depending on whether they approach the head versus other parts of the body of the conspecific. The distinction of touch and close proximity between individuals is currently rarely made in research, but can provide valuable insight in the quality of social relationships. Thus, including micro-expressions in animal behaviour research can be a promising avenue for better understanding animal welfare, especially during low arousal states.

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# IMPROVING ANIMAL WELFARE AND SCIENTIFIC QUALITY: GUIDELINES FOR PLANNING ANIMAL STUDIES

**AJ Smith [1], E Lilley [2], RE Clutton [3], KEA Hansen [4] and T Brattelid [5]**

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Concerns are being raised in many scientific disciplines about the validity of animal experiments, their lack of reproducibility and poor translatability to human medicine. These concerns join the long-standing concerns expressed by animal welfarists and scientists alike about welfare issues.

While these concerns are not new, the efforts to counteract these weaknesses have, since the 1980s, tended to focus on improving the reporting of animal research and testing. Such improvements have certainly been needed, and this work is still not complete, but better reporting cannot affect the quality of studies that have already been carried out. Surely it is more logical to begin at the beginning, and ensure that improvements are implemented from day 1 of planning?

Norecopa has spent considerable time and resources collecting and publishing information on resources which can assist in replacing, reducing and refining animal studies. Based upon experience from this work, as well as long-standing dialogue with regulators, scientists, animal carers and technicians, Norecopa and British colleagues have published the PREPARE guidelines for planning and conducting work which may involve the use of animals or animal material. PREPARE (Planning Research involving Experimental Procedures on Animals: REcommendations for Excellence), contains a 2-page checklist with 15 topics, available at present in 20 languages. However, PREPARE is far more than a checklist: its added value consists of comprehensive webpages describing each of the 15 topics in detail. Emphasis is placed on collaboration with animal facilities and refinement of procedures, not just on experimental design. Large numbers of links to global resources related to each topic are provided (https://norecopa.no/PREPARE).

Checklists are in use in many professions, to ensure quality of their products. Airline pilots, however experienced, use 10-15 checklists even on short flights within Europe, and they have an envious safety record to show for it. Checklists ensure that procedures are not forgotten and that they are carried out in the correct order, as well as encouraging collaboration with all those involved. Pilots do not wait with reading their checklists until they are at the arrival gate.

Good planning, in which scientists are alerted to the essential steps before they become an insurmountable problem, will not only improve scientific validity and animal welfare, but will also drastically reduce the risk of manuscript rejection at the publication stage. PREPARE will in addition facilitate compliance with reporting requirements by journals: “We ARRIVEd because we were PREPAREd”. Case studies will be presented.

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## NEUROIMAGING ASSESSMENT OF CHRONIC STRESS IN SHEEP

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A new way to assess animal welfare, based on hippocampal plasticity, has been recently proposed. Indeed, hippocampal plasticity correlates with moods, responds in opposite directive to positive and negative events and seems to integrate affective experiences over long periods of time. The vast majority of the evidence supporting the hippocampus involvement in affective processes comes from rodents and (human and non-human) primates. The hippocampus is an evolutionarily conserved region, and its regulatory role of the HPA axis is similar in all mammals. However, to assess the welfare of species other than primates and rodents, researchers first need to verify that their chosen hippocampal plasticity marker is sensitive to a validated manipulation of affective state. In this study, we tested whether hippocampal plasticity measured by MRI can detect the effect of chronic stress in sheep. Using a two-by-two design, a group of ewes (N=12) were exposed to a chronic mild stress paradigm (including restrain, social isolation, exposition to blood odour) during four weeks, while the control group (N=12) was left undisturbed. MRI brain scans and behavioural tests of emotionality (open-field, novel object and novel human tests) were performed before and after the four-week period. Analyses revealed a reduced increase of hippocampal grey matter between time points in the stressed group, indicating that hippocampal plasticity was altered by the chronic stress paradigm in the expected direction. Behavioural tests revealed a decrease of emotionality in both groups, suggesting that these tests are sensitive to the current affective state induced by the tests (i.e. reduced fear due to familiarity with the test) rather than reflecting long-lasting affective states. While the availability of MRI scanners remains limited to few experimental farms, the neuroimaging approach opens the possibility to test the welfare impact of procedures routinely used in sheep, which might provide useful information to a large number of stakeholders.

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## OWNER-REPORTED BEHAVIOUR OF REHOMED DOGS IN THE FIRST 14 DAYS OF ADOPTION

**JL Woodward, EL Buckland, REP Da Costa, JK Murray and RA Casey**

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Behavioural problems are commonly reported when returning adopted dogs to rehoming organisations. Supporting owners in managing their dogs' behaviour after adoption is of importance for welfare. This study aimed to investigate reported occurrences of behaviours in dogs in the first weeks after adoption.

Adoptions for 1419 dogs from 20 UK Dogs Trust rehoming centres were analysed. Adoptions were included if the owner opted into, and completed, two telephone calls at approximately 2 days (T1) and 14 days (T2) after adoption and answered standardised questions on specific behaviours of the dogs towards people, behaviour when left alone and other behaviours reported to be a problem. Adopters were offered support if specific behaviours were reported. McNemar tests with exact binomial probability calculations were used to test against the null hypothesis of marginal homogeneity in reports of five behaviours at T1 and T2 using paired data.

Snapping/biting/nipping towards the owner or adult household member was reported significantly more in dogs at T2 only (P = 0.001; not reported T1 or T2 = 1269, T1 only = 42, T2 only = 81, T1 and T2 = 27), as was scratching or damage to the doorway or non-toy and non-food items when left alone or separated from the adopter in the house (P = 0.038; not reported T1 or T2 = 1295, T1 only = 45, T2 only = 68, T1 and T2 = 11). No within-dog differences were found for difficulty walking on the lead, e.g. pulling or reluctance to walk (P = 0.871; not reported T1 or T2 = 1380, T1 only = 18, T2 only = 20, T1 and T2 = 1), barking excessively or barking at dogs, people, or inanimate objects (P = 0.230; not reported T1 or T2 = 1394, T1 only = 16, T2 only = 9, T1 and T2 = 0), or toileting inside the home (P = 1.000; not reported T1 or T2 = 1387, T1 only = 15, T2 only = 16, T1 and T2 = 1).

The results highlight the importance of extending behavioural support to owners beyond the first few days of adoption. In this study, behavioural motivation or context was not assessed, therefore, not all reported behaviours may have been problematic (e.g. snapping could have occurred during play). Supporting owners over time may help identify problems early on and help reduce the risk of dogs being returned for a behavioural reason.

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## SKIN TEMPERATURE OF SLAUGHTER PIGS WITH TAIL LESIONS

**DL Teixeira [1], L Boyle [2] and D E Enriquez Hidalgo [3]**

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Tail biting is a major welfare problem in pig production. Extensive investigations into the epidemiology and consequences of tail biting have proved that it also reflects deficiencies in the pigs' health status. Tail lesions are associated with inflammation and changes in the stress physiology and provide a route for introduction of infection into the body, finally resulting in a body temperature increase. The infrared thermography images have being used in different investigations aimed at improving detection of unhealthy animals and fever. The objective of this study was to assess the effect of tail lesion severity on infrared skin temperature of slaughter pigs measured at the tail region and ear base, and to evaluate their association. Pigs were randomly selected in the lairage, containing approximately 200 pigs/lairage pen. Tail lesions were scored according to severity, using a 0-4 scale. In total, 269 study pigs were imaged, both on tail region and ear base; the hotspot of the selected infrared image area was assessed, yielding two values for each study pig. Tail lesion scores 0 and 1 were summed as it was difficult to distinguish healed lesions or mild lesions due to animals dirtiness. The effect of tail lesion score and sex of the pig on the hotspot of the infrared image areas were analysed using generalized linear mixed models. Association between imaged areas were evaluated using Pearson correlation. Increasing tail lesion score was associated with an increase in infrared skin temperature of both tail region and ear base (Tail region: score 0+1 = 32.1±0.28°C; score 2 = 35.0±0.41°C; score 3 = 36.6±0.43°C; score 4 = 36.9±0.37°C; Ear base: score 0+1 = 32.6±0.23°C; score 2 = 34.3±0.33°C; score 3 = 34.6±0.34°C; score 4 = 34.7±0.28°C; $P < 0.0001$ for both). Furthermore, there was an association between both measurements ($r = 0.50$; $P < 0.0001$). The relationship between both measurements suggests that being a victim of tail biting is associated with chronic inflammation and infection, which is showed by the elevated systemic temperature.

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## WHAT'S UP DOC? – EXPOSING PET RABBIT WELFARE ISSUES USING VETCOMPASS VETERINARY CLINICAL RECORDS

**D O'Neill [1], H Craven [1], D Brodbelt [1], D Church [2] and J Hedley [2]**

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Pet rabbits may have a cute fluffy public image but do their real lives mirror this belief? Despite an estimated 1 million UK pet rabbits (*Oryctolagus cuniculus*), limited robust research exists on pet rabbit health but serious welfare issues from extreme conformation and inappropriate housing and diet are often suggested. Human desire for phenotypic variation has led to 50+ breeds and 500+ varieties with consequent breed-specific disease predispositions. Traditionally regarded as children's pets, rabbits were commonly hutched outdoors and fed concentrate-based diets with dental, digestive and body condition implications. This study aimed to characterise common disorders and reasons for mortality of pet rabbits as recorded by veterinary practices in England to start putting hard data being this potential welfare calamity that may be hidden in plain sight.

VetCompass is now the world's largest generator of welfare evidence and shares veterinary clinical records from 30% of UK practices covering 15 million companion animals. This cross-sectional study included 6,349 rabbits attending 107 primary veterinary care clinics. Demographic information was extracted on all rabbits. A random subset were reviewed manually to extract information on all disorders and deaths during 2013.

The median age of the rabbits under care was 3.2 years (IQR 1.6-5.1) and median adult bodyweight was 2.1 kg (IQR 1.7-2.6). The most common breed types described were domestic (31.9%), lop (26.4%) and Netherland dwarf (10.6%). The median age at death was 4.3 years (IQR 2.1-7.0). The most common causes of death were myiasis (10.9%), anorexia (4.9%), recumbency/collapse (4.9%) and ileus (4.3%). The most prevalent disorders were overgrown claw/nails (16.0%), overgrown molar(s) (7.6%), perineal soiling (4.5%), overgrown incisor(s) (4.3%) and ileus (4.2%).

This study is the largest evidence resource to date on the demography, mortality and clinical problems of pet rabbits under veterinary care in England. These results highlight the potential for improved observation, dietary and general care management as opportunities for owners and veterinarians to both prevent and identify issues earlier. The high frequency of dental and digestive issues suggest the need to reconsider standards for breed design, diet and management. Alarmingly common deaths from fly strike emphasise the need for more regular observation of rabbits to detect and remove the predisposing factors for this unacceptable condition. These results can also focus undergraduate and postgraduate training for veterinary professionals towards priority rabbit welfare areas.

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# SCIENTIFIC PROGRAMME:

# Poster Abstracts

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   Agonistic behaviour and mobility of egg-type chickens on alternative housing systems
2. **Balzani A, C Aparacida Vaz do Amaral and A Hanlon** *(University College Dublin, Ireland)*
   Stakeholder perceptions of sexed semen in the dairy industry in Ireland: A case study
3. **Bardhaj L, S Duro, M Shehaj and C Leeb** *(Agricultural University of Tirana, Albania; University of Natural Resources and Life Sciences, Austria)*
   First assessment of weaning and finishing pig welfare in Albania using animal-based parameter
4. **Bari MS, TR Dyall and DLM Campbell** *(University of New England and CSIRO, Armidale, Australia)*
   Do rearing enrichments and ranging influence free-range hen welfare?
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7. **Castellano Bueno J, M Jay, Josephine Panafieu, J Safourcade, M Bateson and C Poirier** *(Newcastle University, UK)*
   "Inactive not alert" as a new indicator of enduring negative affective state in laboratory macaques
8. **Collinson A, R Dean, M Bennett, M Brennan and J Stavisky** *(University of Nottingham and VetPartners, UK)*
   Identifying research priorities for canine surgical sterilisation programmes: What are the unanswered questions?
9. **Cooper JJ, S Marsh, K Wilks, A Watson and A Hargeaves** *(University of Lincoln and Yorkshire Wildlife Park, UK)*
   Citizen polar bear. Use and validation of visitor data to record behaviour of field housed polar bears
10. **Cox EJ and C Mancini** *(The Open University, UK)*
    Towards the assessment of dogs' individual welfare needs: personality, laterality and arousal
11. **Downing J, D Amiouny L Lekang, L Greening and SD McBride** *(Aberystwyth and Hartpury Universities, UK)*
    The effect of altering routine husbandry factors on the quantity and quality of sleep in the horse
12. **Duley A, B Vigors and M Connor** *(University of Edinburgh and Scotland's Rural College, UK)*
    The impact societal shift towards increasing animal welfare concern and negative framing in the media have on Irish farmers' attitudes and perceptions of animal welfare
13. **Eagan BH and D Fraser** *(University of British Columbia, Canada)*
    The effect of animal shelter noise on cat behaviour and welfare
14. **Elwell EJ, S Vaglio, SSK Kaburu and CH Young** *(University of Wolverhampton and Durham University, UK)*
    The use of scent marks to create a novel enrichment to improve the welfare of lemurs
15. **Estévez-Moreno LX, GC Miranda-de la Lama and GA María** *(University of Zaragoza and CITA. Spain)*
    Pet owners' perceptions and keeping practices: Understanding the emerging profiles of the animal-human relationship in Spain
16. **Eze CA, CO Ukwueze and AO Anaga** *(University of Nigeria, Nsukka and Michael Okpara University of Agriculture, Nigeria)*
    Evaluation of analgesic effect of xylazine, tramadol and lignocaine on propofol anaesthesia in West African dwarf (WAD) goat
17. **Gordon J, K Mcilvaney, GT Bergkvist and F Langford** *(University of Edinburgh and Scotland's Rural College, UK)*
    Dental health in dairy cattle – identification of welfare concerns through grimace scale evaluation, post-mortem examination and CT imaging
18. **Greening LM, A Pullen, S Tame and CA Bufton** *(Hartpury University, UK)*
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19. **Griffin K, K Yarnell, C Hall and S Upton** *(Nottingham Trent University, UK)*
    Can we use rest patterns to measure welfare in horses?
20. **Hemingway-Wood O'Dell, MR and JK Margerison** *(University of Nottingham, UK)*
    Effect of housing calves individually or pairs, along with environmental enrichment, on behaviour, feed intake and growth rate of dairy calves
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    Effects of environmental enrichment on dog behavior

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Ventilation attributes: Impact on litter quality and associated bird welfare outcome measures
24. **Iyasere, OS, DE Oyetunji, JO Daramola and M Wheto** *(Federal University of Agriculture, Abeokuta, Nigeria)*
Acute heat stress impairs the cognitive performance of FUNAAB Alpha chickens
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26. **Kinsman RH, RA Casey, TG Knowles, S Tasker, MS Lord, JL Woodward, REP Da Costa, SC Owczarczak-Garstecka and JK Murray** *(Dogs Trust, RVC, University of Bristol, Linnaeus Group and Co-Evolve, UK)*
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A survey investigating public knowledge and perception of the equine welfare crisis
29. **Maggs HC, RM Bennett and AM Ainslie** *(University of Reading, UK)*
An interdisciplinary approach to donkey welfare and their contribution to livelihoods in Northern Ghana
30. **Margerison JK, M Sorely, N Saunders and J Hankin** *(University of Nottingham, UK)*
Effect of breed and peri-natal live weight on suitability of pure and cross bred dairy bull calves for beef production
31. **McCormick WD** *(University of Northampton, UK)*
Feeding our 'fur-babies': The influence and impact of human diet choices on our pet dogs
32. **Mellor E, I Cuthill, G Mason and M Mendl** *(University of Bristol, UK; University of Guelph, Canada)*
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37. **Narayan EJ** *(University of Queensland, Australia)*
Measuring stress in koalas: Minimally-invasive hormone monitoring can advance our knowledge of animal welfare
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The real price of Christmas traditions - Live sale of carp in Poland; Consumer attitudes and welfare impacts
39. **Norris S and L Kubasiewicz** *(The Donkey Sanctuary, UK)*
Equid welfare in Nepalese brick kilns - Application of the Equid Assessment, Research and Scoping Tool
40. **O'Hagan DD and TV Smulders** *(Newcastle University, UK)*
Assessing transient affective state using intracranial recordings of brain oscillations in poultry
41. **Oke OE, JO Akande, ID Sodipo, OS Iyasere, OF Smith and OM Onagbesan** *(Federal University of Agriculture, Abeokuta, Nigeria; University of Lome, Togo)*
Access to legume pastures improved welfare and performance of broiler chickens in a humid tropical environment
42. **Oyetunji DE, OS Iyasere, JO Daramola, M Wheto, OO Akinyemi and HA Muraina** *(Federal University of Agriculture, Abeokuta, Nigeria)*
Behavioural responses of two strains of Nigerian native chickens exposed to different temperature regimen
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44. **Ramirez MA, M Mendl, HR Whay, S Held, SL Lambton and H Telkänranta** *(University of Bristol, UK; NUI Galway, Ireland)*
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46. **Ricci-Bonot C, D Mills, C Nicol and T Romero** *(Lincoln University and RVC, UK)*
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47. **Richmond S and C Mason** *(Humane Slaughter Association, UK)*
Welfare provisions for livestock at markets in the 21st century — The results of a survey of 24 markets across England and Wales carried out between 2017 and 2018
48. **Riley LM and R Hammerton** *(University of Winchester, UK)*
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49. **Rodrigues JB, J Ryding, A Judge, K Rickards, Z Raw and F Burden** *(The Donkey Sanctuary, UK)*
EARS - Equid assessment research and scoping tool: A new approach to analyse, understand and respond to equid welfare problems worldwide
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51. **Rosenberger K, C Nawroth, N Keil, J Langbein and JH Rasmussen** *(Agroscope, Switzerland; Leibniz Institute for Farm Animal Biology, Germany; Texas A&M University, USA)*
EasieRR: An open-access software for HRV-analysis and artefact processing in non-restrained animals
52. **Smith, AJ** (*Norecopa, c/o Norwegian Veterinary Institute, Oslo, Norway)*
Norecopa: PREPARING for better science
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## P1: AGONISTIC BEHAVIOUR AND MOBILITY OF EGG-TYPE CHICKENS ON ALTERNATIVE HOUSING SYSTEMS

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Negative emotions and pain as a result of housing inside conventional battery cages may affect the behavior of egg-type chickens. The bad welfare conditions of hens housed in these cages need to be further emphasized to back up its total eradication, most especially in developing countries of the world. Performance and physiological responses of hens to different intensive housing systems have been severally reported. However, there is paucity of information on likely effects on defensive behavior and mobility of these hens after prolonged stay inside conventional battery cage. Therefore, an investigation was carried out to establish the mobility and defensive behaviors of hens on different housing systems in humid tropics. 225; 8-weeks old each of Nera Black pullets (NBpx) and Lohman Brown pullets (LBpx) were randomly allotted into three housing systems; Conventional Battery Cage (CBc), Deep Litter System (DLs) and Deep Litter System with outside run (DLr) in a Randomized Complete Block Design (RCB). Each housing system constitutes a treatment group with seventy-five chickens in three replicates for each strain. Routine management practices were strictly observed. The chickens were maintained under these respective housing conditions for 24 weeks at the end of which they were tested for their abilities to move about and aggression. For mobility test, each bird from each replicate was freely released and the numbers of step made per minute were recorded. Defensive behavior was measured by monitoring the tendency of each hen from each housing system to peck the handler. Data generated were subjected to qualitative scoring (for defensive behavior) and analysis of variance (mobility) statistically. Both NBpx and LBpx on DLr were more ($p<0.05$) mobile (17.00 ±0.02steps /minutes) than those on DLs (15.00 ±0.02 steps/minutes) and CBc (7.00 ±0.01steps/minutes). Furthermore, both NBpx and LBpx on CBc were more defensive and less friendly than those on DLs and DLr. Meanwhile, these post housing behaviors were not strain dependent hen. The results of this experiment suggest that hens housed inside CBc tend to be more defensive (less friendly) and less mobile than those on DLs and DLr as a result of bad welfare condition of prolonged stay inside conventional battery cages.

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## P2: STAKEHOLDER PERCEPTIONS OF SEXED SEMEN IN THE DAIRY INDUSTRY IN IRELAND: A CASE STUDY

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Stakeholder perceptions of farm animal welfare (FAW) differ depending on knowledge, interests, values and norms regarding livestock. As we might expect, veterinarians' perception of FAW differs to farmers and farmers in turn may differ in their perception about FAW compared to advisors. The complexity of mitigation strategies for FAW issues vary. The case for unwanted surplus or low value male offspring illustrates a complex problem inherent to dairy (cattle and goats) and egg production, and could be described as a wicked problem. Sexed semen is a potential mitigation strategy to increase the proportion of heifer calves and thereby reduce the numbers of male dairy calves. This exploratory study investigates perceptions of key stakeholders to the use of sexed semen as a mitigation tool to reduce the proportion of male dairy calves. An online survey was completed by farmers (N = 6), veterinarians (N = 17) and advisors (N = 11) involved in dairy production in Ireland. All the veterinarians, 80% of the farmers, and only 62% of the advisors believed that the use of sexed semen has a positive influence on herd welfare. Most farmers (4/6) used sexed semen but mainly in heifers and breeding stock, veterinarians and advisors, reported that 15 and 12% of their clients respectively, used the same strategy. All participants identified the same barriers to the implementation of sexed semen: lower conception rates, low availability of the sexed semen in some geographic regions and high costs. The majority of farm advisors perceived that they and breeding companies influenced the use of sexed semen. Whereas most farmers were self-informed or influenced by other farmers as well as advisors. When asked general questions about use, cost and conception rate estimation, veterinarians' responses differed from farmers and advisers, showing a lack of understanding of farmers' priorities. Advisors underestimated costs and did not believe that sexed semen justified the investment. The results of the case study were similar to other research reported in the literature. Interdisciplinary studies indicate that farmers' personalities, knowledge, values, economic advantages, communication with the veterinarians and advisors, as well as workload influence the implementation of FAW. Whereas, studies on veterinarians' perceptions show that understanding of farmers' goals, communication skills, and years of experience are the main factors influencing FAW improvement. Whether mitigations strategies are adopted will depend on resources, the interest and knowledge of stakeholders. Therefore social science is pivotal to understand barriers to behavioural change and supporting the implementation of improvements to FAW.

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## P3: FIRST ASSESSMENT OF WEANING AND FINISHING PIG WELFARE IN ALBANIA USING ANIMAL-BASED PARAMETER

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The pig breeding industry is an important source of the Albanian livestock economy even though, the pig sector is still at the initial stage and faces a major gap on reliable data of farm structure, husbandry systems and especially welfare of pigs. Therefore, the aim of this study was to assess for the first time animal-based parameters, including clinical parameters and behavioural observations of weaning and fattening pigs in Albania.

This study was carried out from January to April 2019 in Albania. During this time, 15 family- and commercial pig farms were visited, where in total 59 weaner- and 79 fattening pens (1153 weaners, 1788 finishing pigs) were observed. Assessment of the health and welfare of pigs was carried out by two trained observers using an adapted Welfare Quality® assessment protocol for pigs. This focused on animal based parameters such as positive and negative oral manipulation, lameness, body-, ear- and tail lesions as well as evaluation of husbandry and management practises. Statistical analysis was performed using SPSS 22. Descriptive statistics include an overview of prevalences (mean, standard deviation, min. and max. values) and Wilcoxson test was carried out to test for difference between the two pig categories ($p<0.05$).

In both pig categories the percentages of positive oral manipulations (24.1 ±23.1 % and 35.6 ±23.0 %) were higher than negative manipulations (15.7 ±7.98 % and 22.9 ±15.2 %) of weaning and fattening pigs, respectively. Ear lesions were much higher in fattening pigs 10.1 ±26.0 compared to weaning pigs with only 2.8 ±7.5%. Interestingly, a strong correlation between negative oral manipulations and ear lesions (0.719; $p <0.01$) was found for fattening pigs. The lameness prevalence was almost the same in weaning pigs 4.64 ±5.50 % compared to 4.0 ±3.1 % for finishing pigs.

As a conclusion, this first study obtained important data, which highlight welfare problems, such as ear lesions and lameness. However, the large range of prevalences across farms indicate potential for improvements. As factors, which can potentially contribute to those welfare problems, housing conditions such as lack of enrichment as well as moisture, poor floor surface or inadequate slats are discussed. This study shows the importance of further investigation in this field in Albania. Furthermore, awareness of farmers about the importance of health and welfare in both, weaning and fattening pigs can contribute to develop the pig farming industry in Albania.

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## P4: DO REARING ENRICHMENTS AND RANGING INFLUENCE FREE-RANGE HEN WELFARE?

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Free-range egg production has been gaining popularity in Australia. Consumers perceive free-range eggs to be healthier and tastier and they are concerned about the hen welfare. In Australia, pullets are reared indoors but the adults go outdoors, this mismatch might impair their adaptation to the range environment. Enrichments during rearing may contribute to better adaptation and thus improve hen welfare. Ranging outdoors may also present greater opportunities for exercise and natural behaviours to improve health and welfare. A total of 1386 Hy-Line Brown® chicks were reared indoors across 16 weeks with 3 enrichment treatments including a control group with standard housing conditions, a novelty group providing novel objects that changed weekly, and a structural group with H-shaped perching structures. At 16 weeks of age, the pullets were moved to a free-range system, all hens were leg-banded with microchips and daily ranging was assessed (average hours outdoors) from 25 to 64 weeks via radio-frequency identification technology. Welfare parameters including body weight, comb wounds, beak condition, toenail lengths, footpad lesions and plumage coverage were evaluated at 27, 33, 43, 56 and 64 weeks of age. These welfare measures were correlated with mean individual time outside in the period prior to the sampling days. General linear mixed models showed significant interactions between hen age and rearing treatment for live weight, the number of comb wounds, plumage coverage and toenail length ($P < 0.006$) with the enriched hens showing more consistent live weight at the later ages, fewer comb wounds at 33 weeks and better plumage coverage at the later ages, whereas the structural hens had shorter toenails as age increased. Plumage coverage showed a positive relationship with range use (i.e. more feather coverage with more time spent outside) across all age points ($P < 0.0001$). Rearing enrichments can have some long-term benefits to the hens, but the management of range access is also important in a free-range system.

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## P7: "INACTIVE NOT ALERT" AS A NEW INDICATOR OF ENDURING NEGATIVE AFFECTIVE STATE IN LABORATORY MACAQUES

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The lack of an objective method to assess enduring negative affective states is a current obstacle to improving the welfare of non-human primates in research. We propose the behaviour “Inactive not alert" as a welfare indicator of enduring negative state in rhesus macaques. The behaviour is defined as sitting or lying stationary with no visual contact with objects or individuals and not engaged in any other action for at least 10 seconds. In the past, this behaviour has been experimentally induced by exposing macaques to stressors known to cause depression in humans, and has been pharmacologically validated with antidepressants. Therefore, literature suggests that the display of this behaviour is related to a negative affective state associated with low arousal (depressive-like state). Using video recordings of home-cage behaviour of eight laboratory rhesus macaques housed in a relatively enriched environment, we report the presence of this behaviour, with an important variability in its frequency between and within individuals. These results pave the way to future investigation of factors responsible for this variability. Furthermore, results show no correlation with an "Inactive alert" behaviour, in which the subject is stationary but not withdrawn from its environment. We therefore suggest that the “Inactive not alert” behaviour should be differentiated from other inactive behaviours that are not known to be associated with a negative affective state. Limitations of the use of "Inactive not alert" as a behavioural welfare indicator include the current lack of a standard definition across the literature, its unknown sensitivity to negative affective states associated with high arousal and its potential sensitivity to factors unrelated to affective states (e.g. ageing).

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## P8: IDENTIFYING RESEARCH PRIORITIES FOR CANINE SURGICAL STERILISATION PROGRAMMES: WHAT ARE THE UNANSWERED QUESTIONS?

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Canine surgical sterilisation programmes are widespread throughout the world. They are implemented for different reasons including improving animal health and welfare, reducing human-dog conflict and the elimination of canine-mediated rabies. However, there are few published studies reporting the outcomes of such programs, therefore it is difficult to assess if and how their objectives are achieved. The aim of this study was to conduct a comprehensive, end-user centred study of research priorities, which would identify the top ten priorities for research into the impact of canine surgical sterilisation programmes.

The design, methods, and analysis of this project are modelled on the James Lind Alliance (JLA) priority setting process. An initial scoping survey was distributed online via email and social media. The survey asked people working in the field of dog population management what questions they had about the impact of their programmes. A total of 110 responses were received from 47 countries and 644 individual questions were submitted. Submissions were analysed using qualitative thematic analysis. The main themes identified were the impact of sterilisation on dog behaviour, health and welfare, human behaviour change, population size and structure, logistics to achieve impacts, policy and economics, effects on other animal populations, negative impacts and rabies control. Relevant submissions (n= 468) were collated into representative questions (n=47) which were taken forward for interim prioritisation via a second online survey. A final shortlist of 26 questions was used in a modified Delphi consensus process to finalise the top ten priorities. The majority of questions prioritised related to the impact of sterilisation on dog population size and turnover and how to achieve this most efficiently. Other priorities were effects on human behaviour change and perception of free-roaming dogs, dog-bites, rabies control and cost-effectiveness. Additional findings were demonstration of geographical and organisational diversity in programmes, many shared outcomes of interest regardless of geographical region or main aims of organisation and multiple uncertainties as to if and how outcomes are achieved in such programmes.
Asking the right question is the first step in practising evidence-based veterinary medicine. By using this priority setting methodology, we can identify directions for future research that will be directly applicable to organisations who plan and implement dog population management programmes.

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## P9: CITIZEN POLAR BEAR. USE AND VALIDATION OF VISITOR DATA TO RECORD BEHAVIOUR OF FIELD HOUSED POLAR BEARS

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The polar bear (*Ursos maritimus*) is challenging to house in captivity with high incidence of stereotypy and low reproductive success. Yorkshire Wildlife Park socially house 4 male polar bears in an area of 3ha, largely laid to grass, with deep lakes, hills and several dens. These large field enclosures allow space to roam and opportunities for enrichment, but may create a mis-match with visitor expectations, as they do not resemble artic conditions; so an online "Citizen Science" survey was developed to sample visitor perceptions. Notice boards advertising the project with QR codes allowed submission of surveys via mobile phones. Behaviour was recorded using one instantaneous sample per bear as resting, eating, walking, stereotypy, swimming, environmental and social interaction. Visitors could also rate the bears' welfare and the naturalness of their behaviour. Researchers from Lincoln recorded the bears' behaviour during period of study to compare survey data with that collected by more systematic observation.

254 records were submitted from March to December 2017, which equated to 889 individual bear recordings. Resting in open was most commonly recorded (38.1% of samples), followed by walking (17.9%), swimming (11.6%) and social interaction (10.2%). Resting in cave took up 8.9% of samples, eating 4.3% and "playing with enrichment" 3.5%. Stereotypy was only recorded in 8 samples and consisted of 1 incidence of door-banging and 7 of head-rolling. Bears were more likely to eat in morning which reflected feeding times ($P<0.01$) and more likely to swim in summer months ($P<0.01$). Direct observations indicated an over-estimate of social and environmental interaction and an underestimate of resting behaviour. Visitors generally rated bear welfare as excellent (70%) or good (26%) and 85% of respondents agreed or strongly agreed with the statement "Do you believe Project Polar allows Polar Bears to exhibit naturalistic behaviour?"

These data suggest visitors had a positive perception of the bears' behaviour and quality of life. It is noteworthy that few incidences of stereotypy were recorded by public or by researchers and consistent with behavioural data collected from these bears over several years. Social and environmental interactions were over-represented in sample; this may be because visitors were more likely to record an "interesting" activity, or because such interactions made visitors more likely to complete the survey. This project highlights the value of using Citizen Science projects to assess visitor impression of zoo animal housing and potential to compliment more systematic data collection.

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## P10: TOWARDS THE ASSESSMENT OF DOGS' INDIVIDUAL WELFARE NEEDS: PERSONALITY, LATERALITY AND AROUSAL

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Approximately 11 million dogs live and work alongside humans in the UK, with many companion dogs (90,000 in 2010) being relinquished to shelters and many trainee working dogs (up to 50%) failing to achieve operational status. Relinquishment and failure to qualify could be related to welfare issues, which may occur when canine individual differences are not taken into account, and thus human use and the living environment conflict with a dog's needs and wants. Although research has shown that dogs have personality and feel emotional arousal, canine individual differences are not yet fully understood. Emotional arousal is believed to be lateralized. The right hemisphere of the brain is associated with negativity and fear, and the left with positivity and familiarity. Having a dominant hemisphere has been found to account for some behavioural differences seen in the domestic dog. Therefore, assessing laterality could help to understand which hemisphere is more dominant overall or for certain tasks and situations. Personality traits such as extraversion and neuroticism are also known to have a positive or negative bias respectively, and could also be linked to hemispheric dominance. Understanding the links between laterality, personality and emotional arousal in dogs is therefore key. Eye temperature has been shown to reflect increases in internal body temperature in dogs and is a validated non-invasive method to measure internal arousal. Although body temperature can increase for both negative and positive emotion, the environment or stimuli present may explain any increase. The study presented here aimed to discover if there were associations between personality, laterality and arousal in dogs. Laterality was measured using the First Stepping Test and personality was rated using the revised Monash Canine Personality Questionnaire. Eye temperature was measured using an Infrared Thermography Camera before and after the dogs' interaction with a novel food-based game. The results indicate a significant positive association between right-pawed dogs and extraversion. A positive association was also found between extraversion and a greater temperature increase in the left eye following the game, with males presenting a greater increase in eye temperatures after the game. These results suggest that measuring arousal, laterality and personality could be useful when assessing, companion, shelter and working dogs. Canine professionals may be able to better understand individual differences and tailor training and/or adapt the environment to improve welfare. Future research should consider measuring arousal levels during interactive tasks alongside personality and laterality to uncover any further associations.

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## P11: THE EFFECT OF ALTERING ROUTINE HUSBANDRY FACTORS ON THE QUANTITY AND QUALITY OF SLEEP IN THE HORSE

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Sleep is a critical maintenance behaviour for all domesticated and captive animal species and yet deficits in sleep (quantity and quality) are rarely monitored as a way of ensuring the physical and/or psychological well-being of the animal. Due to the protracted time that horses spend standing (approximately 80% per day), this species has limited opportunity to engage in sleep states, particularly REM sleep which requires full body skeletal muscle atonia. Horses are thus often perceived as opportunistic sleepers reflecting an evolutionary strategy of predator avoidance (by not lying down) with a higher frequency of cycling in and out of sleep and non-sleep states. The consequence of the latter is that the horse is more susceptible to transitioning from sleep to non-sleep states as a result of changes or stimuli in its environment (e.g. unfamiliar sounds, changes of stable, changes in lighting). The aim of this study was to examine if the quantity and type of sleep (as inferred from correlated sleep behaviours) in the horse was affected by routine changes in husbandry (bedding depth and nightime light exposure) and to assess whether this impacted the cognitive performance of the animal via a spatial memory task. Within a two-factor cross-over experimental design, twelve horses were exposed to high (10cm straw) and low (5cm straw) level bedding depth and high (125 lux) and low (0 lux) night time lighting for 7 days per treatment. Wakefulness, drowsiness, REM and NREM sleep states were estimated from continuous focal behaviour sampling and data analysed using a repeated measures two-factor ANOVA or a non-parametric equivalent. In addition, all animals were tested on a spatial memory task during the high bedding-low light and the low bedding-high light treatments and data were analysed using a paired T test or non-parametric equivalent. Here we present the results of this study and discuss the effects varying routine husbandry factors on the quantity and quality of equine sleep.

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## P12: THE IMPACT SOCIETAL SHIFT TOWARDS INCREASING ANIMAL WELFARE CONCERN AND NEGATIVE FRAMING IN THE MEDIA HAVE ON IRISH FARMERS' ATTITUDES AND PERCEPTIONS OF ANIMAL WELFARE

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Over recent decades, increased urbanisation has created a knowledge gap between farming communities and the rest of society. Mainstream media has begun filling this gap through reports on farm animal welfare incidents. The framing of farming in mainstream media is often negative and increasing societal pressures contribute to farmers feeling overwhelmed and may result in reducing the level of animal welfare previously provided. The aim of this study was to explore how negatively framed media stories about farm animal welfare incidents affect farmers' attitudes and perceptions of animal welfare in Ireland. Face-to-face interviews were conducted with seven Irish beef and dairy farmers using vignettes displaying negative (cattle) farm animal welfare incidents presented in the media. NVivo 12 was used to code data from transcripts into a set of thematic categories. The behaviour change wheel (BCW) was used alongside the theoretical domains framework (TDF) to categorise qualitative data coded from interviews and identify emerging themes. The findings revealed that farmers perceptions are affected by various social influences and that negatively framed media stories on farm animal welfare may indirectly impact on the human-animal bond. The need for more animal welfare education and social supports for farmers was also made apparent. These results suggest that rural restructuring in Ireland and the public's increasing reliance on the media for agricultural information may negatively affect farmers' mental health and motivation which may have indirect implications for the welfare of their animals.

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## P13: THE EFFECT OF ANIMAL SHELTER NOISE ON CAT BEHAVIOUR AND WELFARE

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Stress cats experience when admitted to a shelter can lead to welfare consequences. Acclimation to a shelter is influenced by many factors. This study aimed to assess how noise in an animal shelter affects cat behaviour and welfare.

Singly housed cats (n = 70) were observed in a 5-month study conducted in a large shelter. Fear-related behaviour (hiding, ears flat, etc.) and maintenance-related behaviour (grooming, eating etc.) were made for 30 min during two periods on weekdays (AM at 10:00-10:30 and PM at 20:00-20:30) daily from admittance for 10 days or until adoption. Behaviour, plus the presence of sound (classified by the source), was recorded using instantaneous and one-zero sampling with 15-second intervals. To test the effect of sound level on behaviour, each 30-min observation period was classified as “quiet” or “loud” if the sound score was above or below the median of all periods at the same time of day.

AM periods consistently had much more sound than PM periods, and cats showed more fear behaviour ($p<0.001$), and less maintenance behaviour in the AM than the PM ($p<0.001$) as shown by a mixed model analysis. Owner-surrendered cats showed less fear behaviour than strays ($p=0.013$) and males showed less fear behaviour than females ($p=0.003$). Cats showed different levels of fear on different study days ($p=0.014$), with some cats showing more fear on day 1 than on later days.

Cats showed more fear behaviour in loud AM periods than in quiet AM periods ($p=0.001$ by Wilcoxon signed-rank tests) but there was no comparable difference in maintenance behaviour ($p=0.501$). A minority of 30-min recording sessions included a noticeable transition from quiet to loud or loud to quiet. Contingency tables showed that fear-related behaviour was more common after a transition from quiet to loud ($p=0.002$ by Fisher’s exact test) and less common after a transition from loud to quiet ($p=0.008$).

These results suggest that noise in shelter environments can greatly affect the behaviour of cats and that lowering noise levels may help improve cat welfare.

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## P14: THE USE OF SCENT MARKS TO CREATE A NOVEL ENRICHMENT TO IMPROVE THE WELFARE OF LEMURS

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Many of the world's primate species are declining and face ongoing threats in the wild. However, captive populations, potentially serving as buffers against extinction, are experiencing problems that keep them from being viable for reintroduction into the wild. Particularly, managing zoo populations can be challenging because of the mismatch between natural and captive environments. Primates evolved distinct behavioural patterns, and difficulty in engaging in these behaviours can cause frustration or boredom, which, in turn, can lead to stress and development of abnormal behaviours that undermine their individual welfare as well as their breeding success. Modern zoos employ a variety of enrichment techniques to improve both psychological and physiological wellbeing of captive animals by providing a stimulating environment. There are currently a number of studies on using enrichment as a tool to increase welfare in captive primates, but these usually focus on feeding and cognitive puzzles, with less emphasis placed on sensory stimulation, as well as a bias towards charismatic species. Olfactory enrichment programmes are still understudied in primates. Furthermore, the effects of enrichment and welfare on breeding programmes have received little attention. This project aims to investigate the effects of a novel scent enrichment programme on the endangered crowned lemur (*Eulemur coronatus*). This will involve the investigation of female fertile odour secretions, indentifying key compounds and then synthesising these in the laboratory to create a novel enrichment. The project involves the use of behavioural observations combined with semiochemistry and faecal endocrinology to test whether the enrichment can help to improve captive lemur welfare. The project will also look at the relationship between welfare and breeding by looking in particular for increased socio-sexual behaviours when enrichment is used. This project will help to inform on best practices for captive primate management and conservation breeding.

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## P15: PET OWNERS' PERCEPTIONS AND KEEPING PRACTICES: UNDERSTANDING THE EMERGING PROFILES OF THE ANIMAL-HUMAN RELATIONSHIP IN SPAIN

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Pets are non-human family members for millions of people in Spain, but little is known about the owners' perceptions towards their bond with their animals, the keeping practices they perform, and the relationships between both. In this study, we aimed to describe these two aspects and, based on them, to profile pet owners' typologies that define different human-animal relationships. In-person surveys administered in the city of Zaragoza collected data from 1572 adult pet owners, representing 1143 dogs, 223 cats, 60 birds, 59 rodents, 57 fish and 50 exotic animals. Our results show some perceptions shared by the vast majority of respondents associated with the importance of their pets in their lives, the emotional benefits that obtain from them, the empathy towards their pets suffering and the reluctance to abandon them. Cluster analysis revealed four owner profiles. Two of responsible, concerned dog owners, which differ by the strength of the bond outside the home and in the provision of aesthetical care; one of responsible, concerned multi-species owners, more interested in the feeding care, and one last of the most distant and careless pet owners. These profiles suggest that human-pet relationship may assume different characteristics that go beyond the species' limits, so that non-traditional and traditional pets can belong to owners with similar perceptions and keeping practices. The growth of the interest in pets in the modern's societies establishes an element of a far more multifaceted phenomenon of animal-human relationships and support of a new paradigm called responsible ownership of pets in a developed country such as Spain.

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## P16: EVALUATION OF ANALGESIC EFFECT OF XYLAZINE, TRAMADOL AND LIGNOCAINE ON PROPOFOL ANAESTHESIA IN WEST AFRICAN DWARF (WAD) GOAT

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General anaesthesia in small ruminants is becoming popular due to recent developments in total intravenous anaesthetic (TIVA) techniques. Anaesthetic drugs used in TIVA techniques in goat include ketamine, thiopentone, Alflazone and propofol. Propofol is devoid of substantial analgesic effect, and should be combined with analgesic like opoid, alpha 2-adrenoceptoragonist or lidocaine in anaesthetic protocol for noxious painful procedure. As part of larger study to determine suitable analgesic, anti-hyponsensive, bloat preventive adjuncts during propofol anaesthesia, twenty goats were assigned into groups (gps) A, B, C, D of five goats each were used in part to first evaluate analgesic effect of Xylazine, Tramadol and Lignocaine on Propofol Anaesthesa in West African Dwarf (WAD) Goat. The groups recieved Normal Saline (2ml) intravenously (i.v), Xylazine (0.05mg/kg, iv), tramadol, 2mg/kg, iv and Lignocaine, 2.5mg/kg, subcutaneously (SC) as premedicants respectively. Goats in all groups were anaesthesized and maintained with propofol at 9mg/kg and 6mg/kg respectively. The experiment was repeated followed by laparotomy in each goat. In both protocols, analgesia, anaesthetic indices and sleeping time were measured. The onset of Propofol was same in all the groups except gp B which was significantly shorter. Analgesic duration was significantly ($P<0.05$) longer in gps B and D compared to Normal saline group A. Sleeping time was significantly ($P<0.05$) shorter in gp C but longer in B. There was decrease in Heart Rate at 30 min post induction (Pi) in gps A, B, and C compared to D. There was no significant variation within gps A and B compared to baseline values. Apnea was observed in almost all goats in the four gps. There was a significant decrease in control gp at 30min pi compared to others. In protocol ii; similar results were obtained for the measured parameters as in protocol I. Significant increase ($P<0.05$) in respiratory rate was observed in control gp 20min PI. In conclusion, duration of analgesia was longest in lignocaine – Propofol combination, followed by Xylazine- Propofol and then least with tramadol –Propofol combination. Sleeping time, recumbent time and standing time was longest in the following order: Xylazine-Propofol < Lignocaine <tramadol in both protocols.

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## P17: DENTAL HEALTH IN DAIRY CATTLE – IDENTIFICATION OF WELFARE CONCERNS THROUGH GRIMACE SCALE EVALUATION, POST-MORTEM EXAMINATION AND CT IMAGING

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Dairy cattle consume a high concentrate/low roughage diet which might be expected to relate to dental problems in cows. However little published data exists regarding the dental health of dairy cattle, with most veterinary students taught only comparative dental anatomy between cattle and horses.

All data was collected from ten cull cattle from SRUC's Crichton Royal dairy farm in Scotland. Lifetime lactation data was collated for each cow including date of birth, profitability for life index, lifetime yield, and number of lactations.

One day before slaughter each cow was body-condition scored, lameness scored (excluding cow 4), and photographs were taken for Grimace-Scale evaluation.

Following slaughter, the heads of the cadavers were removed, and a post-mortem examination of each cow's head was conducted. The teeth, gums and associated tissues were assessed for the following dental conditions: fractured teeth, sharp enamel edges, loose teeth, 'wavy-mouth', diastema, ulcers and abscesses. A simple score was developed for 'dental health' of each sample, this score was created through the use of a scale to rank the severity and occurrence of conditions, these condition scores were then multiplied to create the individual cows simple score for 'dental health'. Three heads were selected for CT scanning for further assessment (highest, lowest and median dental health score). The CT scanning results heightened conditions helping develop the understanding of bovine dental anatomy.

All ten cows displayed evidence of some dental health problem, from relatively minor (e.g. sharp edges found in all 10 cows) to severe (e.g. large tooth root abscess in one cow). No significant correlation was found between Grimace Scale and dental health. There was also no significant correlation found between the cattle's dental health and profitability for life index.

Although only a pilot, these results suggest further research is required immediately to understand the prevalence of poor dental health in cattle and to consider solutions to a problem that may be causing significant pain.

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## P18: THE WELFARE IMPLICATIONS OF OWNER PERCEPTIONS AND KNOWLEDGE OF EQUINE SLEEP

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The occurrence and function of sleep in the domestic horses is poorly understood. Research in other mammalian species would suggest that its function is also to facilitate memory consolidation and vital body maintenance. The occurrence of sleep does appear to be vital to horses, where sleep deprivation has been linked to spontaneous collapse in some cases. The current study aims 1) to establish whether owners recognise the importance of sleep relative to welfare and performance of their horse, and 2) to determine whether social media can be used to raise awareness and knowledge of a specific topic in animal welfare (in this instance, the functional importance of equine nocturnal behaviour and equine sleep). An online mixed methods questionnaire created using Google Forms was piloted before being distributed via social media platforms with effect from 13th November 2019 (with 213 responses collected by the 27th November). All data are due to be subjected to descriptive analysis before being analysed via binary logistic regression to determine factors that predict whether a person is more or less likely to consider the importance of sleep for their horse(s). Open questions have been designed to explore husbandry factors that owners perceive to be important in influencing the occurrence of sleep, and also the behavioural signs that indicate whether sleep in their horse is taking place. For the second part of the study, results are due to be summarised and published on the social media group platforms used to distribute the questionnaire initially. To determine whether this feed-forward approach to lay-public education is impactful, comments from members of the public interacting with the social media platforms will be analysed via themed content analysis. The results of the study will form the basis of discussion within the talk/poster.

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## P19: CAN WE USE REST PATTERNS TO MEASURE WELFARE IN HORSES?

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Recently the importance of sleep deprivation in domestic horse populations has been highlighted. In horses, normal sleep patterns include periods of slow wave sleep (SWS) and rapid eye movement (REM) sleep. Horses will often lie down for SWS but can also achieve SWS when standing up. All muscle tone is lost when in REM sleep, therefore this phase can only occur when the horse is either laterally or sternally recumbent (lying down). Research has shown that a normal, healthy horse will spend some time lying down to rest every night, which implies a level of inherent importance to this behaviour for the horse. On the other hand, individuals that are stressed, in pain or discomfort are less likely to lie down to rest, therefore it may be an important indicator of poorer welfare. For this to occur we must first have a good understanding of what a 'normal' sleep pattern is for a horse and how this may be influenced by environmental and inter-individual variation. Here, the night-time behaviour of 14 horses stabled at the same facility were analysed for 4-7 nights as well as additional measures such as ambient temperature, exercise level, personality (as determined by a 5-factor personality questionnaire), and other behaviours. A General Linear Model (GLM) was fitted in order to determine if any of the variables measured had a statistically important impact on the variation of rest over consecutive nights as represented by the coefficient of variation of total rest time. Horses spent an average of 137.92 ± 48.74 minutes in lying rest. Of the variables measured there was a significantly positive association between variability of rest over consecutive nights and scores for neuroticism ($F(12)=4.120$, $P=0.005$). Due to the small sample size caution is required when generalising these results, however, they do agree with studies in humans where neuroticism is associated with poor sleep quality. As negative affective state is a component of neuroticism it may be that variability of rest pattern could warrant further research when investigating horse welfare.

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## P20: EFFECT OF HOUSING CALVES INDIVIDUALLY OR PAIRS, ALONG WITH ENVIRONMENTAL ENRICHMENT, ON BEHAVIOUR, FEED INTAKE AND GROWTH RATE OF DAIRY CALVES

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Housing calves individually limits natural behaviour and cognitive development, resulting in consumer concerns. Unfortunately, housing calves in pairs or groups increases the risk of disease and physical injury, due to cross sucking. This occurs most commonly over the first twenty minutes following milk consumption and is indicative of poor welfare. This study compared the effect of housing and environmental enrichment (EE) on calf; health, behaviour, feed intake, growth rate and feed efficiency. Calves were housed either individually (12 calves) or in pairs (48 calves) and, at 5 weeks of age, offered either: No EE (No); cereal straw bedding (CSB); a bucket each (BK); or a manila rope and chain (MRC) for an hour, directly following milk feeding twice daily. Behaviour was observed for 5 mins prior to and 30 min following milk feeding, on three consecutive days; prior to, on the day of and 7 days following EE being offered. Live weight, feed and water intake were measured weekly, found to be normally distributed and analysed by ANOVA GLM. While milk intake rate and behaviour were not normally distributed and analysed using the Kruskal Wallis (Minitab 17.0). Animal was applied as a random effect, while housing and EE were applied as fixed effects in the models. Individually housing lowered cross sucking, but increased non-nutritive sucking. Housing calves in pairs reduced non-nutritive behaviour, but increased cross sucking. Small amounts of straw bedding, directly following milk consumption, almost eliminated cross sucking, and increased nutritive and play behaviour, while MRC and buckets did not. EE had no effect on growth rate, feed intake, feed efficiency or total nutritive behaviour. Natural play and cognition was enhanced, while cross sucking was eliminated, almost fully, by bedding with straw directly following milk feeding. Calf welfare can be improved by changing bedding practice, without increasing rearing costs.

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## P21: EFFECTS OF ENVIRONMENTAL ENRICHMENT ON DOG BEHAVIOUR

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Environmental enrichment (EE) is a technique designed to enhance the quality of life in captive and domestic animals, by providing environmental stimuli to promote psychological and physiological wellbeing. EE has been shown to be beneficial to a range of species, and is often used as a standard part of husbandry across a range of environments including the home, kennels and laboratories. The impacts of enrichment appear dependent upon the type of activity, the animal's mental state and previous experience. To support the development of best practice guidance for clinicians, practitioners and pet dog owners a pilot study was undertaken to evaluate the impact of seven different EE items on the behaviour of dogs in an office environment. Activities were either inanimate, animate or a mixture of both. The activities evaluated were; tug play with a handler, conspecific play with a known individual, bonding session with a handler, a large playhouse to explore, a bubble machine with bacon bubbles, an interactive food toy and a stuffed food toy. Ten dogs received all seven EE activities twice on different days with the EE activities provided in a randomised order. Behavioural data were collected using continuous sampling via video recordings for two 15-minute time periods; one prior to the activity (pre-EE) and another post-activity (post-EE). Behaviours were grouped into categories of maintenance, play, locomotion, relaxation, alert or stress behaviours and the behavioural change scores between pre- and post-EE were compared. All EE activities resulted in an increase in behaviours previously associated with positive welfare and a decrease in behaviours associated with negative welfare. The change in behaviours varied between the EE activities. Differences in the average behaviour change scores ranged for relaxation (1.00 to 18.30, $DF = 6$, $F = 6.48$, $P < 0.01$), alert (-16.00 to 0.20, $DF = 6$, $F = 4.16$, $P < 0.01$), and stress (-13.20 to -1.55, $DF = 6$, $F = 2.79$, $P = 0.02$) behaviours. Play with conspecifics and playhouse activities resulted in the greatest behaviour change. The smallest effect on behaviour was observed for food-based EE activities. The variation in behaviours after each EE activity suggests the type of EE selected could have different beneficial impacts on a dog's wellbeing. This suggests a need to diversify thinking around EE, shifting common thinking of EE as one entity, to consider EE in different categories.

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## P22: HEALTH AND WELFARE CONSIDERATIONS OF GERIATRIC TIGER (*PANTHERA TIGRIS*) CARE IN UK ZOOLOGICAL COLLECTIONS

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Improved understanding of husbandry and veterinary care of captive tigers has led to an increase in longevity, and significant increase in the age of the zoo population. As animals age, physical and behavioural changes can limit opportunities for animals to experience positive wellbeing. Clearer understanding is needed of the challenges involved in maintaining welfare as animals age. This small focussed study funded through a UFAW student scholarship, sought to ask veterinarians and keepers in zoological collections with older tigers what problems they recognised in their care and what steps were taken to address these issues. They were specifically questioned regarding decisions made concerning euthanasia. Four zoological collections were chosen for detailed evaluation of the issues noted above. Interviews were recorded and then later transcribed and coded. Thematic analysis was used to identify themes in the data, with further interpretation in relation to previous literature. All zoos described arthritis as one of their primary concerns in geriatric tiger medicine. At one zoo, two female hybrid tigers around 20 years of age were euthanised for welfare reasons. Both tigers had shown significant reduction in mobility and muscle wastage. At post-mortem keepers were shocked to 'see the extent of arthritis', stating that 'it was worse than we thought, because they're very good at hiding pain'. Dental disease was mentioned by 3 of the zoos when discussing common issues in aging tigers. However, out of 12 tigers discussed in detail, only two had diagnosed dental disease. Ingrown nails were an issue at two of the zoos. Two of the zoos noted renal disease as a pathology seen in aging tigers. Management changes implemented generally related to improving comfort in arthritic animals with reduced mobility. Separate from welfare assessments, which are done independent of age or pathology, two of the zoos implemented quality of life assessments, with the other two performing either periodic geriatric health checks or creating end of life plans. Underestimating the severity of pathology was a common theme during the interviews. With regard to detecting chronic changes zoos described how keepers may get used to subtle, incremental changes. One veterinarian noted that keepers would under-report disease severity through an emotional bias, a statement supported by a keeper who said that emotions do play into the assessment of an animal. All four zoos stated that the welfare of the tigers was the most critical factor in deciding whether or not to euthanise.

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## P23: VENTILATION ATTRIBUTES: IMPACT ON LITTER QUALITY AND ASSOCIATED BIRD WELFARE OUTCOME MEASURES

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The incidence of hockburn and pododermatitis remains a challenge across global broiler production. The mean incidence of each across the Tesco supply base for the 2018 reporting period was 27% and 9% for pododermatitis and hockburn respectively. However, there is substantial variation between suppliers based on geography, production method and bird slaughter weight. Litter quality is a significant factor in the development of lesions and irrespective of litter substrate the objective is to maintain a dry, friable condition throughout the crop cycle (litter score 1 -2) and limit the rate at which it deteriorates to a damp, capped (score 3) or wet, greasy (score 4) contact surface. Factors affecting litter management include: substrate type, bird health, ventilation and temperature. However, ventilation and its effect on temperature and relative humidity, has the potential to have the most immediate impact on bird environment. Typically, poultry integrations will specify a company-wide approach to litter management. Although, the inter flock variations seen in pododermatitis and hockburn levels at slaughter may be indicative of inconsistent implementation. In the current study, three indoor sites in the same integration, producing birds to the same production requirements were evaluated to determine the practical limitations of ventilation policies and the subsequent impact on bird welfare.

| | A | B | C |
|---|---|---|---|
| House negative pressure test (Pa) | -46 | -15 | -58 |
| Ventilation rate (m³/hour/bird) at day 0 | 0.07 | 0.04 | 0.08 |
| Ventilation rate (m³/hour/bird) at day 21 | 0.89 | 0.66 | 0.89 |
| Ventilation rate (m³/hour/bird) at day 35 | .53 | 1.48 | 1.53* |
| Supplementary Ventilation | No | No | Yes |
| House RH at day 21 | 65 | 74 | 60 |
| House RH at depletion | 80 | 78 | 67 |
| Litter Score @ day 21 | 2 | 3 | 1 |
| Litter Score @day 35 | 2/3 | 3 | 1 |
| Pododermatitis (%) at depletion | 12 | 21 | 9 |
| Hockburn (%) at depletion | 44 | 24 | 13 |

Results indicate a trend relationship between integrity of housing structure (as indicated by air pressure), relative ventilation rates, humidity and subsequent litter score. Early deterioration of litter is likely to be associated with an increase in pododermatitis (unit B) while later deterioration (and increase in relative humidity) may be associated with increased levels of hockburn (unit A). In turn reflecting differences in bird motility and behaviour with age. This case study confirms that early attention to ventilation has lifetime implications for bird welfare.

This work was funded by a Tesco Future Farming Foundation Scholarship.

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## P24: ACUTE HEAT STRESS IMPAIRS THE COGNITIVE PERFORMANCE OF FUNAAB ALPHA CHICKENS

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The expansion of global poultry production may be hampered by the effects of global warming which leads to an increase in the incidence of heat stress. Heat stress impairs animal welfare and productivity. Animal welfare encompasses both the physical and mental well-being of animals. Cognitive function or processes can be impaired by stress. This study used the new improved indigenous chicken (FUNAAB Alpha) as a model to investigate the effect of acute heat stress on physiological (rectal temperature, wing and eye temperatures) and cognitive performance since chickens have good cognitive abilities and are also susceptible to heat stress. Twenty five (7 weeks old) birds were recruited for the training to differentiate between two cone colours; white (rewarded; underneath which birds could get feed) and black (unrewarded; nothing was placed under the cone). Learning was confirmed when birds uncovered the rewarded cones faster ($P<0.001$) than the unrewarded. The birds that learnt the task (n=17) were randomly assigned to three temperature regimens (22-24, 30-32 and 36-38$^{o}$C for 3hrs/day) for three consecutive days during which body temperatures (rectal, eye and wing) were monitored. After the 3$^{rd}$ h of the exposure, birds were allowed to rest in a holding pen for 1h before the cognitive test was performed (birds were presented with 4 rewarded and 4 unrewarded cones positioned randomly in the test arena). Time taken by each bird to open all cones within 5 mins period was recorded. A memory recall test (similar to the cognitive test) was conducted a week after. Data collected during the training was subjected to a paired sample T-test while rectal, eye and wing temperatures and cognitive performance were subjected to one way ANOVA using SPSS. Time taken to open the rewarded cones were longer ($P<0.001$) in birds exposed 36-38$^{o}$C than those in 30-32 and 22-24$^{o}$C. However, time taken to open the unrewarded cones was not affected ($P>0.05$) by temperature regimen. For the memory test, birds showed no difference ($P>0.05$) in average time to open either the rewarded or unrewarded cones. Rectal temperature was greater in birds is as follows 36-38$^{o}$C >30-32$^{o}$C >22-24$^{o}$C ($P<0.05$). Wing and eye temperature followed the pattern of 36-38$^{o}$C and 30-32$^{o}$C >22-24$^{o}$C ($P<0.05$). In conclusion, acute heat stress had immediate but not long lasting effect on cognitive performance of FUNAAB Alpha chickens.

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## P25: THE STABILITY OF SOCIAL PROMINENCE AND INFLUENCE IN A DYNAMIC BREEDING SOW HERD: A SOCIAL NETWORK ANALYSIS APPROACH

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Social network analysis has developed as a valid research technique in animal behaviour; despite an increase in the number of social network studies in this field, comparatively few studies have focused on commercial animals. This study investigated a dry breeding sow herd as a model species for identifying socially prominent sows, individuals engaging in significantly higher levels of direct interactions than their conspecifics and socially influential sows, individuals with significantly higher levels of indirect interactions than their conspecifics. Animals were frequently added and removed from the herd during the study, creating a dynamic system and an unstable social environment. In total, 63 h of video observations were obtained over three production cycles. Each production cycle covered twenty-one days and behavioural observations occurred on days 1, 2, 3, 7, 14, 20, 21. The social network metrics of degree centrality (number of interactions), betweenness centrality (number of times an individual falls along the shortest path between two individuals) and centralisation (the extent to which a network is dominated by a single individual) were analysed to assess the stability of aggressive behaviour and preferential associations between production cycles. Preferential associations refer to lying behaviour <1m from selected partners. Agonistic interactions included; biting, thrusting, chasing and displacement behaviour. The results found the formation of subgroups within the herd, based upon connectedness. Socially prominent and influential sows were identified within the subgroups, a result unaffected by low centralisation in the preferential association networks and substantial centralisation variance between the aggression networks. Sows quantified as socially prominent in the preferential association and aggression networks did not generally hold this position between the production cycles, showing significant changes in degree centrality. Sows also demonstrated inconsistency in social influence in the preferential association networks, again with significant differences in betweenness centrality between production cycles. However, in the aggression networks, betweenness centrality was found to be a stable individual social network metric, with no significant changes in behaviour. Knowledge of the stability of social influence in the aggression networks could improve levels of agonistic interactions as it becomes possible to make predictions of future behaviour to aide and inform intervention or management strategies. Furthermore, the study highlights betweenness centrality as a powerful and alternative tool that extends beyond the traditional methods of analysing dyadic interactions to identify critical animals.

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## P26: A SUMMARY OF CANINE SLEEP BEHAVIOUR: EARLY FINDINGS FROM THE GENERATION PUP COHORT STUDY

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Sleep is a vital part of the lives of animals, with quality and duration of sleep known to impact on health and wellbeing. Limited research exists on sleep behaviour in dogs in domestic situations. This work sought to address this gap by summarising the sleep behaviour of dogs, aged 12 months, belonging to UK/ROI dog owners participating in an ongoing longitudinal study.

Online surveys were completed by 820 participants when their dogs reached 12-months of age. For owners with >1 study dog, one dog was randomly selected for inclusion in the dataset used here.

Owners were asked to approximate the minimum and maximum numbers of hours that they estimated their dogs slept in total during both the night-time and daytime. The average total number of hours that owners perceived their dogs slept was 7.58 hours during night-time (SD=1.39, n=572). During daytime, the median number of hours was 3.50 hours, with most, 59.3% (204/344) sleeping <4 hours but some reporting up to 10.5 hours of sleep.

When asked what their dog usually slept on at night, owners reported: on a dog bed not in a crate/kennel (42.2%, n=346), on a human bed (26.7%, n=219), in a crate/kennel not on a dog bed (22.0%, n=180), on other furniture (16.2%, n=133), in a crate/kennel on a dog bed (13.4%, n=110), on the floor (not on a dog bed or in a crate/kennel) (7.7%, n=63), and four owners reported they didn't know. (Owners could select multiple answers, 44.20% (n=361/816) of owners selected more than one place.)

As for location of sleep at night, owners reported their dogs slept indoors in a room without human company (57.258.3%, n=469), indoors in a bedroom with human company (39.340.0%, n=322), outdoors in a kennel/small sheltered area (1.5%, n=12), outdoors in an outbuilding (for example stable/barn) (0.2%, n=2) and data were missing for 15 dogs. Additionally, 40.9% (n=335) of owners reported their dog could get close to people if he/she chose, and 87.5% (n=293/335) of these dogs reportedly chose to be around people.

The sleep behaviour most commonly reported (using a predefined list) was small twitching movements of the dog's legs (71.60.4%, n=577/806). Some owners reported that their dogs often snored very loudly (12.97%, n=104).

A greater understanding of sleep behaviour and its impact on dogs' health and wellbeing is required. Future research within this longitudinal study will examine the influence of sleep characteristics on various health/behaviour outcomes.

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## P27: SALIVARY STRESS BIOMARKERS, LESIONS AND PERFORMANCE OF PIGLETS IN FARROWING PENS WITH TEMPORARY CRATING OR FARROWING CRATES

**HL Ko, D Temple, X Manteca and P Llonch**

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The aim of this study was to assess piglet welfare in three farrowing systems on an intensive farm in Spain. The farrowing systems included one conventional crate system (CON) and two commercially available temporary-crating systems (SWAP and JLF15, designed by Jyden, Denmark). Four batches of crossbreed Duroc were studied from birth to weaning: 185 piglets from 18 sows in CON, 252 piglets from 24 sows in SWAP and 237 piglets from 23 sows in JLF15. Sows entered the farrowing unit about 1-week prepartum. Crating period in CON was from entry to weaning while in SWAP and JLF15, sows were crated from one day before expected farrowing day to three days postpartum. Salivary cortisol (CORT), chromogranin A (CgA) and lesions due to aggression in piglets were determined on 1d before, and 1d and 2d after weaning. Body weight was obtained at 3 days and 19 days of age and foreleg abrasion was assessed at 19 days of age. Crushing and other death causes during lactation were recorded. On 1d after weaning, CORT (µg/dL) increased in CON (1.54±0.28) and JLF15 (1.59±0.22), compared to SWAP (1.15±0.19) ($P$<0.05). On 2d after weaning, CgA (µg/mL) increased in CON (pre-: 0.48±0.05; post-: 0.82±0.18) and JLF15 (pre-: 0.49±0.06; post-: 0.83±0.13) ($P$<0.05), whereas CgA did not change in SWAP (pre-: 0.81±0.13; post-: 0.59±0.07) ($P$>0.05). Prevalence of foreleg abrasion on 19 days of age (CON: 61.9%; SWAP: 59.2%; JLF15: 68.9%) did not differ between systems ($P$=0.20), and neither did lesions due to aggression after weaning ($P$=0.61). Average daily gain during lactation (g/day) did not differ between systems (CON: 176.4±4.2; SWAP: 190.7±4.7; JLF15: 180.0±4.4) ($P$=0.29). During lactation, crushing rate (number of piglets/sow) was higher in SWAP (1.5) than CON (0.3) ($P$=0.01), and with JLF15 (0.6) in the middle. Additionally, a peak of crushing in SWAP was observed in the summer (3.3) where a particular sow overlaid 8 of her piglets during the study. In conclusion, growth performance was similar across systems and crushing rate did not differ in CON and JLF15. Despite having a higher risk of crushing incidence in SWAP, those piglets appeared to have a better adaptability to weaning stress.

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## P28: A SURVEY INVESTIGATING PUBLIC KNOWLEDGE AND PERCEPTION OF THE EQUINE WELFARE CRISIS

**ACD Liddell, C Hall and SE Upton**

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Over the last ten years, there has been a significant increase in the number of abandoned and neglected horses in the UK. Systematic review of the literature and recent media reports identified a requirement to understand the public perceptions of the horse crisis.

To identify themes for the main survey industry stakeholders at a National Equine Welfare Council meeting completed a series of open answer questions concerning the equine welfare crisis. The main online survey was open to participants from the UK with or without experience of caring for an equine. Questions were mainly closed with check boxes for responses or Likert-scale format. The survey was distributed through social media for 1 month between July and August 2019. Data were analysed in SPSS.

In total 127 respondents completed the questionnaire. More respondents aged between 18-24 years completed the survey (46.5%). This may be reflective of the age of audience attracted to social media and a drawback associated with this method of distribution. Responses were obtained from 33 counties across the UK with a bias towards the East Midlands. In total 73.2% of respondents had equine experience.

A high proportion (86.6%) of respondents did not agree with the statement that equine abandonment and neglect is an issue in the UK. There was a significant difference between experience caring for an equine and agreement towards this statement ($U=907$, $p= <.001$). When asked 62.2% of respondents were aware of local cases of abandoned horses. This contrasts with the previous response suggesting that abandonment is perceived as an isolated issue rather than a UK wide problem.

With regards to welfare legislation 80.3% of respondents were aware of the Animal Welfare Act (2006) with 30.7% confident with their knowledge of the legislation. Only 40.2% respondents were aware of The Control of Horses Act (2015) and of these 12% were confident with their knowledge of this legislation.

To report an abandoned or neglected equine respondents stated they were most likely to contact an equine welfare charity or the RSPCA, other organisations that were selected included the local authority, a local veterinary practice and the police. All respondents were aware of the RSPCA whereas awareness of the equine welfare charities differed.

The study concludes that this small, localised sample population lacked awareness of the equine welfare crisis in the UK. Further research is required with a sample group more representative of the UK population.

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## P29: AN INTERDISCIPLINARY APPROACH TO DONKEY WELFARE AND THEIR CONTRIBUTION TO LIVELIHOODS IN NORTHERN GHANA

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This research aimed to understand how donkeys underpin the livelihoods of donkey owners in rural North Ghana. Semi-structured interviews, questionnaires and focus group discussions with men, women and children from both donkey and non-donkey owning households were undertaken during the dry season, to research how donkeys underpin the livelihoods of two rural communities in northern Ghana: Fielmuo and Gia. Data were also collected using Wemelsfelder's Qualitative Behavioural Analysis (QBA) and the Donkey Sanctuary's Equid Assessment Research and Scoping tool (EARS) to assess the emotions and welfare of the donkeys from each household where an interview took place. This research protocol was repeated during the wet season, with the same respondents and nearly the same donkeys. Donkeys play important roles in the livelihoods of poor rural communities in northern Ghana, but these roles differ, depending on the community and the season. These roles visibly include ploughing and/or transporting a diversity of goods, including construction materials, manure and farm inputs like fertilizer from home to farm, farm produce from farm to home, water, firewood and farm produce to market. However, donkeys also offer a way for their owners to generate income through hiring out their services. This role is less evident and is used more by women than men.

The core services donkeys evidently provide to small, rural farmers in Gia and Fielmuo are ploughing and transportation assistance. The value in these services is the time and drudgery they save both genders in undertaking domestic and agricultural chores. However, despite donkey owners reporting they only hire out their donkeys for 2.6% of their total use across the year, approximately 50% of households say they hire out their donkey to generate income, the majority of them women. Nuances of donkey utilisation in Fielmuo and Gia and their importance in activities of daily living, especially to women, were augmented with analysis of their interview and seven daily time budget transcripts, where some donkeys are contributing up to 60% of household incomes. Although donkey owners report their donkeys spend nearly 10% of their time roaming or resting across the year, there is a risk that the welfare of donkeys that are hired out is compromised, as a result of the extra work they undertake in addition to their daily domestic workload

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## P30: EFFECT OF BREED AND PERI-NATAL LIVE WEIGHT ON SUITABILITY OF PURE AND CROSS BRED DAIRY BULL CALVES FOR BEEF PRODUCTION

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Dairy bull calves are displaced from beef production in favour of specialist beef breeds. Loss of dairy bred bull calves from meat production is neither efficient nor ethical. Consequently, milk purchasers are beginning to mandate that dairy farmers retain dairy bull calves on farm up to 8 weeks of age, while food retailers have begun to accommodate dairy beef products into the food chain. Historical displacement of such animals results in little data being available regarding the relative rearing costs and suitability of such animals for beef production. This study consequently aimed to assess 60 dairy bred bull calves, that were sourced from a single Spring calving dairy herd, and allocated these according to breed and live weight (LW) to one of three groups: Holstein Friesian (HF) of 50 ± 0.9 kg LW; HF x Jersey (JHF) of 51.0 ± 0.9 kg LW and of 44.1 ± 0.9 kg LW at 10 (± 3) d of age. All calves were offered adlibitum access to colostrum < 10 (± 3) d of age, followed by milk replacer (MR) at <10 L/d (150 g MR/L) on an individual basis twice daily, along with adlibitum access to water, cereal straw and calf starter (16 % CP) up to weaning at 12 weeks of age, when starter intake was > 1 kg/hd/d for 3 consecutive d. Live weight, growth rate, feed intake and feed efficiency were normally distributed and analysed by GLM, ANOVA (Minitab, 17.2.1), applying animal as a random effect, and breed and LW at 10 (± 3) as fixed effects in the model. Growth rate and feed efficiency were similar in HF and all JHF calves. Smaller JHF (< 50 kg) calves consumed less starter and took 7 d longer to achieve 120 kg LW compared with larger HF and JHF calves.

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## P31: FEEDING OUR 'FUR-BABIES': THE INFLUENCE AND IMPACT OF HUMAN DIET CHOICES ON OUR PET DOGS

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During the last century, the status of dogs within our homes has changed dramatically where they now occupy positions of high importance and are even considered full family members. This elevated status is often accompanied with greater consideration by owners of how to keep their dog healthy. This includes key decisions around nutrition and feeding. Concern has also grown in humans about their own diet with regards to sustainability, carbon footprint, food security, food safety / contamination, and welfare of farmed animals, and it is no surprise that these topics may influence the pet food decision-making process.

In spring 2019, the factors influencing the choices that UK dog owners make when feeding their pets was explored using an online questionnaire promoted by the BBC's The ONE Show. Over 36,000 individual responses were received from owners detailing the diet choices made for their pet dog as well as their own diet, with particular relevance to the primary protein source (e.g. omnivore, vegetarian). Several important factors were determined including the incidences of both animal-only and animal-free diets being provided to dogs in the UK, with animal-free diets showing a clear link to the owner's own choices. In addition, the high proportion of respondents that produced homemade diets themselves (12.19%) should raise concerns given the potential for nutrient imbalances to be present here. This talk will discuss these matters and address some of the reasons given for the choices made, as well as exploring the potential concerns that need to be addressed.

In a world where the internet provides increasingly more access to read about dog food related topics and online sales that allow a much greater range of options to purchasers, the face of dog food diets as we know it is changing. This work suggests that we need more research into the long-term consequences of new diet trends and more consideration of the influences that owners are under when making dietary choices for their dogs. Only then can we fully understand how to keep our 'fur-babies' nutritionally healthy.

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## P32: AN ECOLOGICAL APPROACH TO UNDERSTANDING OBESITY IN CAPTIVE LEMURS

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Excessive body weight, such as being overweight or obese, is associated with other serious health problems, e.g. reproduction issues and reduced lifespan, and is therefore concerning in captive animals. Some lemur species seem prone to extreme weight gain in captivity, yet for others a healthy body condition is typical. Understanding the basis for susceptibility to captive weight gain is fundamental to successfully addressing it, and to improve health and welfare. Madagascar, to which all lemurs are native, is characterised by poor plant productivity, pronounced seasonality, and unpredictable inter-year climatic variation. Adaptations to this environment may result in some species being especially "thrifty" (storing fat when food is available) and thus prone to weight gain under well-provisioned captive conditions. Wild lemurs also vary in arboreality, which increases the mass-dependent costs of locomotion, and could explain why some species consistently maintain lower fat levels. Alternatively, predation risk might be the driver, as excess weight impedes escape. Controlling for species' statistical non-independence, we tested these hypotheses by exploring relationships between species-typical ecological predictors, and deviation from wild-type body mass. Weight records and corresponding husbandry were collected using a survey, yielding useable data on 675 adult animals representing 13 species from collections worldwide. Data on species-typical wild biology were collated from published literature and online climate databases. We found tentative support for one hypothesis: species that experience unpredictable, large between-year variation in rainfall, and thus food resource unpredictability, tended to have larger captive weight gain ($t_{1,\ 11}$=2.04, $R^2$=0.27, λ=<0.001, P=0.07). Based on this we discuss practical recommendations to address unwanted weight gain; the need to establish the appropriateness of the threshold we used to infer obesity; and whether the captive feeding environment might in fact be perceived by some as being unpredictable, thus helping to explain our results.

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## P33: COMPASSION FATIGUE IN LABORATORY ANIMAL PROFESSIONALS: FACTORS FOR A SUPPORT PROGRAM

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Compassion fatigue (CF) has been increasingly recognized as an area of concern within the laboratory animal community. CF is a condition that can negatively impact laboratory animal professionals and may impact the quality of care provided to animals if not addressed. Coping mechanisms and support programs are important to help build personnel resiliency and provide employees with opportunities to engage in activities that help them to cope with feelings of CF. The current study aimed to better understand 1) coping mechanisms that are currently used to deal with CF, and 2) beneficial components for a CF support program. An online anonymous cross-sectional questionnaire was distributed to laboratory animal professionals using various Canadian and US laboratory animal list serves and a Charles River (CR) list serve. The questionnaire asked for information about demographics, compassion fatigue, coping mechanisms used, and top physical, emotional, social, and work-related needs for a support program. SPSS statistics software was used for descriptive statistics, and associations between demographics and self-reported feelings of compassion fatigue were evaluated using a Mann-Whitney test. Overall, most respondents (general: n =268, CR: n=154; N=422) were female (general: 79.2%, CR: n=69.8%), and reported having experienced feelings of compassion fatigue at some time (general: 65.6%, CR: 68.7%), with females more likely to report feeling CF than males (P=0.006). Most general respondents had roles as animal care (34.4%) or veterinary staff (24.7%) and worked in Canada (65.6%), while most CR respondents had animal care (25%) or research positions (29.9%) and worked in the US (92.9%). Participants indicated the top coping mechanisms are: talking to someone (general: 82.5%, CR: 78.1%) and getting away from work (general: 70.1%. CR: 67.2%). Respondents rated the top components for a CF support program including, 1) physical components: financial reimbursement for physical activities (general: 27.8%, CR: 35%), time and place to exercise at work (general: 29.2%, CR: 27.3%), 2) emotional components: a quiet place (general: 38.4%, CR: 35.1%) and self-care training (general: 20.6%, CR: 21.7%), 3) social components: support groups at work (general: 26.2%, CR: 19.2%), and lunch time activities (general: 18.1%, CR: 20.0%), and 4) work-related components: paid leave (general: 20.1%, CR: 30.3%), rehoming animals (general: 25.5.%, CR: 19.8%), and strict workday hours (general: 18.1%, CR: 17.2%). The survey results provide important information for building CF support programs for laboratory animal professionals, and we recommend that these components be incorporated to create useful and beneficial support programs.

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## P35: THE USE OF HEARTRATE VARIABILITY (HRV) AS A MEASURE OF AFFECTIVE STATES IN DOMESTIC DOGS

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Heartrate Variability (HRV) is widely used as a measure of affective states in a range of species, including domestic dogs. The Polar V800 is widely used in animal research to collect HRV data and although there is a very good correlation of inter-beat intervals with ECG recordings in static dogs, we have found that the unusually high variance compared to other species can lead to errors in interpretation and the rejection of good data as artefact.

We compared basal HRV parameters for genuinely relaxed dogs (familiar environment) with readings taken in animal rescue and rehoming centres, where animals may be subject to low grade chronic stress. The results indicated clear differences between HRV in the two environmental conditions when compared with previously published data. This suggests that in those studies 'basal' HRV is likely to have come from dogs that were displaying at least a mild stress response and therefore my not be the best benchmark for welfare assessments. Our data also demonstrated the highly significant interactions of age and sex on basal HRV in relaxed dogs, a finding supported in the human literature but not previously reported in dogs.
We have also found that frequency domain analysis needs to be conducted with caution, as species-specific frequency bands need to be selected. Use of the Low Frequency (LF) as a measure of sympathetic activity has been questioned in recent literature and our findings are that LF power was not a good predictor of affective state. Time domain analysis is not species-specific although if sampling for under 5 minutes, only some metrics are valid.

Whilst HRV remains an extremely useful and accessible tool for animal scientists to quantify affective states, a clear understanding of what it can, and more importantly, cannot do, is fundamental to the reporting of credible data. The equipment and software used to collect the raw data is almost universally designed for human use and therefore the methodology should be adapted relative to species-specific parameters to avoid the risks of drawing false conclusions from data. Our findings will hopefully enable ourselves and other researchers to make the most effective use of HRV.

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## P37: MEASURING STRESS IN KOALAS: MINIMALLY-INVASIVE HORMONE MONITORING CAN ADVANCE OUR KNOWLEDGE OF ANIMAL WELFARE

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Animals are naturally sentient as they can feel or perceive environmental changes using complex physiological and behavioural mechanisms. In today's world of rapid expansion of human population, animals are facing increased pressure from human induced changes in the environment. The big questions that often remain unanswered are; can animals adjust to environmental change; and if adaptation does not occur then what are the likely short- and long-term consequences? These research questions are relevant across free-living and captive (zoo and farm) animal welfare science. The neuroendocrine stress response occurs as a result of any unpleasant change in an animal's surroundings, which mainly involves the hypothalamus-pituitary adrenal (HPA) axis. Activation of the HPA-axis during stress results in the secretion of stress hormones such as glucocorticoids. With modern technological advancements in steroidal biomarker detection techniques, hormone metabolites can be readily measured in minimally-invasive samples such as urine, faeces, saliva and hair. The technique can readily be applied to animal study systems to explore specific research questions related to health and well-being. This method provides a quantitative way of profiling the stress responses of individual animals living within specific contexts and appropriate samples enable the distinction between acute and chronic stress responses. In this presentation, I discuss the main basic steps involved in validation of glucocorticoid hormone monitoring in animals using an example of Australia's iconic marsupial, the koala (*Phascolarctos cinereus*) and some of its applications. The poster will highlight the usefulness of non-invasive endocrinology research in advancing the health and welfare knowledge to boost management of rare and threatened animals.

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## P38: THE REAL PRICE OF CHRISTMAS TRADITIONS - LIVE SALE OF CARP IN POLAND; CONSUMER ATTITUDES AND WELFARE IMPACTS

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Carp are part of Polish culture and history. Since the 12th century carp, once considered "The fish of the King" have been eaten in the country. Under communism Poland saw the 'Centrala Rybna' programme, a large scale carp breeding programme, designed to provide "Carp on every Christmas table in Poland". Carp is traditionally eaten on Christmas Eve.

Consumers in Poland are slowly becoming aware of animal welfare, with two major supermarkets banning the sale of live carp. The project first aimed to survey consumer attitudes.

We first surveyed students of Veterinary Medicine. Future veterinarians were asked about carp consumption, slaughter methods and behavioral indicators of fish stress and suffering. The survey contained 18 peer reviewed questions. 112 students were surveyed.

Results showed that 40% of students consume carp at Christmas. 60% of all surveyed see no benefit in purchasing live fish. 4% of students think carp should be slaughtered at home, while 42% think they should be slaughtered at a purpose-built facility. 100% of surveyed students believe carp can experience pain and stress.

These results indicate that veterinary students, between the ages of 20 to 25, are aware of the welfare and suffering of carp. It also shows that they are not supporters of the traditional live sale of these fish. 85% of students surveyed indicated welfare concerns were the grounds for banning live sales in Auchan and Tesco. From this we can conclude that future veterinarians in Poland are not comfortable with this tradition.

In the pre-Christmas period, a survey will be conducted on customers who are purchasing live fish from street sellers. This survey will give us information on the slaughter methods people use at home. There is very little data currently available. It will also tell us how long people keep the fish live and under what conditions.

The next stage will be laboratory work looking at cortisol levels in the street seller's tank water as an indicator of stress. We will also examine cortisol, lactate and acute phase proteins in blood as biomarkers for stress in carp. Basal levels will be established by sampling blood from fish in grow out ponds in polish carp farms. This will allow us to account for handling and sampling stress.

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## P39: EQUID WELFARE IN NEPALESE BRICK KILNS - APPLICATION OF THE EQUID ASSESSMENT, RESEARCH AND SCOPING TOOL

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Equids fulfil many different roles within communities. In developing countries, equids provide essential transport of food, water, and goods as well as providing sources of income for communities by enabling draught power and producing manure. The total population of mules and donkeys in 2017 was 55,483,642; which is comprised of 9,685,278 mules and 45,798,364 donkeys, with the majority of these equids found in low and middle-income countries. Developing a standardised tool to assess equid welfare is therefore vital to allow us to identify countries, regions, and communities where interventions to improve the welfare of equids would be of the greatest value, as well as areas with high levels of equid welfare from which we can learn, which in turn can help support developing communities. Over the last two decades, there has been an increase in the number of measures available to assess the welfare of farm, laboratory or working animals; however, none of these provides comparable assessment specifically for equids in all situations that they may be exposed to.

To understand the welfare of equids in a range of different situations, The Donkey Sanctuary has developed the Equid Assessment, Research, and Scoping (EARS) tool. The EARS tool is sub-divided into bespoke protocols that select specific questions from the EARS data bank. The EARS tool provides a set of questions to assess equid welfare across contexts and geographical locations. The EARS tool provides a rapid assessment tool to collect information relating to the welfare of equids in a range of different situations. The EARS assessments draw on both animal- and resource-based questions to build a comprehensive understanding of equid welfare.

The aim of this investigation was to use the EARS tool to understand the welfare conditions that donkeys, mules, and horses are exposed to whilst working in Nepalese brick kilns. To understand the welfare conditions of equids in Nepalese brick kilns key indicator questions relating to demographic information, body condition, skin condition, and nutrition, health, working conditions, behaviour, and housing were used to assess equids. Trained staff carried out 2448 welfare assessments between December 2018 and April 2019. The results of equid welfare assessments indicate that to improve the welfare of equids working in Nepalese brick kilns there should be better provision of bedding material, improved access to water and equipment should be removed during rest periods.

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## P40: ASSESSING TRANSIENT AFFECTIVE STATE USING INTRACRANIAL RECORDINGS OF BRAIN OSCILLATIONS IN POULTRY

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The welfare of farmed animals is becoming an increasingly important and emotive factor for the public when determining what products to purchase. Consequently, the implementation and maintenance of welfare standards has been the focus of important legislation. Clearly, animal welfare is a significant research area to both the public and government.

Many welfare studies focus on the effect of chronic stressors on animals. However, it is also vital that we consider the stress which can be imposed by short term processes animals encounter throughout their lives. Traditional methods used to measure such short-term stressors, like stress hormone levels, behavioural observations, or gene expression, are sometimes difficult to implement for the assessment of an animal's transient affective state, especially during periods of restraint or inaccessibility.

Broiler chickens are exposed to many short term processes prior to slaughter, e.g. capture, loading into crates, transportation, and lairage, all of which restrict the animals' movements and the opportunity for a researcher to collect samples. Recording electrophysiological signals, including heart rate and intracranial local field potentials from key brain regions (Nidopallium Caudolaterale and Nucleus Taeniae) suspected to be involved in processing affective state, could provide potential methods to measure transient affective state during these processes. I will be presenting brain wave (EEG spectrograms) and heart rate data from slaughter age broiler chickens exposed to three negative and one positive experiences: being held upside-down; being separated from their flock mates; having their comb pinched; and being fed mealworms. We will discuss which signals have the potential to identify the most stressful experiences, and therefore to improve the subjective experiences of broilers.

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## P41: ACCESS TO LEGUME PASTURES IMPROVED WELFARE AND PERFORMANCE OF BROILER CHICKENS IN A HUMID TROPICAL ENVIRONMENT

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There have been a plethora of studies on the effects of access to runs on chickens' welfare and behavioural repertoire with a paucity of information on the comparative advantage of various legume pasture and deep litter system. A total of 200 day-old unsexed Marshall broiler chicks was used in this study to investigate the welfare and behaviours of broiler chickens reared on different legume pastures. Chicks were weighed and assigned randomly into five experimental groups viz.; deep litter without access to run (DL), deep litter with access to *Stylosanthes hamata* (SH), birds reared on *Stylosanthes guanensis* (SG), on *Mucuna pruriens* (MP) and free run (FR) during dry season. Each treatment had 4 replicates consisting of 10 birds per replicate. Data were collected on behavior, tonic immobility (TI) and gait score and performance of the birds. Data obtained were subjected to One-Way Analysis of Variance in a Completely Randomized Design. Results showed that the birds with access to SH, SG and MP spent higher ($P < 0.05$) time drinking, preening, dust-bathing, spot pecking and walking standing behaviours while those in DL and FR spent more ($P < 0.05$) time feeding. Generally, the gait score of the birds on the different legume pastures was similar but better those without access to pasture. The different legume pastures had no significant ($P > 0.05$) effect on plasma triiodothyronine ($T_3$) concentration. Tonic immobility of the birds was similar at the starter phase but the TI of the birds in DL was longer than that of FR whose duration was longer than those of the birds on the pastures. The final weights of the birds in SH were significantly higher ($P < 0.05$) than those of the other treatments whose weights were similar. The feed conversion ratio of the birds on different legume pasture was similar but significantly lower ($P < 0.05$) than those without access to pasture. The study concluded that access to different legume pastures improved the welfare of broiler chickens without adverse effect on the performance of the birds.

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## P42: BEHAVIOURAL RESPONSES OF TWO STRAINS OF NIGERIAN NATIVE CHICKENS EXPOSED TO DIFFERENT TEMPERATURE REGIMEN

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The impact of heat stress on genetically selected birds has been reported in heavier and faster growing poultry breeds. The FUNAAB Alpha is the first improved indigenous strain of chicken developed in Nigeria for improved meat and egg production without compromising the adaptation to tropical climate and diseases. However, there are no studies that have compared them with the pure native indigenous chicken in order to establish the appropriate temperature regimen for these birds. Under high temperature, poultry birds exhibit many behavioural changes which allow them to re-establish heat balance with their surroundings. Thirty six birds each of two strains of Nigerian indigenous chickens (FUNAAB Alpha and Yoruba ecotype) were used for this experiment. At week 9 of age, birds were randomly allotted to three temperature regimen namely 22-24$^{o}$C (mild temperature), 30-32$^{o}$C (moderate temperature) and 36-38$^{o}$C (high temperature) respectively for 3 hours/day for 3 consecutive days. This exposure was repeated at the 12$^{th}$ and 15$^{th}$ week of age of the birds. Behavioural parameters such as percentage of birds feeding, drinking, panting and comfort behaviours (preening, resting, sitting) were recorded during the experiment with the use of digital cameras. Behavioural data collected were analyzed using Kruskal Wallis test having strain and temperature as fixed factors using SPSS version 23. The percentage of the Yoruba ecotype feeding and drinking were greater ($p<0.05$) than FUNAAB Alpha while the percentage of FUNAAB Alpha exhibiting comfort behaviours were greater than Yoruba ecotype. The percentage of birds feeding at 20-22$^{o}$C and 30-32$^{o}$C was greater ($p<0.05$) than the birds at 36-38$^{o}$C while the percentage of the birds drinking at 30-32$^{o}$C and 36-38$^{o}$C was greater ($p<0.05$) than the birds exposed to 20-22$^{o}$C. The percentage of birds panting was greater ($p<0.05$) at 36-38$^{o}$C, followed by 30-32$^{o}$C which was in turn greater than 20-22$^{o}$C. Comparatively, the percentage of FUNAAB Alpha birds feeding and drinking was more ($p<0.05$) compared to Yoruba ecotype. In conclusion, the behaviour of Nigerian indigenous chicken differed from the FUNAAB Alpha. Behavioral responses showed that both strains were more comfortable at 22-24$^{o}$C but exhibited heat stress related behaviors at temperatures above 30$^{o}$C.

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## P43: THE EFFECT OF DIFFERENT FACTORS ON THE WELFARE STATUS OF TWO ZOO-HOUSED PERSIAN LEOPARDS

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Captive environments are restrictive for many animal species because they impose conditions that the animals cannot control and provide limited opportunities for them to fulfill their behavioural needs. This leads to high levels of stress and negative welfare status. Welfare is defined as what matters to the animals from their point of view. It is influenced by the animals' individual characteristics and can be associated with different types of behaviours. The aim of this study was to assess the welfare status of one male and one female Persian leopard which means, based on the welfare definition, to identify if and how differently they perceive their environment. This was answered by investigating their differences on how they respond to specific stressors such as number of visitors, lack of food, absence of enrichment and the effect of social housing. Observational data were used to indicate the individuals' daily activity budget and their response to different environmental factors. Observations also took place during a separation and reunion period. This was considered as a test period in order to indicate the effect of social housing on the male. The two individuals indeed showed different responses. The male did not appear to be significantly affected by the specific environmental stressors and did not respond positively and with more natural behavior to the different forms of enrichment provided by the zoo. On the contrary, the presence of the female was clearly beneficial to him. The female appeared to be significantly more influenced by the environmental stressors. Lack of food worked as an enrichment for her by leading to more natural behaviour and the context of social interaction with the male also had a significant effect on her welfare. She did not respond to the other stressors or the presence of enrichment. To conclude, the observed differences between the animals support the importance of individualized observations in assessing the welfare status of an animal. Suggestions for a better welfare status for the leopards were made.

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## P44: FACIAL TEMPERATURE ASYMMETRIES AS AN INDICATOR OF ANIMAL EMOTION: DISBUDDING IN DAIRY CALVES

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Emotions are short term affective states that can be assessed in terms of valence (positive or negative) and arousal (low or high). It has been hypothesised that emotions are processed differently in the brain hemispheres (brain lateralisation), one hypothesis is that positive emotions are processed by the left hemisphere and negative ones by the right hemisphere. We used Infrared Thermography to assess if temperature asymmetries (left – right temperature) on different areas of dairy calves' faces were in line with this lateralisation hypothesis. We observed the routine restraint and hot-iron disbudding of the calves in the herd using local anaesthesia, assuming that this induced a negative state. Thirty-six calves were evenly assigned to three groups: calves that were disbudded during the study (disbudded); calves that had been disbudded previously (ExpObs) and calves that had not yet been disbudded (InexObs) – all of which observed the disbudding of conspecifics during the study. Thermal videos were recorded on three days: Baseline (D1), Disbudding day (D2) and day after disbudding (D3), and at two different times: disbudding time (T1) and three hours after disbudding (T2). Results from ANOVAs for repeated measures showed asymmetric temperatures in the 'base of the ears' ($F(2,66)= 3.986$, $p=0.023$), 'inner corners of eyes' ($F(4, 66)=3.104$, $p= 0.021$) and 'rostral eye surroundings' ($F(4, 66)= 3.441$, $p= 0.013$). Calves had higher temperature asymmetries towards the left ear on the disbudding session (D2, T1) than on the day before (D1, T1) ($p=0.028$). On the Disbudding day (D2) calves also had lower skin temperature of the forehead and muzzle than on D3 ($p<0.05$). One interpretation of these findings is that calves were in a more highly aroused negatively valenced state on D2 compared to D3 and D1 respectively. There were also some effects of experience on thermal asymmetries. On the disbudding day (D2, T1) ExpObs tended to have higher asymmetric temperatures towards the right eye inner corner than the InexObs ($p=0.052$). On the day after disbudding (D3, T1) this difference was reversed, with the InexObs having higher temperature asymmetries towards the left rostral eye surrounding than ExpObs ($p<0.05$). InexObs also had lower muzzle and whorl temperatures on D2 than the other groups ($p<0.01$). This study provides initial evidence of the effects of disbudding experience on temperature asymmetries in the skin of dairy calves, and highlights the potential of Infrared Thermography in the study of animal emotions. Interpretation and reliability of results requires replication and further understanding of precise links between brain hemispheric activity and facial temperature asymmetries.

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## P45: A TIME COURSE OF BLOOD PARAMETERS BEFORE AND AFTER LAMBING IN MERINO EWES

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Dystocia poses significant welfare risks to ewes and lambs, causing exhaustion, increased risk of complications and death of the ewe, and hypoxic brain injury and death of the lamb.

The nutritional plane of the pregnant ewe is a known risk factor for poor lambing outcomes, especially for dystocic lambing events, a major contributor to neonatal lamb mortality in Australia and internationally.

The metabolic status of the ewe before and after lambing may be correlated with the incidence of dystocic lambing events, and blood parameters such as glucose, lactate, base excess may be informative of depletion of energy reserves after prolonged birth events. Creatinine was included as depletion of muscle glycogen can lead to elevated creatinine levels. In the first step reported here, we developed a time course to identify the best sampling time points for a future larger-scale trial comparing dystocic and normal lambing events.

Pre-lambing blood samples were collected and analysed at mid- and late-gestation. Ewes were housed indoors in a group pen under natural light conditions with 24-h video surveillance. A blood sample was taken within 2 h of birth, and then at 4, 8, 24 and 48 h post first sample collection. Samples were analysed for glucose, haemoglobin, base excess and creatinine (among others) using an iStat-1 handheld blood analyser (Abbot Point of Care, Princeton NJ, USA).

The greatest variability in all blood parameters was observed at birth. Blood glucose level peaked at birth and reduced substantially by 4h post-birth. Creatinine concentration peaked 4-8h after birth. This result is consistent with our hypothesis linking increased creatinine levels with the high energetic demand of labour in skeletal muscle tissue. For base excess, the time point of greatest metabolic change was at birth, again consistent with the accumulation of lactic acid in glycogen depleted skeletal muscle tissue. Haemoglobin also recorded the highest values at birth.

In conclusion, blood samples measurements in the protocol under development should be taken at birth, as they show the greatest variability, and hence may allow separation of birth types. Alternatively, the effect of birth may mask other differences and therefore a second post-lambing sample at 16-24h should be included, as most parameters were observed to have settled back to pre-lambing levels by 24h. Finally, a pre-lambing time point several days before expected lambing date should be added to the protocol to address the question whether pre-lambing metabolic status may be informative for birth type.

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## P46: IMPACT OF A COMPANION HORSE DURING STRESSFUL SITUATIONS

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Social buffering is the capacity of an individual (usually a conspecific) to reduce the stress of another in a variety of ways. The horse, as a highly social species that is often kept in isolation, is a good model for researching social buffering effects in animals.

The aim of this study was to assess the impact of a horse companion on the reaction and recovery time of subject horses to two separate unusual events (sudden opening of umbrella, or appearance of a large ball). In addition, we wanted to know if a companion habituated to the events was more efficient than a naïve one. 32 horses (16 subjects and 16 companions) living 2 or 3 per stable were used.

Each subject completed 4 tests in a counter-balanced order: Novel stationary stimulus test (ball) - alone and with companion; Novel sudden stimulus test (umbrella) - alone and with companion. Half of the companions were habituated to the stimulus and the other half were naïve like the test subjects. To avoid order effects, the 16 pairs were randomized into 4 groups; with each group performing the tests in a different order. Physiological parameters (heart rate) and behavioural parameters (reactivity score) were recorded.

Our results showed that the presence of a companion significantly reduced the behavioural response (reactivity) of subject horses in the novel stationary stimulus test (Cumulative Link Mixed Models (CLMM): estimate ± s.e.: −2.11 ± 0.88, p=0.0162) but not in the novel sudden stimulus test (CLMM: estimate ± s.e.: −1.14 ± 0.78, p=0.145). However, we found the opposite results for the heart rate recovery. The presence of a companion was associated with quicker heart rate recovery in the novel sudden stimulus test (Linear Mixed Model (LMM): t-value, df: −2.319, 13, p=0.0373) but not the novel stationary stimulus test (LMM: t-value, df: −1.336, 11, p=0.208). We did not find that habituation of the companion had an effect on the subject's reaction and recovery time.

In conclusion, the effect of the companion depends on the nature of the stressor, but is independent of companion habituation.

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## P47: WELFARE PROVISIONS FOR LIVESTOCK AT MARKETS IN THE 21ST CENTURY — THE RESULTS OF A SURVEY OF 24 MARKETS ACROSS ENGLAND AND WALES CARRIED OUT BETWEEN 2017 AND 2018

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The first purpose-built livestock marketing facility in Great Britain opened in Hawick in 1817. Today there are approximately 120 markets in England and Wales and the welfare of animals passing through them is of paramount importance. A previous study into animal welfare in UK markets was performed by the Humane Slaughter Association (HSA) and Royal Veterinary College between 2005 and 2007. In 2017, the 200th anniversary of Hawick market, the Livestock Auctioneers' Association commissioned the HSA and the Royal Society for the Prevention of Cruelty to Animals to carry out a survey of livestock markets in England and Wales. The purpose of this work was to provide a 'snapshot' of animal welfare at livestock markets in the 21st century. Twenty-four markets across England and Wales, considered to be representative in terms of species (cattle and sheep), age of animals handled, annual throughput (high, medium, low), location and market age (dating from 1800s to 2010s), were selected for inclusion in the project. Data were obtained using two surveys: the first was a questionnaire in which market managers provided information on staff training, protocols and animal management practices. The second was an assessment of the handling facilities; for this, key features were scored as present or absent. These surveys were completed by HSA technical staff between March 2017 and July 2018. The aims of this study were to evaluate how livestock facilities in markets have changed since 2007 and to establish whether there is a relationship between the standard of handling facilities, market age and annual throughput. To investigate this, Analysis of Variance tests were used followed by a post-hoc Tukey Test where appropriate (Minitab V18). There have been improvements in aspects of market management and facility provisions since 2005 for both cattle and sheep. When grouped into three categories; 1 to 15 years, 15 to 49 and 50+ years, markets below 15 years of age were found to have significantly higher total facility scores than those aged 50+ years ($F(2,56)=5.06$, $P=0.01$). Markets in the high-throughput category received significantly higher scores for the market management questionnaire than those in the low-throughput category ($F, (2, 21)=5.16$, $P=0.015$). High-throughput markets also received significantly higher facility assessment scores than low-throughput markets ($F, (2,38)=4.10$, $P=0.024$). In conclusion, the operation and facilities of livestock markets in England and Wales have improved over recent years, but operators must remain vigilant at all times with regard to animal welfare.

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## P48: KEEPER REPORTS OF ABNORMAL BEHAVIOUR IN ZOO HOUSED PRIMATES

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Utilising the knowledge of zoo keepers can help determine and assess animal welfare indicators, particularly when sampling populations across multiple zoos. When familiar with individual animals, keeper reports, although subjective, can advantageously provide insight into long-term welfare status and retrospective changes in welfare. Abnormal behaviour, an established welfare indicator, has been well studied in discrete zoo groups, but rarely have chimpanzees, gorillas and orangutans been considered simultaneously, across multiple zoos. We completed an online survey emailed directly to the research department of zoos in the British Isles, in 2017. We asked keepers to report on the prevalence, frequency and severity of abnormal behaviour in the great ape groups under their care (15 abnormal behaviours identified from the literature plus any additional behavioural abnormality the keepers have identified). Keepers noted that in five great ape groups all 15 abnormal behaviours occurred. Across all great ape species collectively, keepers reported regurgitation (n=10), regurgitation and reingestion (n=15), coprophagy (n=13), hair plucking (n=10), displacement yawning (n=11) and displacement scratching (n=12) in significantly more great ape groups given the overall distribution of abnormal behaviours ($\chi 2=25.365$, n=126, df=15, $p=0.045$). Diet was a risk factor of spinning and hyperaggression, which were significantly more prevalent in groups fed cultivated fruit ($p<0.001$), while self-patting was significantly more prevalent in groups fed a cultivated fruit free diet ($p<0.001$). Species was also a risk factor as the prevalence of abnormal behaviour in gorillas (as reported by keepers) was significantly higher than for chimpanzees and orangutans ($p<0.001$), though keepers reported frequency of abnormal behavioural expression tended to be higher in chimpanzees. These methods are now being repeated for lesser apes (lar gibbon), monkeys (Sulawesi crested macaque, cotton top tamarin, common squirrel monkey) and lemurs (ring-tailed lemur). Preliminary findings suggest that abnormal behaviours are well established in these species, with notable species differences. Despite modern husbandry and management practices, and an array of feeding enrichment used with each primate group, oral stereotypies particularly persist throughout the captive population in the British Isles, indicating widespread incidents of reduced welfare. A review of enrichment and other husbandry practices would be warranted according to these results and the use of targeted enrichment, amongst other measures, should be prioritised.

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## P49: EARS - EQUID ASSESSMENT RESEARCH AND SCOPING TOOL: A NEW APPROACH TO ANALYSE, UNDERSTAND AND RESPOND TO EQUID WELFARE PROBLEMS WORLDWIDE

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The capacity for decision-making and intervention in any project related to equid welfare should be based on a knowledge of the real issues affecting these animals worldwide, regardless of the tasks performed. This approach is even more important when new emerging economic activities around equids - e.g. donkey skin trade - are particularly challenging in terms of animal welfare.

The Equid Assessment Research & Scoping (EARS) Tool is a research and data collection tool developed by *The Donkey Sanctuary*, with the main purpose to provide reliable information about the general health and welfare of equids worldwide. EARS is primarily designed to obtain individual information about an equid and its surrounding environment, or from a group of equids in similar conditions, through cumulative repetition. It is organized into 19 indicators, each one divided in to different categories, and each category with a specific set of questions. The EARS Tool allows the development of different protocols, by choosing the correct set of questions that best fit the inherent needs.

Data collection and preliminary analysis of data in a simple, fast and effective way are also a central aspect of EARS, by using open source software (OSS) throughout the data collection cycle: *Open Data Kit Collect* to log information in the field; *R* to parse, analyze and filter this information; and *R Shiny* to disseminate the results through dashboards. These OSS products allow off-line data collection with initial overview results presented as soon as the user uploads their surveys when back online.

This new tool contributes to a better understanding of the underlying reasons behind poor equid welfare, and allows the design of evidence-based strategies that not only identify and tackle the real causes of problems, but also allow the organizations to measure the impact of decisions taken over time.

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## P50: WHERE TO GO WITH ZOO WELFARE? IDENTIFYING OVER-LOOKED TAXA AND PRIORITISING RESEARCH QUESTIONS

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The application and output of zoo science has expanded in scope and ambition over the past decade. With calls for a more evidence-based approach being heeded by the research community to generate data relevant to best practice care for captive wild animals. To determine the scope of research conducted using zoo-housed species, we systematically reviewed the literature to identify trends and evaluate output with an animal welfare focus. We conducted a survey of the zoo-focussed literature from the journal database Web of Science© from 2009 to 2018. We located a sample of 1063 papers that contained research focussing on or pertaining to captive wild animals. The taxonomic classification of the subject species was recorded, and papers were summarised by aim, outcome and gain to the zoological and scientific community. Of this sample, 41 had a primary Welfare aim and 38 of these papers focussed solely or partly on mammalian study subjects. Of this sample, 301 papers had a sole Husbandry and Training aim. As an evidence-based approach can inform positive welfare states, by providing species-appropriate captive care, welfare aims can be suggested from these pieces of research too. This husbandry-focus too showed a strong mammalian bias, with 257 of these papers being solely or partly including mammalian species. Across all papers, 434 papers had a Husbandry and Welfare outcome, supporting our argument that husbandry and management questions do relate to improving welfare. However, only a small overall sample (245 papers) had an Advancement in Practice gain, with the majority of papers advancing knowledge of the study area. Our research parallels with that in other areas of biological science and with other recent papers from the zoo science world, which identify a need for diversity in the study subjects used for research in these areas of investigation. We provide suggestions for how zoo researchers can take existing questions, focussed on mammals, and apply them to non-mammalian taxa to further evidence and improve captive welfare. We provide suggestions for important research topics, currently not being investigated and show that priority research lists can help “fill a knowledge gap” in areas of zoo animal husbandry that are currently lacking in evidence, including a call for a keener focus on zoo and aquarium-housed fish and invertebrate species.

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## P51: EASIERR: AN OPEN-ACCESS SOFTWARE FOR HRV-ANALYSIS AND ARTEFACT PROCESSING IN NON-RESTRAINED ANIMALS

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In order to ensure good animal welfare, valid methods to measure and analyse stress parameters are required. The assessment of heart rate (HR) and heart rate variability (HRV) based on electrocardiograms (ECG) is considered a good proxy for stress in a wide range of animal species. However, problems can occur when acquiring ECG in unrestrained animals using non-invasive devices. Artefacts, that can be caused by technical (i.e. bad electrode skin contact) or physiological (i.e. ectopic beats, non-cardiac muscle potentials) sources, are common and can disrupt the ECG signal. As HRV-analysis is highly sensitive to artefacts in the interbeat interval time series, the process of visual inspection of the ECG and tachogram to detect and subsequently correct these artefacts is essential. Most of the commercially available software packages for this purpose are not freely available, and/or require intensive training and extensive manual work.

EasieRR is a stand-alone software optimised to assist researchers with HRV-analysis in non-restrained animals. The program allows a species-specific analysis and calculation of established standard HRV-parameters in both, the time- and the non-linear domain (RMSSD, SDRR, SD1, and SD2). The intuitive graphical user interface and the visualization of data using Poincaré plots and tachograms eases the validation of correct heart cycle interval detection and minimises manual work for the user. The software automatically detects prominent peaks and potential artefacts can then be manually corrected. The analysis report can be exported using common formats (TXT, MAT, PDF, SVG, PNG, JPG, TIFF, EMF, EPS). A special feature of EasieRR is the possibility to synchronise ECG data with videos in order to link cardiac responses to specific behavioural responses. This supports import into software for behavioural analysis such as BORIS or The Observer. EasieRR is an open access software and hosted at: https://figshare.com/account/home#/projects/68831).

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## P52: NORECOPA: PREPARING FOR BETTER SCIENCE

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Norecopa's role is to disseminate resources which advance the replacement, reduction and refinement of animal experiments.

Norecopa launched a new website in 2016 (https://norecopa.no), which made it possible to merge the individual databases and webpages which its staff had produced since the early 1990s into one resource, with an intelligent search engine. The website has just under 10,000 pages at present, and it currently receives approximately 350,000 hits per year.

Norecopa collaborates widely with other members of the research animal community. In 2017, such a group published the PREPARE guidelines for planning animal research (https://norecopa.no/PREPARE). PREPARE consists of a 15-topic checklist, translated into over 20 languages, supported by a dedicated section of the website which provides supplementary resources for each topic.

Norecopa provides websites for two international collaborations: the European Network of 3R Centres (https://norecopa.no/3REuropeOverview) and the International Culture of Care Network (https://norecopa.no/coc). The Norecopa website also hosts a compilation of severity classification systems produced by European colleagues (https://norecopa.no/severity).

In addition, Norecopa arranges international consensus meetings, produces guidance on topical issues related to the three Rs, and publishes an English-language newsletter 7-8 times a year.

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## P53: STEREOTYPIC PACING AND FAECAL CORTICOSTERONE METABOLITES AS NON-INVASIVE INDICATORS OF STRESS IN REHABILITATING GREEN TURTLES (*CHELONIA MYDAS*)

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Species of marine turtles are experiencing large population declines, and there are many conservation projects worldwide which aim to rehabilitate and release sick or injured turtles. Whilst in captivity, turtles will inevitably experience unnatural conditions and large amounts of human interaction, both of which may cause stress to the animals. Green turtles (*Chelonia mydas*) are believed to travel 5-10km per day, and animals with a similarly large range area have been shown to develop stereotypic behaviours such as pacing whilst held in a captive environment. However, there is both limited research of stress in marine turtles, and a lack of subjective method to quantify the locomotion of pacing. Here, we trialled a new method of incorporating transition probability to identify repeated pathways. It has been suggested that in order to improve the success of conservation interventions increased collaboration between animal welfare and conservation physiology is required. Here, for the first time in a marine turtle species, we also trial the use of faecal corticosterone metabolites (FCM) as a biological marker of stress in a non-invasive alternative to the classical use of blood sampling, which can itself induce stress. Three of the four subjects displayed repeated pathways ($p = 0.03$, $p = 0.02$, $p = 0.04$). FCM were successfully extracted and assayed from all four subjects. The aim of the study is to develop techniques to identify stress in real-time and non-invasively, in order to improve detectability of physiological stress and influence best practice for the welfare of captive marine turtles. This may reduce any chronic effects of stress such as immunosuppression, inappetence and impaired reproductive function, which could subsequently support the success of rehabilitation efforts and other conservation interventions. It is hoped the successful application of the methods will advocate their use within future research and captive care of green turtles.

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## P54: DOES GENDER MATTER WHEN GETTING OLDER? BEHAVIOUR OF TURKEYS IN A NOVEL OBJECT TEST – INFLUENCE OF AGE AND SEX

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In this study we applied a Novel Object Test (NOT, original literature: Erasmus and Swanson, 2014) to a large group, to test animal behaviour on-farm. Presenting novel objects is a common tool in the prevention of cannibalism and feather pecking, both being major welfare problems in turkey production. The aim was to evaluate behaviour of turkeys in the NOT repeatedly over an entire fattening period in male and female animals. Our hypothesis was, that turkeys would display different reactions according to their age and, furthermore behaviour would differ between sexes.

The study was conducted on a farm with two stables keeping both male and female turkeys at the same time. First NOT started in the 3rd week of life (LW) and was repeated every 14 days (5.LW/ 7.LW/ 9.LW/ 12.LW/ 15.LW/ 17.LW). One of four different novel objects was presented at each date at six different positions in the barn. The testing time was 10 minutes for each position, data was collected by direct observation. The latency up to the first approach (LA), the latency up to the first peck (LP), the pecking frequency (PF) and the number of animals in the approach (NAA) were recorded.

The LW revealed a significant influence on PF ($F>3.7$; $p<0.05$) and NAA ($F>3.5$; $p<0.05$). Gender was found to have a significant influence on all recorded parameters (all $F>32.0$; all $p<0.001$). The object revealed a significant effect for LP ($F=15.7$; $p<0.001$) and for NAA ($F=2.8$; $p<0.05$). In addition, there was a significant effect of the interaction between LW and sex (all $F>5.7$; all $p<0.001$). Here, both, FP and NAA increased with age in the hens, whereas no differences could be found for the toms. In contrast, toms showed longer LA in LW 5, whereas hens remained stable over the whole fattening period.

The presented results show that there are differences in behaviour depending on the age of the animals and that those differences clearly differ between the two sexes. The NOT normally is used to indicate fear behaviour, however, recent studies discuss the test to also be related to exploration and / or personality of animals. Even if we have no evidence for the underlying motivation triggering the differences we found, our results may contribute to a better understanding of the respective needs of both, male and female turkeys.

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## P55: HERPS ACROSS ENGLAND: INVESTIGATING THE SCALE OF THE REPTILE AND AMPHIBIAN TRADE

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In recent years the herpetological trade has become increasingly accessible to pet owners. What was once a specialist hobby between a network of keepers has now become mainstream, with reptiles and amphibians often found in general pet shops and online. Animal welfare legalisation has struggled to keep up with this rapid growth, and we have little idea of what species and how many individuals are being traded. Given their specialist needs, there are concerns as to how these animals can thrive in captivity. Previous research by the Blue Cross and Born Free Foundation initially highlighted the potential issues, but was only able to monitor small samples of classified adverts for 3 months.

This ongoing research will look at trade in pet shops (both physical and online) and classified adverts over 3 years, utilising a bespoke expert software system to process the large data sets. Adverts uploaded to four classified websites in August 2017 (n= 2551), 2018 (n= 2665) and 2019 (n= 1295) represented 263 different species of reptiles and 50 species of amphibians for sale, which is a much larger quantity than what the previous research found (53 and 7 respectively). Of those adverts that gave reasons for sale (excluding businesses and breeders), the most frequently occurring was 'lack of time' (n= 515) followed by 'moving house' (n= 382). Prices varied between species, morph variety, age, and whether equipment was included, however 78 adverts were listed as 'free to a good home' with 32 of those also offering a complete set-up, meaning that a specialist pet could be acquired with very little effort. Emotive concerns that the animal did not get enough handling or attention were expressed in 252 adverts, suggesting that some owners feel that these species may suffer from being constantly caged. When comparing locations of individual animals for sale per 100,000 of the population of England, trade 'hot spots' (by Local Authority) were identified, with Lincoln, Torbay and Chesterfield being the highest. During 2017, 159 physical and online pet shops across England were visited to further quantify species for sale, which identified a further 168 reptile and 72 amphibian species.

Whilst we are at an early stage to properly quantify the herpetological trade, these preliminary findings give a highly detailed snapshot of part of it, which could help inform welfare organisations as to where and how their efforts on education and rescue could be targeted.

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## P56: WHO'S WALKING WHO? THE RELATIONSHIP BETWEEN PULLING ON LEAD AND PET DOG WELFARE IN THE UK AND IRELAND

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Walking may be integral to pet-dog welfare, providing exercise, social exposure, outlets for species-specific behaviours and being positively correlated with owner attachment, despite these probable benefits an estimated 40% of dogs are never walked. One previously unexplored reason for this may be pulling on lead, whereby the dog walks in a manner, or position, or both, that creates pressure on the lead, causing it to become tense and taut. This study aimed to investigate the nature and scope of lead-pulling behaviour amongst petdogs and identify potential associated welfare risks. Between February and March 2019, we surveyed pet-dog owners (n=2,886) in the UK and Ireland online, regarding owner and dog demographics, dog-walking practices, training methods and equipment. Univariate analysis evaluated associations between the independent variables and pulling intensity ($p < 0.05$) — the force with which the dog pulled on lead. Binary logistic regression identified predictors of pulling frequency ($p < 0.05$) — how often the dog pulled. Of dogs 82.7% (n=2,093) pulled on lead and 30.9% (n=770) with moderate to severe/worst imaginable intensity. Over the 30-day study period, dogs that pulled received shorter walks (mean (± standard deviation): (47.6 minutes (± 22.6)), than dogs that did not (50.2 minutes (± 27.7)). As pulling intensity increased, walk frequency decreased, from (51.4 times, (± 38.2)) for no pulling, to (42 times, (± 22.4)) for severe/worst imaginable pulling. At risk groups were dogs aged 6–23 months ($p <0.001$), small (5–10 kg) ($p <0.001$), medium (11–25 kg) ($p <0.001$) and large (26–40 kg) dogs ($p <0.001$), and dogs owned by younger ($p <0.001$), less experienced owners ($p = 0.014$) or owners of one dog ($p = 0.04$). Headcollars, front, and back-connection harnesses were associated with increased lead-pulling ($p \leq 0.046$). Training classes including loose-lead walking exercises increased the odds of pulling frequency by 2.5 times ($p <0{\cdot}001$). However, a cross-sectional study such as this can only provide correlational results; although certain factors were associated with lead-pulling, we cannot infer causality. This study is, to our knowledge, the first to explore lead-pulling behaviour. The results indicate that it is a widespread, undesirable behaviour with potentially serious welfare implications and that further research on the most effective, welfare-centred lead-walking training methods, equipment and practices is essential. Fostering enjoyable, symbiotic dog-walking experiences could increase enrichment and exercise, whilst reducing stress and aversion for pet-dogs and improving owner attachment, all of which contribute to higher welfare.

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## P57: FACTORS INFLUENCING THE BEHAVIOUR OF DAIRY CALVES IN HUTCHES

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The use of hutch-housing for dairy calves is predominant in many parts of Europe and America. Even though hutches have existed for many years, there is an absence of a comprehensive ethogram of hutch-housed dairy calves and literature on factors influencing their behaviour. Thus, this study determined the influence of housing in different hutches, day, and gender on the behaviour of dairy calves housed in hutches using a comprehensive ethogram. Sixteen Holstein Friesian calves (12 females, 4 males) housed in four group hutches (n=4) were recruited for this study. The ethogram comprised of three categories. Postures, attentiveness and social interactive behaviour formed category I; events such as head rub, head shake, ear flick, yawn, body rub, shake, stretch and tail wag comprised category II while category III behaviour composed of states including standing, lying, walking, playing, grooming, eating, drinking, chewing, scratching and sniffing behaviour. Data were obtained using a combination of direct and video observations made simultaneously for five minutes per calf (80 minutes/day starting at 10:00) for two consecutive days. Category I behaviour were scored as frequency by direct observation while the frequency and duration of behaviour in categories II and III were determined using the behavioural observation research interactive software (BORIS® version 7.4.15). Data were analysed using SPSS (IBM® version 25). Tests for normality and homogeneity using Kolmogorov-Smirnov and Levene's test were performed, and due to the significant variations observed, Kruskal Wallis test was used to determine differences between hutches while Mann Whitney U test determined behavioural differences between day and gender. Results showed that housing in different hutches had no significant effect on behaviour over the two-day period. Significant variations ($P<0.05$) were observed in ear, mouth and jaw postures, and response to observer between the two days. 'Tongue inside mouth' behaviour ($P<0.023$), ear flick ($P<0.007$), tail wag ($P<0.042$) and walking behaviour ($P<0.044$) were significantly higher in females than in males while shaking ($P<0.036$) and sniffing other calves ($P<0.045$) were found to be significantly higher in males than in females. Findings suggest that the behaviour of dairy calves housed in hutches maybe influenced by day and gender. It is necessary to control for these factors while designing behavioural studies.

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## P58: HOW DO GRADUAL METHODS OF WEANING GOAT KIDS FROM AN AD LIBITUM MILK FEEDER IMPACT THEIR BEHAVIOUR AND PRODUCTIVITY?

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Rearing kids artificially is standard practice on commercial dairy goat farms. Most producers in the United Kingdom use *ad libitum* milk feeding set-ups that allow constant, unrestricted milk access. Research on calves suggests that feeding *ad libitum* gives increased weight gains and a more natural behavioural repertoire, but lower solid-feed intake and slower rumen development can be problematic. Weaning (transitioning from milk to solids) represents an important management phase, and artificial weaning (weaning that does not take place over a natural timespan involving cues from the dam) is considered stressful. Weaning may be abrupt, featuring sudden and complete removal of milk, or gradual, involving incremental reduction of milk feeding before complete removal. Evidence from calves suggests abrupt weaning results in lower growth rates and reduced welfare. The aim of this experiment was to determine the effects of two gradual weaning methods from *ad libitum* milk feeding on kid behaviour and productivity. 261 goat kids were housed in 9 pens of 25-32 kids. A Förster-Technik Eco-Feeder supplied warm milk *ad libitum* to two teats per pen. Three treatments were used (Table 1). Kids were weighed once each pen was filled, and then at 35, 45, 56, 60 and 64 days old. CCTV recorded seven of the pens for three, two-hour blocks per day to record periods of teat removals and replacements. A behavioural ethogram was created focused on play, feeding behaviour and competition. Modified group-level scan sampling every 5 minutes was used to record the number of kids performing each behaviour to calculate the percentage per pen. Results from Kruskall-Wallis tests show that gradually weaned kids showed a higher frequency of feeding on solids during the weaning period ($P$=0.001), and that abruptly weaned kids showed higher levels of 'frustrated suckling motivation' post-weaning ($P$=0.008). However, there was a significant difference in feeding competition pre-treatment ($P$=0.007). Performance data showed unexpected results and may suggest that abrupt weaning does not reduce post-weaning growth. Overall the study suggests that gradually weaned kids are better psychologically prepared for weaning and therefore may have enhanced welfare as weaning stress is lowered.

**Table 1:** Milk availability by treatment.

| Treatment | 0-35days (Pre-treatment) | 35-45days (Weaning1) | 45-56days (Weaning2) | 56days (Wean) |
|---|---|---|---|---|
| **Abrupt weaning** | *Ad libitum* | *Ad libitum* | *Ad libitum* | None |
| **Gradual weaning 1** | *Ad libitum* | Teats removed for 3.5 hours per day | Teats removed for 7 hours per day | None |
| **Gradual weaning 2** | *Ad libitum* | Teats removed for 3.5 hours per day | Teats removed for 2 x 3.5 hour periods per day | None |

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## P59: SO MUCH TROUBLE IN THE HERD: DETECTION OF FIRST SIGNS OF CANNIBALISM IN TURKEYS

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Cannibalism in turkey husbandry is a widespread, serious problem in animal welfare. The causes which lead to the occurrence of this behavioural disorder are multifactorial. Generally there is a consensus that bloody injuries act as trigger mechanism to induce pecking. Therefore, an early intervention with the occurrence of those first signs enables reducing the number of affected animals. Continuous monitoring of the herd should be provided to implement a timely intervention in turkey husbandry.

The aim of the present study is to develop a camera-based early warning system using machine learning to detect the first signs of injuries due to cannibalism in the stock. Observations were conducted on a German conventional farm keeping fattening turkey hens (B.U.T. 6) with untrimmed beaks (n=2,108). The animals were observed two days a week (9.00 – 16.00h) over the entire fattening period and were filmed in different barn compartments with video-cameras (AXIS M1125-E IP-camera, Axis Communications AB, Lund, Sweden). One camera filmed the turkeys in the general compartment (GC) and one observed the injured, caring and sick animals in the separation compartment (SC) (6m x 5.5m). A third camera was installed over another compartment (AC) which corresponded to the size of SC. In AC 132 turkeys were housed as control group as this number complied to the stocking density at the end of the fattening period (48 kg/m²). The recorded videos were cut into individual frames and subsequently 6,300 images per video (9.00 – 16.00h) were added to a software for annotation. With this software the images are currently annotated by marking new injuries of pecking in the picture. Finally a deep convolutional neural network will be trained on the annotated images to detect such injuries in the herd.

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## P60: CULTURAL 'BLIND SPOTS,' SOCIAL INFLUENCE AND THE WELFARE OF WORKING EQUIDS IN BRICK KILNS IN NORTHERN INDIA

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Human engagement is integral in creating sustained improvements to working equid welfare but often interventions based purely on reactive measures, such as mobile veterinary clinics, fail to provide long lasting sustainable solutions. Human behaviour change is a complex challenge, understanding the lives of those responsible for equid welfare and their barriers to change can provide guidance to those attempting to tackle it. We used the Equid Assessment, Research and Scoping (EARS) and Qualitative Behavioural Assessment (QBA) tools, to assess welfare of working donkeys and mules in India and Nepal. In addition, using livelihoods surveys and semi-structured interviews we established their owners' demographics, socioeconomic status, perceptions, culture and religion.

Though there were differences in welfare standards and the challenges faced by owners in different environments, there were some distinct similarities. Humans, particularly those in low to middle-income countries, have other problems overriding their ability to care well for their own equids. Participants often suffering themselves from malnourishment, pain or ill health, were impoverished and overworked which creates difficulties when attempting to encourage change in management of their equids, despite some participants displaying empathy towards how their animals must feel. Brick kiln workers in particular face migration over huge distances with their equids, where on arrival at their destination a lack of community cohesion, direct conflict, and language and cultural barriers, leave migrants vulnerable to exploitation both economically and physically. This situation has negative implications for the care of working equids, as owners have neither economic stability, literacy, physical security, or access to adequate resources such as medical supplies, to provide care for themselves or 'others'.

Interventions and training workshops traditionally focus on men, with little acknowledgment of women, frequently overlooked despite providing much of the daily care of their working equids. Furthermore, NGOs have traditionally worked as silos focussing simply on the species within their organisation's remit, with little consideration of the cultural backgrounds or context of those they aim to support. We will discuss the need for a more holistic approach drawing on other voices from within the working equid's daily care regime, and involving other organisations to give support to the human part of the animal welfare equation to encourage truly sustainable behaviour change.

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## P61: EVIDENCE-BASED MANAGEMENT IN ZOO ANIMALS: ADVANCING UNDERSTANDING OF SOCIAL NEEDS

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Management-driven changes to zoo animal social groups can lead to disruption in social hierarchies, changes in social networks and, in extreme cases, a temporary breakdown of social relationships. Animals have different roles in social networks, understanding these roles is important for effective management and ensuring individual welfare. Using elephants as a case study, the aim of this research was to investigate fluidity in social relationships within a zoo environment, to determine to what extent zoo animal relationships may mimic those of wild counterparts. Behavioural data were collected over 12 months (January 2016 – February 2017) from 10 African (1 male: 9 females) and 19 Asian (3 male: 16 female) elephants housed at 7 zoos and safari parks in the UK and Ireland. Social interactions were defined as positive physical, positive non-physical, negative physical or negative non-physical. Social network analysis explored social relationships including fluidity of networks over time and dyadic reciprocity. Findings enhance understanding of the role of individual elephants within the zoo network. Positive networks were more interlinked than negative networks. Social networks were found to be fluid but did not follow a seasonal pattern. Positive networks tended to include the entire social group whereas negative interactions were restricted to specific individuals. There were many unbalanced ties within dyads, suggesting potential inequalities in relationships. This could impact on individual experiences and welfare within the social group. This research highlights changing dynamics in animal social networks and provides evidence for the importance of understanding social networks and social behaviour over longer periods of time. We will discuss the importance of understanding social networks and the role of animals within them in pro-active and evidence-based management approaches. The techniques used in this research could be applied to inform social management of other zoo-housed, domestic or production species. Further research should seek to identify minimum sampling efforts for social networks in a range of species, to enable execution of regular monitoring of social networks and thus improve welfare of social species in zoos.

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## P62: THE EFFECTS OF PHYSICAL AND SOCIAL ENRICHMENT ON CALVES' GROWTH RATE, BEHAVIOUR AND RESPONSE TO NOVELTY

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Social enrichment has been shown as an effective means of improving calf welfare, although it may result in other issues, such as increased risk of respiratory disease and cross-sucking behaviour. An additional method to improving animal welfare is the provision of physical enrichment, but this is rarely studied in calves and little is known about whether the combination of social and physical enrichment further improves calf welfare. The study aimed to determine the effects of pair housing, the provision of accessories to calf pens, and the combination of both types of enrichment on pre-weaning calf behaviour, responses to novelty, and growth. Forty-eight calves were randomly allocated to either individual (NSE) or pair (SE) housing from 2 days to 8 weeks of age. Half of the calves in each treatment were provided with enrichment (stationary brushes, plastic chains, rubber teats and haynets filled with strawberry-scented hay; PE). The remaining calves received no additional enrichment (NPE). Concentrate consumption was measured daily, and calves were weighed at birth and weekly thereafter. Calves were video-recorded between 06:00 and 20:00 twice weekly at 2 to 5 weeks of age; behavioural data were collected using instantaneous scan sampling at 5 minute intervals. At 5-6 weeks of age, calf responses to environmental novelty and novel objects were tested. Calves housed in PE tended to consume less concentrate ($p=0.06$) but grow faster than those in NPE ($p=0.095$). In the home pen, PE increased or tended to increase the frequency of hay intake ($p=0.001$), self-grooming ($p=0.017$) and locomotor play ($p=0.066$), but decreased non-nutritive sucking ($p<0.001$) and cross-sucking ($p=0.009$). SE increased the frequency of locomotor play ($p=0.039$) and cross-sucking ($p<0.001$), but decreased self-grooming ($p=0.038$) and non-nutritive sucking ($p=0.014$) compared to NSE. In addition, there was an interaction between enrichment types on sniffing (NPE-SE > PE-NSE, $p=0.008$). In the environmental novelty test, calves from PE tended to show fewer abrupt movements than those from NPE ($p=0.078$). Among calves in NPE, NSE tended to spend longer touching pen fixtures than those housed in SE ($p=0.052$). In the novel object test, latency to touch the novel object tended to be shorter among PE calves than NPE calves ($p=0.072$). NSE calves had more defecation bouts ($p=0.04$) than SE calves. In conclusion, PE seemed to reduce calves' concentrate intake whilst increasing growth rates. PE and SE may satisfy natural behavioural motivations and reduce undesirable behaviour and fear in different ways. However, the combination of PE and SE showed no further improvement on calves' growth rate, behaviour and fearful emotion.

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