SCIENCE FOR ANIMAL WELFARE · CENTENARY CONFERENCE

100 Years of Science for Animal Welfare

23–25 June 2026

Conference Programme & Abstracts

Programme

Beveridge talks numbered A1, A2… · Chancellor's talks numbered B1, B2… Numbers match the abstracts that follow.

Tuesday 23 June 2026

08:30–09:00 · Registration

BEVERIDGE

09:00 Conference Opening

09:30–11:00 Symposium 1: Animal Welfare Science: Past, Present, and Future — *Chair: Huw Golledge*

09:30–09:50
A1 (Hu)Man and Beast – Where are our blind spots now?
Sophia Hepple · Animal and Plant Health Agency, UK

09:50–10:10
A2 The ethical core of ULAWS/UFAW and its early developments
Jes Lynning Harfeld · University of Aalborg, Denmark

10:10–10:30
A3 'Sympathy without sentimentality': UFAW's contribution to the past, present (and future?) of cultures of animal care
Robert Kirk · University of Manchester, UK

10:30–10:50
A4 Science for animal welfare: Building on Hume's legacy
Mike Radford · University of Aberdeen, UK

11:00–11:40 · Break

11:40–12:00
Discussion: The future of animal welfare science

12:20–12:40
A5 ECR AWARD **The challenge of interspecies welfare comparisons**
Heather Browning · University of Southampton, UK

12:40 · Lunch

BEVERIDGE (TRACK A)

14:00–14:20
A6 What drives treatment decisions and NSAID use in pre-weaned calves? A mixed-methods study of farmers and veterinarians
Ginny Sherwin · University of Nottingham, UK
Chair: Zoe Barker, University of Reading, UK

14:20–14:40
A7 Enhancing dairy cattle welfare through precision veterinary monitoring
Samuel Demssie · Addis Ababa University, Ethiopia

14:40–15:00
A8 Foster cow–calf rearing in dairy systems: Implications for welfare, behaviour, and productivity: A scoping review
Ryann McCready · University of British Columbia, Canada

15:00–15:20 SHORT TALKS · 5 MIN EACH

A9 Pigs as fussy as cats: how individual differences in food preferences shape behavioural testing trajectories
Irene Camerlink · Polish Academy of Sciences, Poland

A10 Rethinking positive animal welfare indicators: The composition of grooming behaviour in calves
Laura Whalin · Norwegian Veterinary Institute, Norway

A11 Heat stress as a chronic welfare challenge in dairy cattle: Moving from physiological indicators to valid measures of

CHANCELLOR'S (TRACK B)

14:00–14:20
B1 Stakes and states: what can risk-sensitive foraging tell us about affect in rats?
Vikki Neville · University of Bristol, UK
Chair: Anna Olsson, University of Porto, Portugal

14:20–14:40
B2 Does N-acetylcysteine treat stereotypies in laboratory mice?
Sarah Avendano · Stanford University, USA

14:40–15:00
B3 Rabbit ear disease and welfare: Identifying conformation-related risks and indicators of hidden disease
Maria Jackson · Royal Veterinary College, UK

15:00–15:20 SHORT TALKS · 5 MIN EACH

B4 Opening the cage on pet rat introductions
Caitlin Walburn · University of Bristol, UK

B5 Improving welfare via a strategic approach to Replacement: why and how.
Amy Beale · Replacing Animal Research, UK

B6 Animal Welfare Science in Veterinary Education: A mixed-method study of curriculum frameworks and teaching practices in Austria, Germany and Switzerland

affective state
Serdal Dikmen · Bursa Uludağ University, Turkey

A12 **Individual differences in dairy heifer motivation to access space**
Malina Suchon · University of British Columbia, Canada

Carolin Breitenbach · Universitat Autònoma de Barcelona, Spain

15:20 · Break

16:10–16:30
A13 **Effects of dark brooder rearing on hippocampal plasticity in adult laying hens**
Matthew Craven · Newcastle University, UK
Chair: Ben Lecorps, University of Bristol, UK

16:30–16:50
A14 **Pragmatism bias in farmed animal welfare science**
Eva Read · London School of Economics, UK

16:50–17:10
A15 **Beyond fear reduction: how experience and selection history shape chickens' (Gallus gallus domesticus) use of humans as social buffers**
Vitor Ferreira · INRAE, France

16:10–16:30
B7 **Turning science into enforceable law: the case for embedding indicators in new and revised EU legislation**
Elena Nalon · Eurogroup for Animals, Belgium
Chair: Anna Olsson, University of Porto, Portugal

16:30–16:50
B8 **AI governance and innovation for animal welfare: Veterinary, professional and ethical aspects in animal agriculture**
Raymond Anthony · University of Alaska Anchorage, USA

16:50–17:10
B9 **A scientific framework for navigating horse welfare science for the next 100 years?**
Karen Luke · Melbourne, Australia

17:10–17:30 SHORT TALKS · 5 MIN EACH

A16 **Social facilitation in hens' use of edible enrichments: Do birds of a feather peck together?**
Madeleine McAuley · University of Guelph, Canada

A17 **Methods to assess physiological effects of keel bone fracture development and healing in commercial laying hens**
Kathrin Hinz · Aarhus University, Denmark

A18 **The effects of pecking blocks on laying hen distribution and piling events in commercial barns**
Violet Hipkin · University of Guelph, Canada

A19 **Validation of an automated system for at-slaughter assessment of footpad dermatitis and hock burn in broiler chickens**
Bas Rodenburg · Utrecht University, Netherlands

17:10–17:30 SHORT TALKS · 5 MIN EACH

B10 **Grounded in science: The value of animal welfare science from an end-user perspective**
Jo Hockenhull · The Donkey Sanctuary, UK

B11 **"Somewhat scientific": UK undergraduate views of animal welfare as a concept and scientific discipline**
Beth Ventura · Michigan State University, USA

B12 **Consumer demand, intervention efficacy and potential canine welfare implications of the puppy trade: Evidence from temporal and linguistic patterns in classified online adverts**
Katharine Eloise Ross · The Roslin Institute / University of Edinburgh, UK

B13 **When dogs play, they sound different: distinctive acoustic features of Play-Panting in dogs**
Paula Perez Fraga · Eötvös Loránd University, Hungary

BEVERIDGE

17:30–18:00
A20 PLENARY **What does it take to make a difference?**
Joseph Garner · Stanford University, USA
Chair: Ben Lecorps, University of Bristol, UK

18:00 · Drinks Reception

Wednesday 24 June 2026

BEVERIDGE

09:00 Day 2 Introduction

09:10–09:50
A21 MEDAL LECTURE **Working in Animal Welfare: A journey from farm girl to scientist**
Marina von Keyserlingk · University of British Columbia, Canada

BEVERIDGE (TRACK A)

09:50–10:10
A22 **A Five-Realms framework for animal welfare**
Katarína Bučková · National Chung Hsing University, Taiwan
Chair: Siobhan Abeyesinghe, Royal Veterinary College, UK

10:10–10:30
A23 **Describing the characteristics of feasibility when selecting potential (positive) animal welfare indicators for on-farm assessment**
Heng-Lun Ko · Universitat Autònoma de Barcelona, Spain

10:40–11:00
A24 **The Benchmark Method – a way to make aggregated animal welfare comparisons across production systems, between countries and over time**
Peter Sandøe · University of Copenhagen, Denmark

10:50–11:10 SHORT TALKS · 5 MIN EACH

A25 **Public attitudes towards the fate of non-releasable marine mammals**
Bianca Vandresen · University of British Columbia, Canada

A26 **Raising the bar: How Shell powers up animal welfare beyond regulatory minimums**
Marlly Guarin · Shell, Netherlands

A27 **Avoiding a polarised future: Synthesising diverse perspectives on the future of farm animal welfare in Canada**
Katie Koralesky · University of British Columbia, Canada

11:50–12:10
A28 **The Welfare Footprint framework: A modular architecture for quantifying and comparing animal experience across systems**
Wladimir Alonso · Welfare Footprint Institute, USA
Chair: Jean-Loup Rault, University of Veterinary Medicine Vienna, Austria

12:10–12:30
A29 **Assurance or artifice: Why doesn't transparency always improve animal welfare?**
Mia Cobb · University of Melbourne, Australia

12:40–13:00
A30 **Optimising the selection of welfare indicators in farm animals**
Jon Day · Cerebrus Advies, Netherlands

CHANCELLOR'S (TRACK B)

09:50–10:10
B14 **Knowledge isn't power? Awareness and experience of intervertebral disc disease does little to deter acquisition and re-acquisition of Dachshunds and French bulldogs**
Rowena Packer · Royal Veterinary College, UK
Chair: Mia Cobb, University of Melbourne, Australia

10:10–10:30
B15 **Just toss in a toy? A meta-analytic appraisal of captive primate environmental enrichment**
Luke Duncan · University of Warwick, UK

10:40–11:00
B16 **Associations between judgement bias and other indicators of affective state: a way to advance wild animal welfare science?**
Janire Castellano Bueno · Wild Animal Initiative, USA

10:50–11:10 SHORT TALKS · 5 MIN EACH

B17 **Impact of resource availability on health and welfare of community cats across colonies**
Nattawipa Ampaiwan · Michigan State University, USA

B18 **Assessing reliability of cat health measurements collected in-home by caregivers**
Grace Boone · University of California Davis, USA

B19 **Support-seeking and rehoming pathways differ by surrender circumstances among companion animal guardians**
Lexis Ly · University of British Columbia, Canada

11:50–12:10
B20 **Hatchery design matters: reducing otolith deformities through environmental enrichment in coho salmon**
Leigh Gaffney · University of Victoria, Canada
Chair: Eleftherios Kasiouras, University of Gothenburg, Sweden

12:10–12:30
B21 **Reducing chronic welfare compromise in farmed Nile tilapia through water quality management and farmer awareness in Egypt**
Wasseem Emam · Ethical Seafood Research, UK

12:30–12:50
B22 **Substrate deprivation as a major unrecognized welfare challenge in the world's most farmed aquatic species (Litopenaeus vannamei)**
Benjamin Wilden · Welfare Footprint Institute, USA

11:10 · Break

12:50 · Lunch

14:00–14:40

A31 **Improving lifetime welfare of pigs and chickens by automated monitoring of animal welfare measures at slaughter – progress made by the aWISH project**

Frank Tuyttens · ILVO, Belgium

Chair: Stephanie Buijs, AFBI, UK

14:00–14:20

B23 **EFSA's welfare assessment of animals kept for fur production**

Marika Vitali · EFSA, Italy

Chair: Samantha Ward, Nottingham Trent University, UK

14:20–14:40

B24 **Behavioural freedoms or freedom to suffer? Evaluating the welfare of free-living animals**

Cathy Dwyer · SRUC, UK

14:40–15:00 SHORT TALKS · 5 MIN EACH

A32 **Do sick calves isolate? Changes in lying behaviour and space use during diarrhea**

Heather Neave · Purdue University, USA

A33 **Exploring the relationships between immune markers and behaviours reflecting affective states in piglets**

Liesbeth Bolhuis · Wageningen University & Research, Netherlands

A34 **Changes in locomotor play, social play, and reward sensitivity after disbudding in calves**

Amelia St John Wallis · University of Bristol, UK

A35 **The influence of perforated rubber mats on sow (Sus scrofa) locomotion and welfare**

Jen-Yun Chou · University of Saskatchewan, Canada

14:40–15:00 SHORT TALKS · 5 MIN EACH

B25 **Doing better for zoo-housed birds - key considerations for welfare assessment frameworks**

Paul Rose · University of Exeter, UK

B26 **Increasing the visibility of animal welfare impacts in prosecutions for illegal wildlife trade through the use of species victim impact statements**

Amanda Whitfort · University of Hong Kong, Hong Kong

B27 **Integrating psychosocial resilience into humane endings for livestock**

Scott Kramer · Birmingham, USA

15:00 · Break

15:40–16:00

A36 **From evidence to impact: Building evidence-based animal welfare policy and practice**

Jessica Cait · Charles River Laboratories, USA

Chair: Emily Craven, University of Nottingham, UK

BEVERIDGE

16:10 **Symposium 2: How can we make animal welfare research more reproducible?** — *Chair: Birte Nielsen*

16:10–16:15

Introduction

Birte Nielsen

16:15–16:25

A37 **From protocol to practice: Using ethical review to improve animal welfare and research replicability**

Aileen MacLellan · Canadian Council on Animal Care, Canada

16:25–16:35

A38 **Testing replicability across laboratories: Inter-observer reliability on an ethogram for affiliative behaviour in pigs**

Marie Bordes · University of Veterinary Medicine Vienna, Austria

16:35–17:30

Panel discussion

Charlotte Burn, Christian Nawroth, Georgia Mason, Joseph Garner

18:00 · Networking Reception (separate ticket required)

Thursday 25 June 2026

BEVERIDGE

09:50 Day 3 Introduction

10:00–10:40
A39 PLENARY **Animal health and welfare: Time for a refresh?**
Alistair Lawrence · Scotland's Rural College (SRUC), UK
Chair: Bas Rodenburg, Utrecht University, Netherlands

10:40 · Break

BEVERIDGE (TRACK A)

11:20–11:40
A40 Precision welfare monitoring in dairy cattle via continuous social tracking, personality dimensions, and voluntary optimism bias testing
Oren Forkosh · Hebrew University of Jerusalem, Israel
Chair: Christian Nawroth, Research Institute for Farm Animal Biology (FBN), Germany

11:40–12:00
A41 Do calves show conditioned place aversion to pain 2 days post-disbudding despite gold standard pain relief?
Beth Ledger · University of Bristol, UK

12:00–12:20
A42 Can weaner pigs use 23 mm drinking nipples provided during long-distance transport?
Jeanne Verlaat · Aarhus University, Denmark

12:20–12:40 SHORT TALKS · 5 MIN EACH

A43 Pasture access improves several aspects of dairy cattle welfare during the grazing season
Laura McAnally · AFBI, UK

A44 Supplementation with galacto-oligosaccharides increases Bifidobacterium and brain serotonin without changing severe feather pecking in hens at peak lay
Anna Lea Nicklas · University of Guelph, Canada

A45 Are dairy cows better off in organic farms? A systematic review
Pip Young · University of Bristol, UK

A46 Nociception and reactivity to milking in dairy cows challenged with lipopolysaccharide-induced mastitis
Emeline Nogues · Aarhus University, Denmark

CHANCELLOR'S (TRACK B)

11:20–11:40
B28 Cold nose, warm heart? Rethinking primate nasal temperature decreases in relation to affect
Julia Machado · Nottingham Trent University, UK
Chair: Aileen MacLellan, University of Ottawa, Canada

11:40–12:00
B29 Large numbers of very small animals: when, how, and why do neonatal laboratory mouse pups die?
Anna Olsson · University of Porto, Portugal

12:00–12:20
B30 From law, through policy, to welfare: lessons learnt from the new EU law on welfare of Canis familiaris and Felis catus
Iwona Mertin · Eurogroup for Animals, Belgium

12:20–12:40 SHORT TALKS · 5 MIN EACH

B31 Huts as a refined handling method for laboratory mice
Maya Bodnar · University of British Columbia, Canada

B32 Reproducibility matters: Why image integrity is essential for animal welfare
Helene Dragelund Garcia · University of Copenhagen, Denmark

B33 Handling rabbits: Impact of technique on the behaviour of exhibition rabbits during and after judging
Helaina Cressy · Royal Veterinary College, UK

12:40 · Lunch

14:00–14:20
A47 Progressive welfare inference: Using existing farm data to support continuous assessment of animal welfare in dairy cattle
Syed Hussain · RAFT Solutions, UK
Chair: Jo Edgar, University of Bristol, UK

14:20–14:40
A48 Validity criteria for indicators of affective states at the individual level
Colline Poirier · Newcastle University, UK

14:40–15:00 SHORT TALKS · 5 MIN EACH

A49 Deciphering the neural basis of individual differences in reward sensitivity in pigs
Charlotte Goursot · Federal Veterinary Office, Switzerland

A50 Is welfare only a matter of the hedonic value of the environment?
Isabelle Veissier · INRAE, France

14:00–14:20
B34 Challenge accepted! Conducting impactful animal welfare research without using animals
Anna Ratuski · Stanford University, USA
Chair: Kate Fletcher, Humane Slaughter Association, UK

14:20–14:40
B35 Investigating ending the life of decapod crustaceans: Assessing efficacy of different methods and impact on muscle physiology in Norway lobster and signal crayfish.
Eleftherios Kasiouras · University of Gothenburg, Sweden

14:40–15:00 SHORT TALKS · 5 MIN EACH

B36 A welfare risk assessment of small-scale aquaculture clusters in southern Nigeria
Felix Nwose · Delta State University, Nigeria

B37 Quantifying the effects of water quality on fish welfare and productivity in aquaculture: A meta-regression analysis
Juyoung Yang · Seoul National University, South Korea

A51 **Intra- and inter-observer reliability of scoring pig tear staining using tVAS after observer training**
Kenny van Langeveld · ILVO, Belgium

A52 **Beyond good handling: behavioural evidence for the welfare value of training during anaesthesia induction in pigs**
Jennifer Mein · Charité Berlin University Medicine, Germany

B38 **Quantifying the welfare impact of preslaughter operations in Atlantic salmon**
Cynthia Schuck Paim · Welfare Footprint Institute, USA

15:00 · Break

BEVERIDGE

15:40 **Symposium 3: Assessing Animal Welfare** — *Chair: Birte Nielsen*

15:40–16:20
A53 **Overview of Assessing Animal Welfare**
Mike Mendl and Georgia Mason · University of Guelph, Canada

16:20–16:55
Panel discussion (questions and answers) with Georgia and Mike

16:55–17:10 **Conference Close** — Huw Golledge

Abstracts

Beveridge abstracts (A) first, then Chancellor's (B), each in programme order.

A1 SYMPOSIUM TALK · TUE 23 JUNE, 09:30–09:50 · BEVERIDGE

(Hu)Man and Beast – Where are our blind spots now?

Sophia Hepple

Animal and Plant Health Agency (APHA), Addlestone, Surrey, United Kingdom

“Non misrebitur sapiens, sed succurret” In 1962, Major C.W. Hume, founder of the original University of London Animal Welfare Society in 1926, which formed the basis of UFAW, published a collection of papers (Man & Beast, 1962); most had been written/published as standalone papers since 1943, regarding different animal welfare issues. The early focus of UFAW included efforts to protect wild animals by banning the gin trap, setting standards on stray dog euthanasia using electrocution and increasing protection for animals used in research / education purposes by introduction of the 3Rs (Reduction, Refinement, Replacement). In 1883, 311 experiments had been recorded in Great Britain; by 1961 this had risen to nearly 4 million but with only six home office inspectors employed to oversee this research. In 2024, 2.64 million scientific procedures involving living animals were carried out in Great Britain, the lowest number since 2001 (Home Office statistics, UK Government 2025). This presentation will briefly touch on how far we have come since this time and consider what more needs to be done. Towards the end of this book (Chapter 14: Expanding Mercy (1946) and Chapter 15: Expanding Justice (1943, rev 1962)), Major Hume expands his concerns to other animals, including farm animals and zoological animals. The welfare issues he raises are, interestingly, reflected in some of the welfare issues currently addressed in the English Government’s welfare strategy (DEFRA, UK Government December 2025), published some 80 years after he raised serious concerns about a range of issues. These included dog-worrying of sheep, castration of lambs & piglets, tail-docking of lambs and intensive forms of production such calf and meat chicken production, where animals were described as “living short, overcrowded, joyless lives in order to satisfy the aesthetic whims of this feckless human generation”. Hume even focused on specific issues in farm animals, for example multiple market moves and the presentation of cows with painfully overstocked udders, to improve selling prices. This presentation reflects on what has been achieved against Hume's hopes for the future; it considers whether human society is just as irresponsible as we were then, regarding our duty to animals, given our current state of scientific knowledge of animal sentience, their cognitive abilities, their welfare needs, including essential behaviours. Further, Hume discusses “blind spots” and provides examples of “cruelties”, often perpetuated through "custom". Where are our blind spots now?

A2 SYMPOSIUM TALK · TUE 23 JUNE, 09:50–10:10 · BEVERIDGE

The ethical core of ULAWS/UFAW and its early developments

Jes Lynning Harfeld

University of Aalborg, Denmark

It is clear that there is an ethical core to the ideas that created ULAWS/UFAW 100 years ago and permeate the organisation through the years and into the present. It is, however, much less clear what this ethical core consists of. With a point of origin in the earliest writings of C.W. Hume I will argue that UFAW ethics does not fall easily into any of the established categories of ethical theory. What emerges instead is a distinct ideal about openminded doubt and moral attentiveness through knowledge. While not adhering to classical ethical theories such as utilitarianism or deontology, this phronetic approach is in line with ethical thinkers outside these boxes such as Alasdair MacIntyre, Iris Murdoch and Bernard E. Rollin.

A3 SYMPOSIUM TALK · TUE 23 JUNE, 10:10–10:30 · BEVERIDGE

'Sympathy without sentimentality': UFAW's contribution to the past, present (and future?) of cultures of animal care

Robert Kirk

University of Manchester, UK

Is 'care' an emotion? Whatever answer we have to this question it is unlikely that emotion can be entirely removed from the act of caring for animals. This paper takes a historical approach to exploring the role of emotion in shaping UFAW's work to develop a 'science' of animal welfare. Historically, emotion posed a risk to UFAW's credibility. Yet emotion also motivated UFAW's work. This was captured in the oft quoted phrase that the society aimed to maintain 'sympathy without sentimentality'. Shortly after its founding in 1926, the then University of London Animal Welfare Society (ULAWS), later UFAW, was embroiled in the very form of emotive public controversy that its founder, Charles Hume, had wished to overcome. At the time, animal protectionism was largely a political movement using emotional rhetoric to persuade popular and political culture of perceived cruelties. Animal protectionism had distanced itself from science by portraying the experimental use of animals ('vivisection') as an example of such cruelty. Consequently, 'rational' thinking 'educated' persons, including veterinarians and scientists, were reluctant to associate themselves with the movement. 'Subjective' uncontrolled emotion, after all, had no role in 'objective' modern science. Uniquely, Hume recognised an inherent contradiction within animal protectionism: the very people best placed to improve the welfare of animals through the application of scientific knowledge were disinclined from doing so. Accordingly, he established a radically new apolitical society to foster the application of science to animal welfare. Neither one thing nor the other, ULAWS was immediately attacked by both sides. Antivivisectionists condemned any step toward what they saw as collaborating with cruelty. Scientists viewed the society as a deceptive home to 'crypto-antivivs'. ULAWS survived by adopting the position of abstaining from any involvement with the scientific use of animals. Abandoning this position in 1943, UFAW went on to fundamentally change the landscape of animal experiment. The UFAW Handbook on the Care and Management of Laboratory Animals (1947) made a foundational contribution to the professionalization of laboratory animal care. The Principles of Humane Experimental Technique (1959) introduced the Replacement, Reduction and Refinement of scientific uses of animals, now a global standard of animal research governance. Both interventions adhered to the needs of 'objective' science being cautious in their use of emotion and other subjective factors. Yet neither entirely denied that emotion played a role in shaping animal care and 'humane' science. This paper argues that, when applied to the scientific use of animals, 'sympathy without sentimentality' implicitly acknowledged that emotion was fundamental to animal care and the production of scientific knowledge. Turning to the present, a century after ULAWS challenging birth, the role of emotion within the wider 'culture of care' is increasingly being recognised. This paper concludes by asking whether we are yet capable of acknowledging that science is not opposed to emotions. On the contrary, science requires emotions: not least for maintaining a considered care for animals and those who care for animals.

A4 SYMPOSIUM TALK · TUE 23 JUNE, 10:30–10:50 · BEVERIDGE

Science for animal welfare: Building on Hume's legacy

Mike Radford

University of Aberdeen, UK

A5 ECR AWARD · TUE 23 JUNE, 12:20–12:40 · BEVERIDGE

The challenge of interspecies welfare comparisons

Heather Browning

University of Southampton, UK

While most research in animal welfare science focuses on the welfare of a single species, there are many applications that require comparing the welfare of different species, such as management decisions, multispecies cost-benefit analysis, or prioritisation in charitable giving. However, there is currently no established method for performing interspecies comparisons of welfare. In this paper, I describe the main challenge for interspecies welfare comparisons: the problem of underdetermination arising from our inability to distinguish variation in the underlying target variable (welfare experience) from variation in the relationship of measured indicators to the target. I propose a partial solution, based on the use of similarity assumptions that will have greater or lesser justification in different circumstances, and describe the alternative methods we may use when direct comparisons are not possible. Ultimately, as all currently available comparison methods are imperfect, we need to make explicit context-specific decisions about which will be best for the task at hand while acknowledging their potential limitations.

A6 TALK · TUE 23 JUNE, 14:00–14:20 · BEVERIDGE (TRACK A)

What drives treatment decisions and NSAID use in pre-weaned calves? A mixed-methods study of farmers and veterinarians

Virginia Sherwin, Katie Burrell, Ellie Miller, Christopher Hudson

University of Nottingham, Sutton Bonington, Leicestershire, United Kingdom

Background: Pre-weaning calf mortality represents a major animal welfare concern, alongside having substantial economic and sustainability implications. Diarrhoea and bovine respiratory disease (BRD) remain the predominant causes of morbidity and mortality, with welfare and health outcomes highly dependent on early recognition of disease and appropriate timely treatment. In the United Kingdom, legislation allows farmers to treat individual calves using veterinarian-prescribed antibiotics and non-steroidal anti-inflammatories (NSAIDs). The objective of this study was to identify factors influencing on-farm treatment choices in pre-weaned calves using a mixed method research approach. Materials and Methods Study 1: An online survey was used, featuring eight videos of pre-weaned calves displaying various clinical signs to determine the likelihood of respondents treating these calves. Data were analysed using descriptive statistics and multivariable logistic regression models. Study 2: Veterinarian and farmer focus groups were used to identify underlying influences for NSAID use in sick calves through thematic analysis. Results Study 1: After exclusions, 657 respondents (314 farmers and 343 veterinarians) from the UK and North America were analysed. Respondents were less likely to use NSAIDs for diarrhoea than for BRD. In individual calf scenarios, farmers employing dedicated youngstock rearers, and female farmers were more likely to administer NSAIDs and electrolytes, while male farmers tended to favour antibiotic use. Farmers' treatment decisions were more influenced by specific clinical signs than veterinarians', suggesting greater reliance on intuition and variable interpretation of symptoms. Study 2: NSAID use was shaped by intrinsic factors, including animal welfare values, perceived treatment efficacy, and education, and extrinsic factors including economic pressures, legislation, and accessibility. Although participants discussed the desire to "do the right thing" for the calf, barriers included limited NSAID knowledge, differing farm priorities, habitual practices, staff skill levels, and variable veterinary support. The normalisation of poor calf health and the influence of previous disease experiences recurred as themes, as well as uncertainty around societal expectations for drug use and ambiguity regarding the role and purpose of injectable medicines. Respondents suggested a need for evidence- based, industry-led initiatives to support NSAID use. Conclusions There was a wide variation in treatment choices for calves, highlighting potential inconsistencies in recognising and responding to clinical signs. NSAIDs were underutilised in treatment protocols despite the study highlighting strong intrinsic motivation to improve calf welfare. There were multiple barriers reducing the use of NSAIDs including limited knowledge; this led to a desire for increased education at an industry level.

A7 TALK · TUE 23 JUNE, 14:20–14:40 · BEVERIDGE (TRACK A)

Enhancing dairy cattle welfare through precision veterinary monitoring

Dr. Samuel Demssie Afebo

Dallas veterinary clinic, Addis Ababa, Addis Ababa Ethiopia, Ethiopia. Yordanos Samuel and friends dairy farm partnership, Addis Ababa, Addis Ababa Ethiopia, Ethiopia

Maintaining high welfare standards in dairy cattle is challenging in intensive farming systems, where early signs of illness and stress often go undetected. Traditional monitoring methods rely on manual observation, which can delay interventions and negatively affect animal health and welfare. This study implemented a precision veterinary monitoring system integrating behavioral tracking, physiological biomarkers, and environmental sensors in a commercial herd of 120 cows. Wearable accelerometers and automated rumination monitors collected continuous data, analyzed with a machine-learning algorithm to identify deviations from normal welfare parameters. Veterinary assessments validated the system's accuracy. The monitoring system detected 92% of welfare-compromising conditions up to seven days earlier than conventional observation. Early interventions, including veterinary care and environmental adjustments, reduced severe lameness by 38% and clinical mastitis cases by 27% over six months. Behavioral observations showed decreased prolonged standing and aggressive interactions, indicating improved overall welfare. This approach demonstrates that data-driven veterinary monitoring can identify welfare issues promptly, enabling targeted interventions that enhance health outcomes and reduce stress in dairy cattle. The system provides a scalable framework to improve welfare standards in commercial farming while maintaining productivity.

A8 TALK · TUE 23 JUNE, 14:40–15:00 · BEVERIDGE (TRACK A)

Foster cow–calf rearing in dairy systems: Implications for welfare, behaviour, and productivity: A scoping review

Ryann McCready, Sarah E. Bolton, Daniel M. Weary, Marina Ag. von Keyserlingk

UBC, Vancouver, BC, Canada

Dairy production systems commonly separate calves from their mothers within hours of birth to simplify management and maximize the amount of saleable milk from the cows. However, increasing public concern about early cow-calf separation has led to calls for rearing systems that provide extended cow-calf contact. A major challenge for farmers in dam reared cow-calf contact systems is the loss of saleable milk when calves nurse their mothers. One proposed alternative is the foster cow-calf system, in which a foster cow nurses multiple calves, including unrelated calves. This system has been suggested as a potential compromise to address public concerns about cow-calf separation while maximizing milk production, yet evidence of its impacts on foster cows and calves remains limited. The aim of this scoping review was to evaluate and synthesize the scientific literature on the effects of foster cow systems on cow and calf welfare, health, behaviour, and productivity. Five academic databases were searched using the query: (((foster* OR alien* OR nurse*) NEAR/2 (cow OR cows OR bos OR dam OR dams OR heifer* OR calf OR calves))), yielding 5,656 references. Studies were included if they were primary peer-reviewed research available online, written in English, comparing animals in a foster cow-calf system with a control (either dam-reared or artificially-reared) and reporting outcomes related to health, welfare, behaviour, or productivity. After duplicate removal and two rounds of screening, 34 sources met the inclusion criteria for data extraction and quality appraisal. Studies varied widely in design, objectives, and outcome measures. While some commonly investigated topics (e.g., calf diarrhea, mastitis) were identified, there was substantial heterogeneity in how health, welfare, behavioural, and productivity outcomes were defined and measured. Some studies suggested that foster cow-calf contact systems may improve calf growth or social behavior with minimal impacts on farm milk yield, but others reported challenges like calf rejection, udder health issues, and practical management constraints. Overall, the evidence base was limited, with few rigorous, controlled comparisons. This review highlights substantial knowledge gaps concerning foster cow-calf systems, particularly regarding their implications for the foster cow and calf welfare, health, behaviour, and long-term productivity. Further research using standardized definitions, controlled comparisons, and robust welfare metrics is needed to clarify when and how foster cow-calf systems can be implemented without compromising foster cow or calf welfare. Such clarification is vital to inform evidence-based management practices, policy development, and the social acceptability of the dairy industry.

A9 SHORT TALK · TUE 23 JUNE, 15:00–15:20 · BEVERIDGE (TRACK A)

Pigs as fussy as cats: how individual differences in food preferences shape behavioural testing trajectories

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Over the years, behavioural testing procedures have been refined to facilitate our understanding of animals and improve their welfare during tests. Feed restriction, for example, used to be a standard practice to motivate animals for testing but is now often considered unnecessary and less ethical. However, the refined protocols, and hence subtler behavioural responses, increase the need to account for individual differences. Our objective is to highlight some of the challenges in refining behavioural training and testing protocols, when using food as reinforcement, while avoiding drop-outs. We outline examples from mostly unpublished data of large scale studies involving behavioural tests in pigs. The studies revealed that, in tests in which pigs' performance is rewarded with food, individual food preferences need to be considered regardless of the pig's age. Adult sows actively partake in tests even for low caloric rewards. However, in a voluntary locomotion test where 81 sows were habituated to the food rewards, 85% preferred standard gestation feed and 79% preferred peanuts over chocolate crispies and apples, while the latter two feed types were inconsistently consumed. In 7-week-old pigs (n = 91), ecologically relevant food types such as meal worms were least consumed when compared to apples (89% of time first choice) and chocolate raisins. In long-term tests (Judgement Bias and Spatial Holeboard task), repeated exposure to the same reward may lead to sensory-specific satiety and therefore drop-outs. In holeboard tests across 240 pigs, 4 out of 10 cohorts required a high caloric reward to retain motivation to voluntarily move to the test arena. However, a sudden change in reward, albeit slight, may also result in food avoidance. A mixture of food items, so that pigs can choose, and a mid-training re-assessment of motivation may provide solutions. Experimental protocols typically standardise the external conditions to increase reproducibility; however, for some research objectives (e.g. questions related to animals' decision-making), it is more relevant to aim for a similar motivation to partake in tests rather than a similar food reward. This requires rigorous food preference testing and habituation before training or testing to avoid a lack of animal engagement and to improve the validity of the outcomes. In conclusion, pigs, omnivorous as they are, in practice are specific in their food choices. Improving animal welfare through refined test protocols therefore requires a thorough consideration of individual preferences, while enhancing choice and agency in behavioural tests.

A10 SHORT TALK · TUE 23 JUNE, 15:00–15:20 · BEVERIDGE (TRACK A)

Rethinking positive animal welfare indicators: The composition of grooming behaviour in calves

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Positive animal welfare (PAW) can be assessed with animal-based indicators, such as allogrooming and brushing in cattle. However, valid PAW indicators are not well described in young calves. To validate PAW indicators, the treatment conditions should be known to be preferred by the animals a priori to avoid circular reasoning. Calves prefer to be in peer groups, and there may be additional benefits to prolonged maternal contact. Additionally, there are benefits to providing calves with >8L/d of milk. The aim of this study was to compare grooming behaviours of calves raised in the most preferred management conditions to conditions that are less preferred. Calves (n = 72) were semi-randomly assigned to one of three treatments, that were filled chronologically with 6 calves/group (n = 12 groups): CCC (most preferred; calves were not removed from their dams, they were housed in a freestall area with access to a calf creep with 2 stationary brushes, and they could freely suckle); PEER (medium preferred; calves were separated from their dams and moved to a group pen with 5 other calves and 2 stationary brushes; they had access to ad libitum milk at 4 different 1-h periods/d); MIN (least preferred: calves were separated from their dams and moved to an individual pen; they were given 7 L of milk/d). At 2 wk of age, the behaviour of 3 focal calves/group (n = 36) was scored 12 h/d on 3 days (36 h/calf). The duration of grooming (specifically: self-grooming, brush use, and being allogroomed) was recorded using BORIS. Data were cleaned and analysed using RStudio. All calves spent 31.9 ± 8.0 (mean ± SD) min grooming/12 h. Because the total duration was similar for all treatments, it is worth exploring if there were compositional differences in grooming behaviour. Using a Bayesian Dirichlet regression (brms), we modelled the distribution of grooming, and summarized it using posterior predicted means %, and their 95% credible intervals. We found clear treatment-specific grooming compositions. When grooming, CCC spent 39.5% (24.3 – 55.7%) being groomed by the dam, 10.1% (4.8 – 17.8%) using a brush, and 44.2% (28.9 – 59.3%) self-grooming. PEER spent 13.0% (7.0 – 20.8%) being groomed by a calf, 20.4% (10.1 – 33.9%) using a brush, and 65.0% (49.8 – 77.6%) self-grooming. MIN spent 96.4% (93.8 – 98.1%) self-grooming. In conclusion, perhaps a composite indicator, like grooming, is more useful for distinguishing PAW than relying on a single behaviour.

A11 SHORT TALK · TUE 23 JUNE, 15:00–15:20 · BEVERIDGE (TRACK A)

Heat stress as a chronic welfare challenge in dairy cattle: Moving from physiological indicators to valid measures of affective state

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Heat stress is increasingly recognised as one of the most pervasive climate-driven challenges facing dairy cattle worldwide. While its impacts on productivity and health are well documented, heat stress is still too often conceptualised as an acute management problem rather than a chronic welfare challenge. Animal welfare science has traditionally relied on physiological and production-based indicators—such as rectal temperature, respiratory rate, milk yield, and fertility—to assess heat stress. However, these indicators primarily reflect biological strain and adaptation, not the animal's subjective experience. This raises a fundamental welfare question: to what extent do commonly used heat stress indicators validly reflect negative affective states in dairy cattle? This contribution critically evaluates the use of physiological, behavioural, and performance- based indicators of heat stress through the lens of affective state assessment. Drawing on evidence from long-term field studies under commercial conditions, we explore how chronic heat exposure alters behaviour (e.g. lying, feeding patterns, shade and water use), compromises comfort, and increases stress —key components of animal welfare that extend beyond thermoregulation alone. We argue that reliance on single indicators or threshold- based indices (e.g. THI cut-offs) risks underestimating prolonged negative experiences, particularly under conditions of repeated or cumulative heat load. By integrating physiological responses with behavioural adjustments and environmental context, this work proposes a more welfare-relevant framework for interpreting heat stress indicators. Positioning heat stress as a chronic affective challenge aligns climate resilience research with the core goals of animal welfare science and highlights the need for validated, multi-dimensional indicators capable of capturing how dairy cattle feel, not just how they cope.

A12 SHORT TALK · TUE 23 JUNE, 15:00–15:20 · BEVERIDGE (TRACK A)

Individual differences in dairy heifer motivation to access space

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Dairy heifers are commonly housed in confined environments of low complexity. Previous studies have assessed the motivation of indoor-housed cows for specific environmental resources, such as pasture or brushes, by comparing the weight animals are willing to push to access these resources relative to another reward such as food or an empty space. However, little is known about how cattle value access to additional space independent of other resources. We assessed heifer motivation to access additional space using a weighted gate, as well as their use of the space when access was unrestricted. Holstein heifers (n = 36; mean age: 7.1 ± 0.78 months; mean weight: 287.3 ± 31.20 kg) were housed in groups of 12 in a free-stall pen (7 x 12m) containing 12 lying stalls, a waterer and 35 cm of feed bunk space per animal. Groups were given access to a sand-bedded alley adjacent to the home pen (23 × 2m) across two experimental phases in an AB design, with groups randomly assigned to either free access followed by weighted-gate testing or the reverse order. During the free-access phase, lasting 10 days, the gate to the alley was kept open for 3 h/day, allowing unrestricted entry and exit for all heifers. During the weighted-gate phase, alley access (3 h/day) was only possible by pushing a weighted gate, and weight was added using progressively larger increments every other day until no heifer accessed the alley. Time spent in the alley, number of visit and visit latency were recorded per heifer per day via video. Heifers spent on average 35.5 ± 33.52 min/day in the alley during the free access phase, ranging from 6.3 min to 139.5 min. When alley access was restricted using the weighted gate, the number of heifers entering decreased as the gate weight increased: 34 heifers pushed the minimum weight (1.5 kg), 15 pushed 9.0 kg, 9 pushed 12.75 kg, and only 2 pushed a weight of 22.5 kg. Maximum weight pushed was not associated with total time spent in the alley during the free access phase. These results suggest that indoor-housed dairy heifers are motivated to access additional space, and this motivation varies greatly among individuals. Further analyses will explore how individual and environmental factors contribute to this variability. This study provides additional knowledge on the effect of indoor-housing and space allowance on cattle affective states, demonstrating how these effects vary among individuals.

A13 TALK · TUE 23 JUNE, 16:10–16:30 · BEVERIDGE (TRACK A)

Effects of dark brooder rearing on hippocampal plasticity in adult laying hens

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In commercial rearing, chicks do not have access to a mother hen. Some aspects of maternal care can be imitated using a dark brooder, which has been shown to provide numerous welfare benefits. However, dark brooders are still not widely used commercially. We present two studies in which hippocampal plasticity was used to measure chronic stress in laying hens reared with or without a dark brooder. We hypothesised that rearing chicks with a dark brooder confers resilience to chronic stress in adult hens. In the first study, hens reared with or without a dark brooder were scored for severity of footpad dermatitis (FPD). At 70 weeks of age, brains were collected and immunohistochemically stained against doublecortin (DCX), a marker of neural plasticity. We predicted that conventionally reared birds with more severe FPD would have decreased DCX+ cell density in the hippocampal formation (HF), and that the effects of FPD on DCX+ cell density would be smaller or non-existent in birds reared with a dark brooder. There was a significant interaction between the effects of FPD score and rearing on DCX+ cell density ($F_{1,40} = 4.41$, $p = 0.042$). In conventionally reared birds, DCX+ cell density tended to decrease as FPD score increased. However, in dark brooder reared birds, DCX+ cell density tended to increase as FPD score increased. In the second study, chickens were exposed to unpredictable chronic mild stress (UCMS) or a control treatment for 8 weeks. Within each group, half the birds were reared with a dark brooder (n=12), while the other half were reared conventionally (n=12). At 25 weeks of age, brains were collected to measure hippocampal gene expression of DCX. We predicted that the effects of UCMS on DCX expression would be smaller in dark brooded birds compared to those reared conventionally. There was a significant three-way interaction between stress, rearing and hippocampal subregion ($F_{1,41} = 9.44$, $p = 0.004$). Again, in conventionally reared birds, DCX expression tended to be lower in the caudal HF of UCMS birds than controls. However, in dark brooder reared birds there was significantly higher DCX expression in the caudal HF of UCMS birds than controls ($p = 0.044$). We propose a possible inverted U-shaped relationship between chronic stress and hippocampal plasticity. The results support the hypothesis that dark brooder rearing confers stress resilience which persists into adulthood and add to the call for wider implementation of commercial dark brooding.

A14 TALK · TUE 23 JUNE, 16:30–16:50 · BEVERIDGE (TRACK A)

Pragmatism bias in farmed animal welfare science

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Animal welfare science aims to understand what animals require, their capacities, how they suffer, and the conditions that enable them to thrive. A fundamental role of the discipline is to generate evidence-based knowledge to inform decision-makers, including policymakers, industry, advocacy groups, farmers, and the wider public. Ideally, animal welfare science should be able to influence decisions at all levels, from husbandry practices to legislation. The contribution of the discipline is strongest when its knowledge accurately and completely reflects animals' requirements and interests. In this talk, we argue that the knowledge in animal welfare science, particularly for farmed animals, is systematically shaped by pragmatic considerations that influence its research priorities, methods and outcomes. We introduce the term 'pragmatism bias' to describe this phenomenon. Pragmatism bias arises through several mechanisms. First, funding is often limited to work that aligns with the interests of various stakeholders, typically industry, governments and NGOs. Second, there are operational constraints. Farmed animals are often housed on commercial farms, which limits experimental designs and permissible interventions. In light of these pressures, researchers may incorporate further constraints into their work, prioritising studies that are economically feasible, likely to secure future funding, or acceptable to funders and partners. Together, these pressures produce a systematically skewed knowledge base. Research attention varies substantially across species and even across breeds within species. Short- term studies and interventions compatible with existing production systems are over- represented. Welfare indicators that are cheap, easy to measure and relevant for production tend to be selected. This undermines the completeness and accuracy of the field's knowledge. Moreover, we suggest that it contributes to the entrenchment of production systems that aim for economic efficiency over welfare, while masking the systemic welfare issues within them. We conclude by outlining four actions that would help in addressing pragmatism bias: explicitly recognising and communicating it (for example via reflexivity statements), expanding independent funding opportunities, strengthening study designs to go beyond standard intervention ranges, and considering animals as central stakeholders in animal welfare science. Addressing pragmatism bias is challenging, but it is fundamental to trustworthy research practice and knowledge in this field.

A15 TALK · TUE 23 JUNE, 16:50–17:10 · BEVERIDGE (TRACK A)

Beyond fear reduction: how experience and selection history shape chickens' (Gallus gallus domesticus) use of humans as social buffers

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Positive animal welfare frameworks emphasize not only the reduction of negative experiences, but also the promotion of positive emotional states. Although humans can act as positive cues and social buffers in several domestic mammals, poultry research has mainly addressed human–chicken interactions through fear reduction, with little attention to their potential positive value for chickens. In addition, the influence of breed-specific selection histories on chickens' socio-cognitive responses to humans has rarely been investigated. Here, we integrate findings from two experimental studies to examine how both individual experience and breed-level selection shape chickens' ability to use humans as social buffers. Across both studies, pullets were tested in a novel environment using separation–reunion paradigms. Birds were tested in a sequence of separation and reunion phases, alternating between being alone and being exposed to a social cue (a human or a conspecific), a context known to elicit stress-related responses and social reinstatement. Social buffering was assessed using indicators including calm behaviors (foraging, exploration, and comfort behaviors), locomotor activity, and proximity-seeking towards social stimuli. In the first study, birds from two commercial laying lines (Lohmann LSL Classic and Lohmann Brown Classic) were exposed to different levels of prior human handling: minimal contact, visual- only contact, or gentle physical contact. Birds receiving gentle physical interaction displayed higher levels of calm behavior in the presence of a familiar human (reunion) compared to periods of isolation (separation). Additionally, birds from the Brown Classic line expressed more calm behaviors during reunion phases regardless of handling treatment, indicating that genetic background influences how chickens express and potentially benefit from positive human contact. The second study investigated the role of selection history more directly by comparing a highly selected commercial strain (White Leghorn) with a heritage breed shaped by both natural and artificial selection pressures (Fayoumi). Commercial birds showed behavioral changes across separation and reunion phases, with clear sensitivity to social cues from both familiar humans and conspecifics. In contrast, heritage birds exhibited fewer behavioral changes across phases, suggesting a more socially independent coping strategy. Importantly, breed differences were most evident in responses to humans rather than to conspecifics. These findings demonstrate that chickens' responses to humans are neither uniform nor limited to fear habituation. Instead, both individual experience and genetic background influence how chickens respond to and benefit from human presence. Accounting for these factors in welfare assessment could support the development of positive, breed-sensitive practices in poultry production.

A16 SHORT TALK · TUE 23 JUNE, 17:10–17:30 · BEVERIDGE (TRACK A)

Social facilitation in hens' use of edible enrichments: Do birds of a feather peck together?

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Pecking blocks (PB) are a form of edible enrichment that improve welfare in laying hens by increasing foraging behaviours and reducing feather pecking. Therefore, it is important to understand what motivates hens to use these enrichments. Previous research has noted variation in PB use at the individual and pen levels, and it is possible that pen-mates may influence one another to use PB. The aim of this study was to explore the role of social facilitation in hens' use of PB by comparing distinct experimental housing treatments differing in PB placement. If PB pecking is socially facilitated, hens that can see another hen pecking at a PB will consequently peck more at a PB than those that cannot. 72 Bovans Brown hens experienced with PB were moved into individual furnished cages containing grain-based PB at 70 weeks of age. Neighbouring pairs of hens were separated visually from other pairs by opaque barriers. Each pair was assigned one of three treatments: Adjacent (N=12), in which PB were positioned side-by-side against the adjoining cage wall; Opposite (N=12), in which one hen's PB was against the adjoining cage wall and the other's was on the far side of the cage; and Control (N=12), wherein only one of the two hens was provided with a PB, and the other served solely as a companion. Pairs were video recorded from lights-on until lights-off on two consecutive days, and all occurrences of pecking at PB were assessed. Generalized linear models tested the fixed effect of treatment on total time spent pecking, total number of pecks, and number of pecking bouts on a per-bird basis. Pairs of hens from Adjacent and Opposite treatments were further classified as having pecked simultaneously (≥1 overlapping set of pecking bouts) or not, and the association between this and treatment was analyzed using Fisher's Exact Test., but there was no difference between Opposite and Control in this regard (P=0.499). Hens in the Adjacent treatment had a higher number of pecking bouts per bird (P=0.022), a higher number of pecks (P=0.032), and spent more time pecking (P=0.014) than hens in the Control treatment. There were no differences between Opposite and Control in any of these measures (P=0.321; P=0.134; P=0.126). Simultaneous pecking bouts occurred in half of the Adjacent pairs but none of the Opposite pairs (Fisher's Exact Test P=0.013). These results suggest that hens using PB attract conspecifics to PB through local enhancement. This knowledge could inform decisions on PB number and placement in commercial settings.

A17 SHORT TALK · TUE 23 JUNE, 17:10–17:30 · BEVERIDGE (TRACK A)

Methods to assess physiological effects of keel bone fracture development and healing in commercial laying hens

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Keel bone fractures constitute a major welfare problem in commercial egg production: ~80 % of laying hens worldwide sustain at least one fracture by the end of their commercial lifespan, across strains and housing systems. Fracture risk in modern layers is driven by extreme calcium dynamics: for each egg produced ~10% of total bone calcium is mobilized and deposited into the eggshell. It is hypothesized that continuous internal stress from the passage of large numbers of eggs with the added risk of environmentally induced trauma, can result in keel bone fractures, particularly because the keel has not fully mineralized before substantial calcium reserves are diverted to eggshell formation, leaving it structurally weakened. Fractured keel bones are associated with negative affective states, reduced mobility, and alterations to highly motivated behaviors, some of which improve with analgesia. Despite these indications of pain, onset, duration, and physiological consequences of fracture-related pain remain poorly understood. We studied the physiological effects of keel bone fractures as they occurred and healed in 52 commercial Dekalb layers housed from 17-45 weeks of age. Fracture progression was monitored through conscious twice-weekly lateral horizontal beam radiography, combined with physiological data on i) cardiovascular function via implanted bio-loggers measuring ECG and heart rate n=8), ii) pain sensitivity via thermal and mechanical nociceptive testing n=14, and iii) respiratory function via intermittent closed respirometry measuring respiratory frequency, tidal volume and CO2/O2 measures n=14. Here, we present methodological refinements for keel bone radiography and radiology as well as methodologies on acquiring physiological data, including anesthetic protocol and implantation of subcutaneous bio-loggers, local (keel) and peripheral (tarsus) nociceptive testing measuring thresholds to ramped thermal (temperature) and mechanical (pressure) nociceptive stimuli, identified through predefined behavioral responses, and the development of a 65L respirometry chamber.

The effects of pecking blocks on laying hen distribution and piling events in commercial barns

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In aviaries, laying hens can move freely and perform natural behaviours. However, freedom of movement can result in uneven distribution in the barn, leading to local crowding and underutilized areas. This study investigated whether the provision of pecking block edible enrichments (PB) affected laying hen distribution and piling events in a commercial aviary system. Three flocks of Lohmann Brown hens were housed in identical commercial layer barns divided into 4 pens (~9,000hens/pen), 5 rows/pen (rows 1 and 5 were on external walls) from 20-50 weeks of age (WOA). Each barn had three multi-tiered structures running parallel, with littered rows between the structures and external walls. Each pen was either provided PB throughout the laying period [TRT; n=6(30WOA), n=4(40, 50WOA)], or no PB [CONT; n=4(30WOA), n=3(40, 50WOA)]. PB were distributed evenly on litter throughout all rows (ratio of 1 PB/500 hens). At 30, 40 and 50WOA, cameras on the ceiling recorded the number of hens in the littered area 2.3m² around each PB in TRT pens and in identical locations in CONT pens. Counts of hens within 12 areas/pen (#hens/2.3m²) were quantified through instantaneous scans every 15min from 05:00-20:15. Mortality was recorded daily, and when there was mortality due to piling in a row of a pen, it was recorded as a piling event. The median number of hens observed in a given 2.3m² area per day was analysed using GLMM with fixed effects of treatment, row, age and their interactions, with pen nested within flock as the subject. There were more hens in litter areas around PB in TRT (17.1±1.2hens/2.3m²) compared to CONT (11.8±1.4hens/2.3m²; p=0.0208) and more hens in the inside rows (max hens/scan=66) than outside rows (p<0.0001). There was no row by treatment interaction, indicating that providing PB attracted more hens to those areas on the litter, but did not significantly improve the uneven distribution in the outside rows of the barn. There was no effect of PB on the number of piling events (p=0.63). Overall, there were numerically more piling events in the inside rows compared to the outside rows with 34, 15, 13, 5, and 4 total piling events in rows 3, 2, 4, 5, and 1 respectively. While PBs attract hens onto the litter in areas around PB and enhance foraging behaviours, they may not help with even distribution of hens in the barn or affect piling events.

Validation of an automated system for at-slaughter assessment of footpad dermatitis and hock burn in broiler chickens

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The automated assessment of footpad dermatitis (FPD) and hock burn via computer vision at the slaughterline could allow continuous monitoring of these important welfare indicators in broiler chickens. Such a system can be used to monitor the occurrence of FPD and hock burn over subsequent flocks and allow bench marking at different aggregation levels (farms, chains, countries, etcetera). This study aimed to compare the performance of a camera system (ChickenCheck software, CLK GmbH) against three human assessors. FPD (4 point scale based on relative size of the lesions) and hock burn (3 point scale based on absolute size of the lesions) were scored on both the left and right foot/hock according to severity from images captured by the camera system. A total of 50 images (100 feet/hocks) were used in the training dataset used to train the human assessors and 500 images (1,000 feet/hocks) were used in the validation dataset to determine measures of agreement and reliability for the discrete scoring system. Additionally, 100 images were used for lesion annotation (200 feet/hock) to determine the agreement between the camera system and the human assessors in capturing the total area of the foot pad or hock affected by lesions. Despite showing substantial to good intra-observer reliability (kappa: 0.78-0.98) and moderate to substantial inter-observer reliability (kappa: 0.46-0.66) during training, the human assessors showed fair to moderate agreement (kappa: 0.33-0.47) for FPD and hock burn when the dataset included a larger number of images with greater variation in lesion severity and appearance. However, the human assessors showed moderate to substantial agreement with the scores assigned by the camera system (0.60-0.70). More importantly, human assessors and camera system indicated a similar size of lesions on the footpad (R2: 0.93) and hock burn (R2: 0.97), suggesting that lesion size is correctly annotated by the camera system. However, the small but systematic differences found in the size of the affected area of FPD (+2.47%) and hock burn (-0.38 cm2) by the camera system compared to the human assessors need to be addressed to further improve the performance of the automated system. A validated system for automatic assessment of FPD and hock burn at slaughter allows continuous monitoring of all birds that are slaughtered and is a valuable tool to improve broiler welfare.

A20 PLENARY · TUE 23 JUNE, 17:30–18:00 · BEVERIDGE

What does it take to make a difference?

Joseph Garner

Stanford University, USA

From graduate student travel grants, conferences, the mentorship and collegiality of UFAW scientists (past and present), the centrality of the 3Rs in lab animal welfare, the honour and support of the UFAW William Russell Memorial Fellowship, UFAW has been a constant in my career as an Animal Welfare Scientist. After 100 years of leadership, UFAW is rebranding to "Science for Animal Welfare". This centennial meeting represents the vision for the future of Animal Welfare Science as much as our past successes. As Animal Welfare Scientists, we are motivated by both the need to make a difference, and the glimpses into the myriad of animal minds that our discipline uniquely affords. However, understanding the nature of an animals' mind is short solace if we can't make a difference in their lives for the better; and a human life in the service of others has its own pitfalls if approached unwittingly. In this talk I hope to share some insight from my successes (and more importantly, failures), on what it really takes to make a difference, as well as the future for our field. The talk will cover three broad themes. First, how to make a difference for ourselves? If we can't build a successful career, we can't help anyone. This section will cover essential strategies for graduate students, post-docs, and early faculty, especially in a field that is under-resourced. Life is short – only work with people you like. Second, how to make a difference in an indifferent (or worse) environment? This section will emphasize the central importance of understanding how stakeholders make decisions, and selecting the questions and measures that will have the greatest leverage. Appealing to stakeholders' enlightened self-interest is essential, but doesn't preclude the pursuit of beautiful science. Third, what does the future hold? Perhaps the most important development in our field is reverse translation – i.e., taking validated measures of human experience, and state-of-the-art experimental technique, and adapting them to ask questions about animals. In doing so, we have not just opened windows into the animal mind, but have also delivered far better measures and technique for biomedical research than the status quo. Finally, this work takes its toll. Culture of care is real. Compassion fatigue is real. We can't help anyone if we don't put on our own oxygen mask first. To paraphrase: how can you help animal welfare, if you don't help your own welfare first?

A21 MEDAL LECTURE · WED 24 JUNE, 09:10–09:50 · BEVERIDGE

Working in animal welfare: A journey from farm girl to scientist

Marina von Keyserlingk

University of British Columbia, Canada

I grew up on a cattle ranch in western Canada; an environment filled with blue skies, open ranges, horses, dogs, cats, cows, and calves (sorry, no chickens or pigs!). Looking back, I realize that while the dogs and cats had the opportunity to live reasonably good lives - complete with opportunities to run free and express natural behaviours - the lives of the cows and calves were far from perfect. Nevertheless, I do not believe this was the fault of my parents; they were doing what they thought was best with the information they had. The same was true for us as children. My sisters and I were expected to help on the ranch, with little opportunity to question how things were done. For example, I likely castrated hundreds of bull calves without pain mitigation because no one questioned the pain involved. Today, I would never castrate a calf without providing pain relief. In many ways, these early experiences laid the foundation for the work I would eventually dedicate my life to. Having now worked as an animal welfare scientist for close to 25 years, I often think about how fortunate I have been to find a profession that allowed me to marry my love of animals with my desire to improve the lives of farm animals. Although initially trained as an animal scientist, I now consider myself an interdisciplinary researcher. Agriculture is steeped in tradition, and implementing proven welfare solutions requires more than empirical evidence; we must also understand the barriers that prevent these solutions from being adopted if we hope to create meaningful and lasting change. Although progress can sometimes feel slow, looking back over my journey reminds me that change is possible. Practices such as tail docking in dairy cattle have largely disappeared, and calves are now commonly fed twice as much milk as they were two decades ago. These are meaningful successes. As I look to the future, I encourage all of you to find your passion. One of the greatest joys of my career has been mentoring the next generation, and I am especially proud to see so many former students and postdoctoral fellows finding their own passions in this field. That is exactly how change happens: people who care deeply ask difficult questions and challenge tradition. We have addressed many issues, but there is still important work to do. The animals and farmers need you.

A22 TALK · WED 24 JUNE, 09:50–10:10 · BEVERIDGE (TRACK A)

A Five-Realms framework for animal welfare

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Animal welfare science is increasingly recognizing the importance of animals' subjective experiences alongside traditional health and production measures. However, existing welfare frameworks tend to emphasize particular aspect of welfare, such as health or behavior, without always explicitly modelling how sensory, internal biological, and affective- cognitive processes interact to generate outcomes. In this paper, we critically review existing animal welfare frameworks, evaluate their strengths and limitations and propose a new integrative animal "Five Realms" framework for animal welfare. The proposed "Five Realms" framework comprises (1) Sensory Input, (2) Physiology and Health, (3) Microbiota, (4) Cognitive-Affective State, and (5) Behavior. This framework reconfigures existing models by explicitly integrating external sensory factors, internal physiological and health states, and microbiota as co-determinants of an animal's cognitive-affective experiences, which in turn drive behavioral responses. Importantly, behavior is not treated as a passive outcome but as an active process that feeds back to the first three Realms. We discuss how these five Realms interact dynamically and bidirectionally, drawing on evidence from affective neuroscience, animal cognition, physiology, and emerging microbiome research. We further propose a conceptual model wherein sensory, internal physiological, and microbiota-related processes jointly shape cognitive-affective states that motivate behavior, creating feedback loops that can either promote or undermine welfare over time. By incorporating microbiota as a distinct yet interacting biological realm, this framework reflects recent advances in animal science and acknowledges the growing evidence for microbiota-gut-brain interactions in shaping health, cognitive and emotional processing, and behavior. Overall, this review offers a timely and conceptually rigorous contribution to animal welfare science. The proposed framework aims to fill gaps in current welfare assessments by improving integration across biological and psychological processes, thereby enhancing our understanding of animal affective states. Ultimately, this approach may support more sensitive, comprehensive, and animal-welfare-friendly assessment and management practices across diverse contexts. This project was supported by National Science and Technology Council, R.O.C. (grant no. NSTC 114-2313-B-005 -049 -MY3).

A23 TALK · WED 24 JUNE, 10:10–10:30 · BEVERIDGE (TRACK A)

Describing the characteristics of feasibility when selecting potential (positive) animal welfare indicators for on-farm assessment

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There is an emerging interest in objectively measuring positive animal welfare (PAW) in practice. However, it is not clear which PAW indicators are feasible to use during on-farm assessments. Thus, we aimed to 1) refine criteria for feasibility relevant to on-farm welfare assessment, and 2) use these criteria to discern which indicators are promising (i.e., highly valid and highly feasible) for assessment protocols. This study was part of an internal project (SOA13) of the European Partnership on Animal Health and Welfare. First, based on published feasibility definitions, 15 criteria (e.g., total time required, tools needed, level of disruption) were developed. Each criterion was associated with a scale from 0 (least feasible) to 2 (most feasible), meaning the total feasibility score of an indicator can range from 0 to 30. Second, based on systematic literature reviews and ongoing experiments derived from previous work, a list of 125 potential PAW indicators was collated. Researchers (20/22 research performing organisations from SOA13) scored the indicators for their validity on a scale from 0 ('I don't know/I don't have the experience') to 4 ('The indicator is validated for positive affective states'). Based on the average score of validity and consultation with task leaders in SOA13, 14 PAW indicators with high average validity scores (> 1.9) were selected for feasibility assessment. Lastly, through an online survey, the 14 PAW indicators were assessed using the 15 feasibility criteria by researchers in SOA13 and COST Action LIFT, as well as stakeholders with experience in welfare assessment (e.g., certification bodies). Respondents (n = 61) had experience with ruminants (n = 20), pigs (n = 14), poultry (n = 25), and two other species (i.e., horse and fish). Overall, behavioural indicators had higher feasibility scores than cognitive and physiological indicators. To present the highly feasible indicators (total feasibility score: ≥ 21) (by rank): in ruminants, they were 'behavioural synchrony', 'Qualitative Behavioural Assessment (QBA)', 'social grooming', and 'use of enrichment'; in pigs, they were 'ear posture', 'QBA', 'tail posture', 'use of enrichment', 'social grooming', and 'vocalisation'; in poultry, they were 'social grooming', 'vocalisations', 'QBA', 'exploration', 'use of enrichment', and 'behavioural synchrony'. Though we may have missed understudied indicators, to our knowledge, this is the first study to advance the understanding of which PAW indicators might be feasible for on-farm welfare assessments. Future research might consider incorporating sensor technologies and artificial intelligence to increase the feasibility of some indicators.

A24 TALK · WED 24 JUNE, 10:40–11:00 · BEVERIDGE (TRACK A)

The Benchmark Method – a way to make aggregated animal welfare comparisons across production systems, between countries and over time

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States of animal welfare can only be ascribed to individual animals. However, animal welfare may still be compared at aggregated levels. Both animal welfare legislation and market driven initiatives (e.g. sustainability labels) increasingly make animal welfare requirements for different production systems. Yet there is limited insight into the relative impact of public and private initiatives on aggregated animal welfare in different countries and over time. Many people will have an opinion about how to compare animal welfare effects of such initiatives. However, can such comparisons also be made based on animal welfare science? In principle it would be possible to make a random draw of animals from different groups, use several welfare indicators, aggregate the findings and compare welfare levels – resembling the ways in which happiness of different groups of humans are assessed and compared across countries. However, it is not possible to make random draws among privately owned farm animals, and even if it were, practical considerations would make it too costly and therefore impossible. The so-called Benchmark approach is a possible way forward. This approach has been developed and applied to the study of aggregated welfare of pigs, broilers and dairy cattle in five countries (Denmark, Germany, the Netherlands, Sweden, and the UK) since 2018. Here, for each species, a panel of international academic experts in animal welfare science rated the animal welfare effects of features found in different production systems. The experts were asked how a given aspect of a production system – e.g. space allowance per animal, or access to environmental enrichment – affects the welfare of the animals in that system. The answers were scores ranging from 0 (minimum welfare) to 10 (best welfare in a commercial production system). The experts were then asked how important each aspect is from a welfare perspective, with responses ranging from 1 (not important) to 5 (very important). The score for a production system could then be calculated as a weighted sum and rescaled from 0 to 100. The aggregated welfare in a country or over time can be found by adding information about how many animals live in different production systems. In the presentation, we will use the Benchmark method to compare the effects of animal welfare policies on different farm species and in different countries. Also, novel findings on the effect of recent economic and political crises on animal welfare will be outlined.

A25 SHORT TALK · WED 24 JUNE, 10:50–11:10 · BEVERIDGE (TRACK A)

Public attitudes towards the fate of non-releasable marine mammals

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Many rescued marine mammals are deemed non-releasable due to legislation or limited prospects for survival in the wild, resulting in rescue and rehabilitation centers having to decide between providing lifelong care in captivity or performing humane euthanasia. Public opinion may further complicate these decisions, as it can influence center operations, funding, and policy. Therefore, this study examined public attitudes toward the management of non-releasable marine mammals. A total of 1,613 participants (769 from Canada, 844 from the United States) completed a mixed-methods survey. Participants were randomly assigned to a scenario describing either lifelong captivity (n = 788) or humane euthanasia (n = 825) of a non-releasable sea otter. They then answered about their agreement with the scenario and their interest in viewing animals in that rescue centre (7-point Likert scales), whether they would donate to the center, responded to a validated Animal Attitude Scale (AAS), and lastly responded to some demographic questions. Participants had greater agreement with lifelong captivity than humane euthanasia ($p<0.001$). Regression analyses indicated that scenario type ($b = 1.51$, $SE = 0.09$, $p<0.001$) and AAS ($b = -0.30$, $SE = 0.05$, $p<0.001$) predicted agreement, but there was an interaction indicating that individuals with more positive attitudes to animals (i.e., scored higher on the AAS) had particularly low agreement with euthanasia ($b = 0.38$, $SE = 0.09$, $p<0.001$). Interest in viewing animals did not differ by scenario, but was higher among participants with a lower AAS ($b = -0.26$, $SE = 0.04$, $p < 0.001$), those who had previously visited an aquarium ($b = 0.53$, $SE = 0.09$, $p<0.001$), lived near the ocean ($b = 0.34$, $SE = 0.11$, $p = 0.002$), and were from the US ($b = 0.57$, $SE = 0.09$, $p < 0.001$). Willingness to donate was high in both scenarios (~80%) and was predicted by prior aquarium visitation ($b = 0.40$, $SE = 0.13$, $p=0.002$) and higher income ($\chi^2(6) = 16.49$, $p=0.011$). Thematic analyses of participants' reasoning for their answers yielded four themes: scenario conditions, animal attributes, ethical perspectives, and alternative solutions. Our findings indicate that the public is more supportive of lifelong captivity than humane euthanasia, but these attitudes may not necessarily translate into behavioral intentions (such as viewing animals or donating to rescue centers). This highlights the importance of considering both public attitudes and potential attitude-behaviour gaps when making management decisions about non-releasable marine mammals.

A26 SHORT TALK · WED 24 JUNE, 10:50–11:10 · BEVERIDGE (TRACK A)

Raising the bar: How Shell powers up animal welfare beyond regulatory minimums

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As animal welfare expectations evolve across scientific, regulatory, and societal domains, organisations face increasing pressure to demonstrate responsible stewardship in all activities involving animals. While regulatory frameworks establish essential baseline protections, these frequently do not fully address the ethical, scientific, and public trust considerations relevant to contemporary research and operational contexts. This work presents the current approach to animal welfare within Shell, outlining how the company integrates regulatory compliance with enhanced internal governance, voluntary standards, and transparent reporting mechanisms. Shell's animal welfare standards are grounded in compliance with all applicable national and international regulations, including ethical review requirements and a hierarchy of controls based on the principles of Replacement, Reduction, Refinement and Responsibility (the 4Rs). Building on these foundations, Shell has developed internal expectations that exceed statutory obligations through strengthened ethical oversight, cross-disciplinary review processes, and the application of welfare considerations in areas where formal regulation is limited or absent. This includes applying consistent welfare requirements across global operations, promoting evidence-based welfare improvements, and ensuring that both internal and external partners adhere to Shell's welfare expectations. The company has also adopted a voluntary reporting approach for the past 25 years, aligning its animal welfare transparency with broader corporate sustainability and accountability practices. This reporting extends beyond mandated disclosures, providing insights into governance, welfare-related decision-making, implementation of the 4Rs, and number of animals used. Additionally, independent scrutiny is provided by the Animal Welfare External Panel, whose expert members, including external specialists, offer oversight and challenge, enhancing transparency and credibility in the company's animal welfare governance. The intention is to enhance stakeholder trust, support scientific integrity, and demonstrate responsible leadership in an area often overlooked in corporate reporting frameworks. This contribution will discuss the structure of Shell's animal welfare governance system, examples of voluntary measures that go beyond regulatory mandates, challenges in implementing harmonised welfare approaches across diverse jurisdictions, and the benefits of transparent reporting for continuous improvement and stakeholder engagement. By sharing this framework, the presentation aims to encourage broader adoption of voluntary improved welfare standards within industry settings and stimulate interdisciplinary dialogue on how organisations can meaningfully advance animal welfare beyond simply legislative compliance.

Avoiding a polarised future: Synthesising diverse perspectives on the future of farm animal welfare in Canada

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Farmed animal welfare is a topic that involves perspectives from people who care for or about animals, including farmers, advisors, government officials, industry actors, animal advocates, scientists, and citizens. The knowledge and values these people have is diverse and potentially polarizing, which makes reaching consensus on animal welfare policy and on- farm standards challenging. This study explored how people envision the future of farmed animal agriculture in Canada, first from their own perspective and then from a different perspective using a frame reflection exercise. We invited participants attending the Canadian Societies for the Prevention of Cruelty to Animals (SPCAs) and Humane Societies annual meeting (Humane Canada Summit for Animals, 2025, Montreal, QB) to complete a survey and respond to the open-ended question: "What does it mean to you to be a good farmer?" Participants then spun a wheel and landed on a role different from their own (animal, veterinarian, policy-maker, scientist, farmer), and responded to the same question from that new perspective, followed by an interview about their experience. Participants (n=36) were majority female (n=28), aged 25-45 years (n=24), and living in urban regions (n=29). Participants primarily identified as animal advocates (n=17), followed by scientists (n=6) and veterinarians (n=3). Participants' descriptions of a good farmer converged around three themes. First, farmer values included caring toward animals and the environment, resilience to external pressures, mindfulness of impacts on animals, communities, and ecosystems, and capability to balance animal welfare with economic demands. Second, participants emphasised farmers' responsibilities to the public, including transparency, provision of high-quality food, and protection of human, animal, and global health. Third, good farming was associated with ethical and humane animal care and use of best practices informed by regulations and scientific knowledge. When responding from new perspectives, keyword patterns varied by role; "farmers" (n=8) highlighted care, livelihood, and management; "animals" (n=7) emphasised meeting needs, care, and positive experiences; "veterinarians" (n=6) focused on caring for animals' physical and psychological state; "policy- makers" (n=5) discussed farmers following regulations; and "scientists" (n=4) emphasised animal welfare, specifically psychological states. "Positive experience" and "animal rights" were mentioned only in the "animal" role, whereas "good life" emerged in both "animal" and "farmer" perspectives, suggesting potential common ground. These findings demonstrate that although perspectives differ across roles, shared values do exist. Frame reflection exercises may therefore be a useful tool for fostering reflection, identifying convergence, and supporting more constructive dialogue in animal welfare policy and practice.

A28 TALK · WED 24 JUNE, 11:50–12:10 · BEVERIDGE (TRACK A)

The Welfare Footprint framework: A modular architecture for quantifying and comparing animal experience across systems

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Despite decades of advances in animal welfare science, translating the lived experiences of animals into standardized and comparable metrics that can inform policy, certification, and consumer decision-making has long remained a challenge. The Welfare Footprint Framework (WFF) addresses this gap through an evidence-based methodology that quantifies animal welfare using a biologically meaningful measure directly connected to animal experience: cumulative time spent in affective states of varying intensities, both negative and positive. While individual components of the WFF have been applied in previous studies, we present its complete analytical architecture, including the full methodology to produce animal Welfare Footprints of entire production chains. The framework is organized into distinct modules : (I) detailed description of the living conditions and/or processes being evaluated; (II) inventory of their biological consequences for the animals and resulting affective experiences; (III) quantification of each affective experience in terms of intensity and duration using rigorous evidentiary standards; (IV) epidemiological investigation of each experience in the target population; (V) standardization of estimates per animal, system, or unit of product and (Ψ) interspecific scaling to enable cross-species comparisons. Central to the framework is the translation of diverse welfare indicators—behavioral, physiological, neurological, and pharmacological—into explicit hypotheses about the intensity and duration of each affective experience. Affective experiences are decomposed into temporal segments with durations expressed as uncertainty ranges and intensities characterized by probability distributions across operationally defined categories. In addition to making uncertainty and natural variation explicit, this ensures that the subjectivity inherent to all welfare assessments is rendered transparent and open to scrutiny. By calculating cumulative affective burden per unit of animal-sourced product, it yields Welfare Footprints analogous to environmental footprints, enabling animal welfare to be considered alongside economic, social, and environmental priorities. Applications to laying hens, broiler chickens, pigs, cattle and fish demonstrate how the WFF can identify welfare hotspots, evaluate alternative production standards, and inform cost-effectiveness analyses of reforms. Also, by providing a common quantitative language grounded in affective experience, the WFF offers a means for strengthening welfare communication in policy and markets. To support its application, the Welfare Footprint Institute was established to advance the framework's development and enable independent welfare impact quantification across species and contexts. As welfare science advances, the framework's modular architecture is designed to incorporate new data and knowledge, contributing to the continued development of valid, evidence-based approaches to assessing affective states in animals.

A29 TALK · WED 24 JUNE, 12:10–12:30 · BEVERIDGE (TRACK A)

Assurance or artifice: Why doesn't transparency always improve animal welfare?

Mia Cobb

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Animal-reliant industries that depend on public support are investing heavily in transparency: welfare strategies, reports, digital monitoring, and third-party audits and certification schemes. These systems are increasingly treated by policymakers, consumers, and the public as evidence that animal welfare is being assured. However, transparency as a disclosure system doesn't necessarily provide genuine visibility. Welfare information must reach and be understood by stakeholders, including the public. This presentation proposes a theoretical framework for distinguishing welfare washing (transparency that produces the appearance of accountability without measurable benefit to animals) from effective welfare governance. Not all transparency is created equal: disclosure systems vary fundamentally in what they make visible and to whom. Some systems report obscure metrics, aggregate data at national/industry levels that mask salient local detail, or change reporting categories between years, preventing longitudinal comparison. Third-party certification can compound this when audits assess whether organisations adhere to their own documented processes, rather than whether those processes accurately reflect welfare outcomes. The public reasonably interprets an accreditation stamp as evidence that animals are well cared for, but the stamp may reflect how an organisation operates, not how animals fare. These design features have led to some disclosure systems functioning as legitimacy tools, rather than driving welfare improvement. Even when welfare information is unambiguous, visibility may fail to drive change. The health consequences of brachycephalic dogs are extensively documented and broadly understood by the public, yet demand persists. Clear evidence has not been sufficient to shift the acquisition and breeding choices that perpetuate animal suffering. For transparency to improve animal welfare, we need to understand the mechanisms through which disclosure drives accountability. Drawing on theories of social license, information asymmetry, and contemporary animal welfare science, I propose that welfare improvement depends not on whether information is visible, but on whether visibility activates specific accountability mechanisms: consumer pressure, regulatory action, reputational consequences, or internal motivation. Three conditions moderate this activation: the independence of verification (who checks?), the accessibility of information to stakeholders (who sees, and can they understand it?), and the baseline legitimacy of the sector (who cares?). This framework is explained using sectors where individually identified animals are subject to varying transparency expectations, including working, racing, and zoo animals. As national animal welfare strategies increasingly centre transparency as a governance mechanism, understanding what distinguishes systems that serve animals from those that merely document their management is scientifically and practically urgent.

A30 TALK · WED 24 JUNE, 12:40–13:00 · BEVERIDGE (TRACK A)

Optimising the selection of welfare indicators in farm animals

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Risk assessment (RA) frameworks are increasingly used to improve the welfare of farmed animals. Central to these frameworks is a logic chain linking welfare hazards (risks) to welfare consequences, which are each assessed through one or more welfare indicators. Monitoring systems often require selecting a manageable subset of indicators from a much larger pool. Prioritising 'iceberg indicators' (those associated with multiple welfare consequences) can improve efficiency, yet there is no standardised, data-driven method to identify optimal combinations under practical constraints. This study addresses this gap by developing and testing an algorithmic approach for optimising indicator selection. The work comprised six phases: 1) construction of a structured database of welfare indicators; 2) proof-of-concept testing; 3) design of a greedy selection algorithm; 4) enhancement of the algorithm using branch-and-bound and backtracking methods; 5) performance and sensitivity testing; and 6) application to two case studies. A dataset of 382 indicators across seven farm animal species was compiled from European Food Safety Authority (EFSA) scientific opinions and other published literature. EFSA opinions provide structured data linking indicators to hazards and consequences through literature review and expert elicitation. For algorithm development, 'Coverage' was defined as the number of unique welfare consequences linked to each indicator. Additional metadata used in the optimisation was generated through expert elicitation and included 'Impact of welfare consequence', 'Ease of hazard mitigation', and 'Ease of indicator use'. All criteria were standardised using min–max normalisation, and an objective function was defined to enable customised indicator subset selection. Optimisation was performed using both a greedy algorithm and an enhanced algorithm incorporating backtracking and branch-and-bound solvers. Performance and robustness were evaluated through sensitivity analysis, scenario testing, and computational benchmarking. The greedy algorithm was computationally efficient but showed diminishing returns in 'Coverage' as more indicators were added. The enhanced algorithm consistently identified globally optimal combinations within 0.2 seconds across all species. In a broiler chicken case study, it deprioritised indicators that were moderately difficult to use. In a pig case study, it confirmed the greedy algorithm's selections while demonstrating the added value of multi- criteria optimisation by favouring high-impact, easy-to-implement indicators relevant for certification schemes. The enhanced algorithm supports welfare indicator selection beyond simple iceberg indicator logic by integrating multiple criteria. Its data-agnostic design allows application across research, industry, and policy contexts. Ongoing work seeks to refine weighting strategies, expand scenario testing, and integrate stakeholder input to maximise practical relevance.

A31 TALK · WED 24 JUNE, 14:00–14:40 · BEVERIDGE (TRACK A)

Improving lifetime welfare of pigs and chickens by automated monitoring of animal welfare measures at slaughter – progress made by the aWISH project

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aWISH is a 4-year Horizon Europe Research & Innovation Action that started in October 2022. The project focuses on automated monitoring of animal-based indicators at slaughterhouses for documenting and improving the welfare of broiler chickens and fattening pigs during each phase of production (farm, transport and slaughter). Now that the project is nearing completion we give an overview of the main achievements, lessons learned and way forward. An interactive catalogue of technologies for the routine assessment of pig and chicken welfare indicators, covering the five animal welfare domains, has been developed and is regularly updated. Sixteen new sensor-technologies were developed, tested and validated in six pilots across Europe. Each pilot consists of a slaughterhouse with a local research partner, associated farms and various technology providers. Pig pilots are in Austria, the Netherlands, Serbia and Spain, while the broiler pilots are in France and Poland. The technologies selected for pigs measure ear lesions, skin lesions, tail length, tail lesions, blood parameters, stress vocalisations, tear staining, stunning effectiveness, environmental parameters, body weight, lung lesions, coughs, and meat quality. The broiler technologies document hock burn, footpad lesions, catching lesions, back scratches, stress vocalisations, activity, environmental parameters, and an app for on-farm welfare self-assessment. These technologies are mainly installed in the slaughterhouse, but some are also installed on-farm, and some require human observations supported by digital tools (e.g. smartphone applications). For the new sensor systems, TRL levels currently range from 2 to 7, with an average of 6. Expert elicitation was used to aggregate welfare indicator outcomes using an indicator-based “white box” approach, whereas the scenario-based “black box” AI approach is still being developed. Sensor data complemented by metadata from focal farms and socio-economic and environmental metrics are stored and processed on an aWISH data platform. The different actors in the production chain receive feedback on relevant individual and aggregated indicator scores through multiple interactive visualisations and dashboards, allowing a.o. time series monitoring and benchmarking. The interface also provides users access to practical guides to tackle certain animal welfare problems. The platform is further used for documenting the welfare status at operator and regional/national level, for identifying risk and success factors, and for investigating the effect of the feedback loop on pig and broiler welfare. Further development and implementation of the aWISH approach holds promise to cost-effectively monitor the welfare of meat-producing livestock throughout Europe prior to implementing improvement strategies.

A32 SHORT TALK · WED 24 JUNE, 14:40–15:00 · BEVERIDGE (TRACK A)

Do sick calves isolate? Changes in lying behaviour and space use during diarrhea

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This study assessed social isolation behaviour and brush use around disease in pre- weaned dairy calves. Calves were housed in 3 pens of 50-55 calves (4 m²/calf) and all were health monitored daily until 21 d of age. Diarrhea was defined as: loose feces for ≥2 d or watery feces for ≥1 d, and clinical signs of dehydration or depression. Healthy calves showed no signs of diarrhea, BRD, or navel infection over the 21 d. Healthy and diarrheic calves were pair-matched based on pen and age at diarrhea diagnosis. Pens contained 3 hide structures (8 x 2 x 4 ft), 2 rotating brushes, 2 nipples providing ad libitum milk from an automated feeder, 2 concentrate troughs, and open and semi-open resting areas. Calf behaviour was video recorded and analysed continuously on d -1, 0, and 1 relative to diarrhea diagnosis (n = 6 of planned 15 calf pairs analysed). Lying time, lying bouts, percent of lying time spent alone, brush use, and brush bouts were analysed using linear mixed models, with calf nested within pair as a random effect. Time spent lying in 5 pen zones was analysed using Wilcoxon signed-rank tests. Diarrheic calves were diagnosed at 9.8 ± 1.7 d of age, with a duration of 5.8 ± 2.2 d. Across the three observation days, diarrheic vs. healthy calves spent 1.5 ± 0.5 h/d more time lying ($P = 0.04$) with 5.0 ± 2.1 fewer lying bouts/d ($P = 0.04$). No effects of health status were detected on time spent lying alone ($P = 0.14$), brush use ($P = 0.97$), or number of brush bouts ($P = 0.37$). Healthy calves spent approx. 41% of their lying time in the open resting area. The day after diagnosis, diarrheic calves spent 26% less time lying in this open resting area ($P = 0.03$), spent 21% more time lying in resource zones (around brushes and feeders; $P = 0.03$), and tended to spend 12% less time lying behind the hides ($P = 0.06$) compared to healthy controls. Overall, diarrheic calves altered their lying behaviour and space use of the pen, but they did not appear to spend more time lying alone or preferentially use hide areas during illness; this may be due to high pen stocking density or the low sample size analyzed. This study provides insight into calf sickness behaviour that may inform future pen design and automated disease detection.

Exploring the relationships between immune markers and behaviours reflecting affective states in piglets

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A link between sickness and lowered mood has been demonstrated across several animal species. However, also mild, subclinical inflammatory activity, as well as psychological stress, may modulate immune markers in otherwise healthy individuals. It is therefore possible that immune measures could provide insight into the affective states of animals. We aimed to explore the relationships between behaviours of piglets that may reflect their affective state and blood markers of immune status. Video recordings and blood samples were available from 46 female pair-housed piglets, weaned at 4 weeks of age, that were exposed to different sanitary and dietary treatments in a 2×2 factorial design. All piglets were clinically healthy. Behaviours (damaging behaviour including ear and tail biting, aggression, object play, individual locomotor play, social locomotor play, play fighting) were recorded on day 16 post-weaning from 07:00-19:00h using continuous behaviour sampling. Blood samples were taken on day 18. Leukocyte counts and subpopulations, as well as haptoglobin concentrations were determined. Because frequencies and durations of behaviours were strongly correlated, only frequencies are presented. Behavioural frequencies and blood variables were square root and log transformed, respectively, prior to analysis. Pearson correlations were done on residuals of the variables obtained from a general linear model with sanitary status and diet as factors to correct for the experimental treatments. Serum haptoglobin concentrations were negatively correlated with frequencies of play fighting ($r=-0.53$, $P<0.001$), social locomotor play ($r=-0.39$, $P<0.05$) and total play ($r=-0.40$, $P<0.05$), and tended to be positively correlated with damaging behaviour ($r=0.28$, $P<0.10$). Leukocyte counts tended to be negatively correlated with individual locomotor play ($r=-0.30$, $P<0.10$) and total play ($r=-0.31$, $P<0.10$) and were positively correlated with damaging behaviour ($r=0.38$). Neutrophil counts were positively correlated with damaging behaviour ($r=0.42$, $P<0.01$) and tended to correlate negatively with play fighting ($r=-0.28$, $P<0.10$). Basophil counts were positively correlated with damaging behaviour ($r=0.35$, $P<0.05$), and monocytes correlated negatively with total play ($r=-0.30$, $P<0.10$). Lymphocyte or eosinophil counts did not correlate with any of the behavioural variables, and frequency of aggressive behaviour was not correlated with any of the blood variables. In conclusion, moderate correlations were found between several inflammatory markers and positive and negative behaviours in pigs. These findings suggest that variation in basal inflammatory status, even among clinically healthy animals, may be associated with differences in affective state. Further research, ideally using non-invasive markers of immune status, is needed to confirm and extend the insights from this exploratory study.

A34 SHORT TALK · WED 24 JUNE, 14:40–15:00 · BEVERIDGE (TRACK A)

Changes in locomotor play, social play, and reward sensitivity after disbudding in calves

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The use of play behaviour as an indicator of animal affect is complicated, as play is rewarding, and reward sensitivity can increase in response to mild stress but decrease in response to severe stress. This work explored (1) the relationship between play behaviour and reward sensitivity assessed using the sucrose preference test (SPT) in calves and (2) whether both behaviours respond similarly to an affective state manipulation (hot-iron disbudding, a common but painful husbandry procedure). N = 32 Holstein female calves were tested for (i) play levels (paired arena test) and (ii) reward sensitivity (SPT with water vs. 3% sweet solution) for 5 days per week over 2 weeks. Half of the calves were disbudded with local anaesthetic and analgesic at the beginning of Week 2. Prediction (1A) was that individuals with higher reward sensitivity on the SPT would also play more, and Prediction (1B) was that these behaviours would remain associated following disbudding. Prediction (2) was that, at the group level, disbudded calves would show reductions in both play levels and reward sensitivity. For Prediction 1A, at baseline, play and SPT behaviours were unrelated, suggesting partially distinct motivational underpinnings. However, for Prediction 1B, individuals showing higher locomotor play responsiveness and social play solicitations after disbudding also had higher sweet solution preference, suggesting a stronger connection between these behaviours under stress. For Prediction 2 at the group level, locomotor play and play responsiveness were reduced shortly after disbudding but then recovered after 27 h, suggesting that these behaviours may reflect immediate negative affect but not be sensitive to smaller/longer-lasting changes. Conversely, social play solicitations were suppressed most clearly 3 days after disbudding, likely reflecting the disbudded calves avoiding painful head-related behaviours. Sweet solution consumption was reduced from the day after disbudding to 3 days after, potentially suggesting an anhedonic-like response to disbudding pain, but there was no clear directional effect on sweet solution preference. This finding may indicate a general reduction in drinking motivation, especially if the warm water option was also rewarding for calves, or individual variation in responses to disbudding (e.g., some increasing their sweet solution preference to cope with mild stress and others showing anhedonia due to severe stress). Overall, further research is warranted to explore the underlying experiences (e.g., negative affect, pain) represented by these various play and SPT behaviours and, thus, determine whether they reflect distinct aspects of calf welfare.

The influence of perforated rubber mats on sow (Sus scrofa) locomotion and welfare

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Leg health is critical for ensuring positive welfare and productivity in group-housed gestating sows. Rubber mats are proposed to improve comfort and reduce leg injuries, yet results remain inconsistent due to issues such as drainage, durability, and slipperiness. Perforated rubber mats aim to address these concerns. This study included two components: a locomotion test and a one-gestation-cycle housing study comparing concrete versus perforated rubber-matted flooring. The locomotion test involved training 20 sows of varying parities and pregnancy stages to voluntarily walk on an 8m runway. Animals were tested twice on concrete and rubber-matted flooring under clean, dirty, and extra dirty conditions. Locomotion and its components (caudal sway (CS), stride length (SL), fluidity (FL), and reluctance to bear weight (REL)) were assessed. The housing study included four replicates of 23-27 sows and gilts (24.8±1.5; N=99) in group housing with free access stalls. Sows were assigned to either pens with fully concrete flooring (CON) or pens equipped with perforated rubber mats covering the slatted walkway and half of the solid social area (MAT). Locomotion, sow cleanliness and hoof lesions were assessed at the gestation entry, mid-gestation and gestation exit. A subsample of animals was selected for infrared thermography (IR) of hind limbs at gestation entry and exit. Pen cleanliness and sows' space use within the pen were assessed weekly. Generalized Linear Mixed Models were used to analyse surfaces, conditions, and their interactions as fixed effects for the locomotion test, and flooring, gestation stage and their interactions as fixed effects for the housing study. Animals moved faster on rubber-mats compared to concrete (mat: 0.81±0.06 vs. concrete: 0.71±0.05 metre/s; $P<0.001$), with the greatest difference on the dirty condition. They had worse locomotion (overall: $P<0.001$; CS: $P=0.02$; SL: $P<0.001$, FL: $P<0.001$; REL: $P<0.001$) when walking on concrete compared to rubber. Overall, locomotion worsened as conditions got dirtier (overall, SL, FL, REL: $P<0.001$). Preliminary results showed that at farrowing entry, MAT sows had better locomotion and greater IR leg temperatures ($P\leq0.02$). The latter may be due to increased insulation by rubber mats. CON pens tended to have higher faecal soiling throughout gestation ($P=0.05$). Sows' cleanliness, space use within the pen, and hoof lesion scores did not differ between flooring treatments. Rubber mats can improve sow comfort, evidenced by improved locomotion during the voluntary walking test and post-gestation, but did not change sows' space use or hoof lesions.

A36 TALK · WED 24 JUNE, 15:40–16:00 · BEVERIDGE (TRACK A)

From evidence to impact: Building evidence-based animal welfare policy and practice

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Persistent “evidence-to-practice gaps” limit the impact of animal welfare science. Proven welfare refinements often take decades to become standard practice (e.g., group housing pigs), while others are never adopted due to concerns about cost, feasibility, or productivity (e.g., enrichment). At the same time, those responsible for animal care—technicians, veterinarians, facility managers, farmers, and policymakers—must frequently make decisions based on evidence that is incomplete, conflicting, biased, or absent. When human health care faced similar challenges, it adopted Evidence-Based Medicine—reshaping health care globally. If animal welfare science were to follow a similar path, “Evidence-Based Animal Welfare” has the potential to reshape how welfare science is conducted, policy and guidelines are developed, and practical animal care decisions are made. Using foundational principles from Evidence-Based Medicine, we present an overarching framework for evidence-based animal welfare science, drawing on parallel challenges faced in human medicine. We also describe our ongoing efforts that harness the power of AI technology to make these approaches accessible to the animal welfare community. This evidence-based approach begins with integrating systematic review methodology into animal welfare science. By comprehensively identifying, appraising, and synthesizing all available evidence, systematic reviews reduce bias, resolve conflicting findings, and provide a transparent foundation for informed decisions, while also improving the replicability and reliability of welfare research. However, the complexity and resource-intensive nature of systematic reviews present a barrier for their rapid uptake. To address this barrier, we present two complementary initiatives in development: (i) a Systematic Online Living Evidence Summary (SOLES) for environmental enrichment, a free, continuously updated AI-assisted evidence synthesis platform used to directly support welfare-relevant decision making, and (ii) the validation of rapid review methodologies to generate timely evidence when full systematic reviews are not feasible. Evidence synthesis alone, however, cannot close evidence-to- practice gaps. Decision makers must also judge how much confidence to place in cumulative evidence and how to translate it into actionable recommendations. In human healthcare, this challenge is addressed through transparent frameworks such as the Grading of Recommendations, Assessment, Development and Evaluation (GRADE) approach, now the global standard in guideline development. We argue that adopting similar frameworks to welfare contexts represents a critical next step for welfare science. Here we will demonstrate how evidence-based frameworks, combined with tools to make this approach accessible, provide a clear pathway for real-world decision making that improves replicability, transparency, and impact, bettering animal lives.

A37 SYMPOSIUM TALK · WED 24 JUNE, 16:15–16:25 · BEVERIDGE

From protocol to practice: Using ethical review to improve animal welfare and research replicability

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Introduction: Ethical review of animal experiments is a potentially powerful mechanism for improving animal welfare and research replicability. Here, ethical review committees evaluate animal use protocols that describe and justify proposed research for adherence to the 3Rs (replacement, reduction, refinement), alongside key elements of experimental design (e.g., sample size calculation). However, existing evidence suggests that ethical review committees face challenges in evaluating both 3Rs implementation and experimental design. Reporting within approved animal use protocols has been examined in a small number of studies, in part because these documents are rarely publicly accessible. To date, no study has simultaneously assessed reporting of both the 3Rs and rigour, and reporting in Canadian protocols has not been investigated. Addressing this gap is essential for identifying evidence- informed opportunities to improve ethical review. Objectives: In partnership with the Canadian Council on Animal Care (CCAC), we conducted an assessment of animal use protocols to characterize reporting of 1) the 3Rs; and 2) rigorous methodology (randomization, blinding, sample size calculation, planned data analysis). Methods: A request for submission of animal use protocols was sent to 35 academic institutions. From each institution, for recently approved mouse and rat protocols, for minimal, low, moderate and severe stress categories of invasiveness, in both basic and translational research (n=48 protocols/institution). Screening and data extraction were performed independently and in duplicate. Results: Fifteen institutions participated (43%), contributing 308 protocols. For the 3Rs, replacement practices were described in 29% of protocols and 65% of remaining protocols explicitly justified use of animals. Reduction practices were reported in 75% of protocols, and refinements in 39%. With respect to rigour, blinding was reported in 7% of protocols, randomization in 20% and planned data analysis in 16%. Use of sample size calculations was reported in 28% of protocols, but 2% provided details of the calculation (e.g., effect size, power). Conclusion: This study provides the first systematic characterization of reporting of the 3Rs and methodological rigour in parallel, and the first evaluation of Canadian animal use protocols. The findings identify clear opportunities for improvement, particularly with respect to sample size calculation and refinement. To build on these findings, a focus group study is now underway to examine barriers faced by ethical review committees and identify improvement strategies. Together, this work highlights evidence-informed opportunities to strengthen ethical review processes in ways that support animal welfare and research replicability.

A38 SYMPOSIUM TALK · WED 24 JUNE, 16:25–16:35 · BEVERIDGE

Testing replicability across laboratories: Inter-observer reliability on an ethogram for affiliative behaviour in pigs

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Affiliative social relationships have received increasing attention in farm animals in recent years due to their relevance for positive animal welfare. Social bonds, defined as frequent and non-random affiliative interactions and associations between individuals, can provide benefits such as reduced stress and improved coping in challenging environments. These relationships are commonly estimated based on the frequency of affiliative behaviours. However, the accuracy of these estimates critically depends on the observation method and observer reliability, as inconsistencies can compromise the measurement and interpretation of social bonds. In this study, researchers from four laboratories working on affiliative behaviours and social relationships in pigs collaborated to investigate the reliability of their behavioural observations. The aim was to evaluate inter-observer reliability (IOR) of affiliative behaviours in pigs using a new ethogram, developed by modifying the ethograms previously used by each laboratory. The ethogram included five affiliative behaviours: nose disc to snout, nose disc to head, nose disc to body, allogrooming, and active lying down in contact with another individual. To assess reliability, researchers from each laboratory independently coded the same 12 30-min video recordings using continuous focal sampling. The recordings were provided by a single laboratory and were randomly selected from 12 different groups of 10 pigs with the intention to represent different types and levels of social interactions. For each behaviour, the agreement was calculated using intraclass correlation coefficients (ICC) based on occurrence data. Active lying down and allogrooming showed good inter-observer reliability (ICCs: 0.826 and 0.856, respectively) and nose disc to body showed moderate reliability (ICC: 0.555), while nose disc to head and nose disc to snout showed poor agreement (ICCs: 0.279 and 0.342, respectively). Despite the use of a common ethogram, our results revealed substantial variation in reliability, emphasizing the importance of assessing reliability separately for each behaviour. Our study emphasizes the need for systematic reliability assessment when evaluating social relationships in pigs to ensure that findings are both robust and generalizable. Such practices are essential for improving research on social relationships based on affiliative behaviours.

A39 PLENARY · THU 25 JUNE, 10:00–10:40 · BEVERIDGE

Animal health and welfare: Time for a refresh?

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Health or conversely disease has been a key element of animal welfare since the Brambell committee; yet several authors and reports point to a lack of research on the welfare impacts of disease. We have recently confirmed this knowledge gap in a scoping review (based on PRISMA guidelines) of the welfare impacts of infectious diseases in pigs (Gonzalez et al., under review). We found a small and fragmented literature with just 23 experimental papers passing our selection criteria, and no papers published before 2000. As far as we can see this is the first structured review of the literature covering welfare impacts of infectious diseases in any animal species, and it provides strong support that the specific interactions between disease and welfare are being largely over-looked at least in farm animals. Of particular relevance to this meeting our review found a complete absence of experimental research directly addressing the impacts of diseases on pigs' mental state, and in this paper we will focus on this specific knowledge gap. We will review current understanding of the potential interactions between disease and mental states in sentient animals (including recent human studies of interoception and how physical signals of disease are transduced into mental states) and approaches used to study these. Across the wider animal literature, we have found examples of quantitative and qualitative experimental studies, expert-based assessments and epidemiologically based approaches and we will discuss the potential and the limitations of these approaches as a guide for future studies. We will also review the wider question of the value of assessing the impacts of disease on animals' mental state. Frameworks which take account of individual animals' subjective experience have the potential to (a) re-prioritise diseases and animal health interventions based on an individuals' quality of life (QoL) and not only economic or production considerations; (b) facilitate inclusion of animals' QoL in estimating the socio-economic costs of disease; (c) more precisely estimate the cost: benefit of welfare improvements (e.g. taking account of positive effects of improving animals' QoL on disease resistance). We will use the specific example of weaner production in pigs to illustrate these points. Pathways to improvement in this area include more integration of veterinary and animal welfare research to better understand the impact of disease on mental state, including applications of welfare metrics sensitive to mental states in clinical disease monitoring and more attention to background health in animal studies.

A40 TALK · THU 25 JUNE, 11:20–11:40 · BEVERIDGE (TRACK A)

Precision welfare monitoring in dairy cattle via continuous social tracking, personality dimensions, and voluntary optimism bias testing

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Animal welfare is often assessed using periodic observations or short tests that remove animals from their social group, limiting ecological validity and scalability. Here we present an integrated platform for continuous welfare monitoring in dairy cattle that combines high resolution, in shed behavioral tracking with an automated optimism bias assay that cows can engage with or ignore. Each cow is fitted with an ultra wideband location tag, enabling continuous recording of trajectories, proximity, and social spacing within the group. From these data we extract a broad set of behavioral readouts capturing movement, space use, resource use, social coordination, dyadic interactions, and dominance relationships, allowing reconstruction of dominance hierarchy within the herd over time. To quantify stable individual differences, we derive personality dimensions from longitudinal behavioral data, learning trait like axes that maximize between cow variability while remaining consistent within each cow over time. These personality dimensions provide an individualized reference for what is typical for each animal, including characteristic social role and hierarchy associated patterns, and support detection of meaningful departures from baseline. In parallel, we implement a shed based, tag mediated optimism bias system that runs in the background and does not require separation or handling. The system presents standardized cues and records individual choices and response latencies to both unambiguous and ambiguous stimuli, yielding a continuous proxy of affective valence while allowing cows to opt out at any time by simply not participating. By integrating each cow's personality dimensions and dominance profile with its ongoing optimism bias measurements, we build individualized expectations and quantify deviations in behavior, social dynamics, and affect that are consistent with emerging welfare challenges, even when overt clinical signs are subtle or delayed. This approach enables precision welfare assessment at the individual level while preserving social context, offering a scalable path to continuous, automated monitoring that can support research on affect and provide actionable decision support for on farm welfare management.

A41 TALK · THU 25 JUNE, 11:40–12:00 · BEVERIDGE (TRACK A)

Do calves show conditioned place aversion to pain 2 days post- disbudding despite gold standard pain relief?

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Hot-iron disbudding is a common, painful procedure in calves. Current best practise involves the use of a local anaesthetic and an analgesic to control the intra-operative and post- operative pain. Although this strategy is efficient in reducing pain during and in the hours after the procedure, recent evidence suggest calves may be in pain in the days following the procedure when the analgesic properties wane. Here, we explored whether calves would benefit from additional pain relief 2 days after the procedure using a conditioned place aversion (CPA) paradigm. This paradigm provides information about the subjective experience of animals, based on how they remember a previous experience and associate it with a specific place - animals are expected to show an aversion for the place associated with the most negative experience. The day after habituation, which was used to determine baseline preference, all calves were conditioned for 6 hours in absence of pain in one of the two pens (either blue or white). A day later, all calves were disbudded using current best practice. Two days later, calves were conditioned for another 6 hours (in the opposite pen) with half receiving an additional injection of meloxicam (one hour prior to conditioning) and the other half not. Calves' preference was assessed on the following day using the time they spent in either pen. After controlling for experimental factors, treatment had a significant effect on the change in preference between test and habituation where calves in the meloxicam treatment spent significantly more time in the second conditioning pen ($p = 0.018$), suggesting that they benefited from pain relief. This result suggests that calves likely experience pain 2 days post-disbudding even when best practices are used and would benefit from additional pain control. Further work should investigate for how long calves are in pain after disbudding, with whether they benefit from pain relief being a promising avenue for future research.

A42 TALK · THU 25 JUNE, 12:00–12:20 · BEVERIDGE (TRACK A)

Can weaner pigs use 23 mm drinking nipples provided during long-distance transport?

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Leslie Foldager, Mette S. Herskin Aarhus University, Tjele, Denmark

Denmark annually exports over 15 million weaner pigs to other EU member states. Currently, journey durations up to 24h are allowed (Council Regulation (EC) No1/2005) and journeys more than 8h require continuous access to water. At the end of the journey, water in the vehicles' tanks may be depleted, but it remains unknown if the pigs drink, or whether the water is largely wasted. This study investigated drinking behaviour and water use of 30kg pigs provided with two or four 23mm press nipples (used in some vehicles approved for long-distance transport) compared to a familiar drinker type they would encounter on farm, as well as whether aggression following mixing unfamiliar pigs (common practice when pigs are in transit) reduced drinking behaviour and water use. The study consisted of eight 24h stays in modelled vehicle compartments (5.4-5.6m2) and 24-25 pigs/compartment (n=789 pigs, average BW±SD= 27.7±5.9kg). The treatments were: 1) Two nipples and mixing unfamiliar pigs (TwoNipplesMix), 2) Four nipples and mixing unfamiliar pigs (FourNipplesMix), 3) Two nipples and no mixing pigs (TwoNippleNoMix), and 4) Known drinkers from the home pen and no mixing pigs (PenDrinkersNoMix). For statistical analyses, a variable subdividing the 24h stays into 8h periods was created (P1- 3). Data were analysed using mixed-model approaches including fixed effects of treatment, period, and their interaction, and random effects of journey and pen within journey. Almost all pigs in the model compartments were observed drinking at least once during the 24h irrespective of treatment (min-max: 93-100%). Water use per pig was highest in FourNipplesMix (4.5±1.0L/pig) and lowest for PenDrinkersNoMix (1.3±0.4L/pig). In PenDrinkersNoMix, less water was used, fewer drinking events observed, and drinking durations were shorter during P1 and P3 compared to other treatments ($P<0.05$). In NoMix treatments, aggression was reduced but there was no effect on water use or drinking behaviour. Also, no aggressive events were performed by or directed at a drinking pig in any treatment. In conclusion, the study's results suggest that weaner pigs can locate and activate 23mm press nipples despite no prior experience. Doubling the drinking nipples led to more water use, but this may reflect exploratory behaviour rather than a physiological need for water. Clarifying weaner pigs' need for water during transport requires both knowledge of intake and physiological status before, during, and after transport. Mixing did not influence drinking behaviour but did increase aggressive behaviour, which may affect pig welfare.

A43 SHORT TALK · THU 25 JUNE, 12:20–12:40 · BEVERIDGE (TRACK A)

Pasture access improves several aspects of dairy cattle welfare during the grazing season

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Driven by a need for increased milk yields and greater challenges in pasture management due to climate change, the proportion of dairy cows that are housed continuously - without access to pasture - is rising steadily. This is often seen as a risk for cow welfare. To assess the protective effect of pasture access on welfare, we used a selection of criteria from the Welfare Quality® protocol to assess 9 herds with and 9 herds without summer pasture access, during summer and winter. Statistical analysis was performed on the Welfare Quality criterion scores which vary from 0 (worst) to 100 (best) using separate linear models for the two seasons. Additionally, paired t-tests were used to assess the effect of season within each herd type. When assessed during the summer, herds with pasture access tended to score better than herds that remained housed for 'absence of hunger' (based on body condition, P=0.06, 91 vs. 76±5) and scored significantly better for 'comfort around resting' (which combines data on lying comfort and cleanliness, p=0.001, 59 vs. 43±3), 'absence of injuries' (which combines data on lameness, skin/coat abrasion and swellings, p<0.001, 78 vs. 45±5) and 'social behaviour' (based on agonistic interactions, p=0.011, 93 vs. 79±3). Conversely, they tended to score worse for 'absence of thirst' (p=0.087, 24 vs. 46±8), whereas no difference was found for 'positive emotional state' (p=0.186, 83 vs. 70±7). No significant differences were found between herds with and without summer pasture access when assessed during the winter (P>0.10). Furthermore, herds with seasonal pasture access had better scores when out grazing in summer than when housed in winter for 'comfort around resting' (mean difference [CI 95%]: 23 [10-36], p<0.01), 'absence of injuries' (14 [0-28], p=0.054) and 'social behaviour' (18 [7-30], p<0.01). In contrast, the herds housed year-round showed no improvement during summer and their 'absence of injuries' score was even reduced (-9 [-18- 0], p=0.045). The results support the idea that pasture access improves several aspects of dairy cattle welfare, but these improvements do not seem to carry over into the (middle of the) housing season. They also emphasize the need to take seasonal influences into account when assessing welfare, even in herds that do not graze.

Supplementation with galacto-oligosaccharides increases Bifidobacterium and brain serotonin without changing severe feather pecking in hens at peak lay

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Severe feather pecking (SFP) is a damaging social behaviour, causing feather damage, painful feather loss, or even skin injuries. In laying hens, SFP is highly prevalent and associated with dysregulation of the gut microbiota and neurotransmission. Some gut bacteria, like Bifidobacterium and Lactobacillus, are considered psychobiotics, capable of influencing social behaviour, through various pathways of the microbiota-gut-brain-axis. Prebiotic galacto- oligosaccharides (GOS) selectively promote Bifidobacterium, and to a lesser extent Lactobacillus growth, and may therefore modulate social behaviour. We hypothesized that GOS would modulate the microbiota composition, altering tryptophan metabolism, and serotonergic signalling underlying SFP. To investigate this, laying hens (N = 191) were housed in 12 groups comprised of hens genetically selected for or against SFP. From 29 to 32 weeks of age, hens were offered GOS (Nutrabiotic®,74% GOS w/w dry matter; Dairy Crest Ltd., United Kingdom) or plain water. Half of each water treatment group underwent social mixing to induce chronic, unpredictable stress. Video-recordings were used to observe SFP. Following the experiment, a small volume of blood was collected from each hen while 16 hens/group were briefly housed individually to collect cecal droppings for 16S rRNA sequencing. Finally, five hens per group were humanely killed to collect brain tissues to measure serotonin (ng/mg tissue). The effects of supplementation, stress, genotype and their interactions were analyzed using PROC GLIMMIX (SAS v9.4), with pen as a random effect. SFP was analyzed on the pen level with SFP during the preceding week as a covariate. Bodyweight was a covariate in the amino acid analysis. Beta diversity was analyzed using PERMANOVA. GOS supplementation increased Shannon diversity ($P < 0.01$), bacterial richness ($P < 0.01$), and beta diversity differed by hen genotype ($P < 0.01$) and supplementation ($P < 0.01$). Lactobacillus abundance did not differ while GOS increased Bifidobacterium ($P = 0.01$), consistent with the known bifidogenic effect of GOS. Blood tryptophan concentrations and the ratio of tryptophan to phenylalanine and tyrosine did not differ between treatments. Despite this, GOS was associated with increased serotonin concentrations in the rostral mesencephalon, its primary production site in the brain ($P = 0.03$). SFP did not differ between treatments. This highlights that although GOS supplementation may alter the microbiota-gut-brain axis, such changes may not always be sufficient to alter SFP during this life stage. Because microbiota instability and SFP prevalence increase with age, a later intervention may prove more effective, which will be explored in a follow-up study.

A45 SHORT TALK · THU 25 JUNE, 12:20–12:40 · BEVERIDGE (TRACK A)

Are dairy cows better off in organic farms? A systematic review

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One of the main aims of organic dairy farming is to ensure "higher welfare standards". To achieve this, the European Union and other jurisdictions in the world set out a comprehensive range of requirements for organic farms to meet, such as mandatory pasture access. However, whether these regulations do lead to better welfare in organic farms remains unclear. Regulations may fail to be applied on farms (although organic dairy farms are under frequent audits from certification bodies), may not lead to direct animal welfare benefits, or may have unintended negative consequences for animals. In addition, nothing prevents conventional dairy farmers from adopting higher welfare standards than the minimum regulations, making the distinction between conventional and organic not clear- cut. To explore whether organic regulations lead to better animal welfare, we conducted a systematic review of the available scientific literature comparing the welfare of dairy cows in organic and conventional farms. We focused on studies conducted in 3 English-speaking jurisdictions: the EU (including the UK), the USA, and Canada. A total of 97 papers were included. Most studies focused on health outcomes although measures of behaviour, husbandry, and management practices were also reported. Our results show that organic farming is often associated with favourable effects on leg health, behaviour, and overall welfare protocol scores. The relationship between farming system and antimicrobial use and resistance, husbandry and management practices, and prevalence of certain diseases and deficiencies was less clear, but organic farms tended to see more positive outcomes overall. Measures of parasite load, udder health, integument alterations, and calf health showed very mixed results across operation types. We also found considerable variation in outcomes both between and within studies, and while certain confounding factors such as pasture access were frequently identified, the factors driving this variation were not always clear. Overall, our findings suggest that the welfare of dairy cows may be improved in organic systems, although individual farm-level management factors appear to play an important role. Future research should extend considerations over other aspects of animal welfare such as naturalness and affective states and should compare the effects of prescriptive requirements (e.g. mandatory pasture access) with outcome-based measures (e.g. targets for conditions like lameness). From a regulatory perspective, raising minimum standards closer to those required in organic farming is likely to yield substantial welfare benefits, particularly for conventional farms with the poorest welfare outcomes.

A46 SHORT TALK · THU 25 JUNE, 12:20–12:40 · BEVERIDGE (TRACK A)

Nociception and reactivity to milking in dairy cows challenged with lipopolysaccharide-induced mastitis.

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Clinical mastitis is a widespread disease in dairy cattle compromising animal health and welfare, and causing significant production and economic losses. Increased udder sensitivity and reactivity during milking have been reported in cows with both naturally occurring and Escherichia coli lipopolysaccharide-induced (LPS) mastitis. In this study, we explored the behavioural response to milking and the evoked nociceptive response associated with experimental clinical mastitis and monitored cows for 5 days after infusion. Holstein cows (n=12, including 4 primiparous; 317±33 days in milk, mean±SD) received an intramammary infusion of E. coliLPS during morning milking on experimental day 0 in the rear quarter with the lowest somatic cell count, as the control group as part of a larger study evaluating potential mastitis treatment. Behaviour in the parlour (frequency of steps, lifts above pastern joint, hoof-to-belly kicks) and nociceptive responses, were recorded 2 to 3 times daily over the 8 experimental days. Here, we report measures taken in the afternoon on days -1 (baseline), 0 (expected peak response) and 5 (expected recovery) relative to the LPS infusion. Nociception was assessed using the Mechanical Nociceptive Threshold (MNT), which quantifies the force required to trigger a withdrawal response when applying increasing pressure at a set rate (2N/s); maximum force applied was set to 25N. Six recordings were taken 30s apart from each other, alternating between the healthy rear quarter and the one treated with LPS. Relative to the baseline, MNT was lower on the afternoon of the LPS injection both in the treated and the non-treated quarter (by -1.8±3.8N and -1.7±3.3N respectively, based on the average of the three measurements taken on each side). The threshold was higher on day 5 compared to day 0, again on both treated and non-treated quarters (by 6.2±5.7N and 5.3±6.1N respectively). Conversely, the sum of leg movements in the milking parlour increased by 22±26 between days -1 and 0, then lowered back between day 0 and day 5 by - 14±34. LPS-induced clinical mastitis causes increased sensitivity in the udder at least on the infusion day as noted by behavioural changes at milking and a lower threshold to respond to a nociceptive stimulus. Interestingly, this change in MNT was also observed in the untreated rear quarter, which has implications for researchers using it as a negative control. Further research is needed to understand how udder innervation may affect these responses.

A47 TALK · THU 25 JUNE, 14:00–14:20 · BEVERIDGE (TRACK A)

Progressive welfare inference: Using existing farm data to support continuous assessment of animal welfare in dairy cattle

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Assessing animal welfare in commercial systems remains a major practical challenge. According to Mellor's Five Domains model, animal welfare is a multi-domain construct encompassing nutrition, environment, health, behaviour, and the overall mental state. Although existing frameworks based on this model provide holistic assessment, their routine use in commercial dairy cattle settings is constrained by cost and labour, and consequently intermittent to rare in frequency. In contrast, modern Precision Livestock Farming (PLF) technologies continuously generate time-series data that are primarily used for productivity optimisation, fertility management and disease detection, yet remain underutilised for structured welfare assessment. As industry, regulatory, and societal expectations increasingly emphasise evidencing positive welfare outcomes, scalable approaches for gathering and interpreting existing farm data in a welfare context are needed. Such approaches are essential for supporting evidence-based inference about animals' lived experience, including their affective state. We present a framework for progressive welfare inference in which assessment resolution scales with available farm data. Developed through an Innovate UK funded Knowledge Transfer Partnership, the framework integrates an initial set of over fifteen research-backed indicators into a composite 'Sustainability and Stability Index' – Welfare Score (SaSI-W). Indicators are explicitly mapped to the Five Domains framework to support structured inference about overall welfare and its implications for mental state. Each indicator is scored on a 1 (optimal) to 5 (critical) scale and combined to generate continuous welfare profiles, operationalised through a prototype mobile decision-support application for farmers and veterinarians. The framework operates across multiple existing data tiers that are available at farm level. At the most basic level, monthly test-day milk-yield records enable coarse assessment of nutritional and health status. Where daily milk yield is available, milk production perturbations can be detected as indicators of underlying compromise. Where available, additional sensor such as accelerometers in 'wearable' systems or digital thermometers in rumen bolus 'implant' systems support higher-resolution inference using complementary signals including rumination time, activity patterns, lying behaviour, water intake, body temperature, somatic cell count, reproductive performance, and environmental conditions. Welfare is inferred from patterns of sustained multivariate deviations in these indicators, such as prolonged milk yield loss, reduced rumination, abrupt activity decline, or persistent physiological stress markers, supporting indirect inference about the animal's lived experience beyond snapshot assessments. These patterns represent disruptions across welfare domains and are associated with biological states linked to discomfort, stress, pain, or metabolic challenge, often preceding overt clinical signs. Pilot validation of such sensor signals has been carried out with trained welfare assessor observations. By integrating complementary indicators within the Five Domains framework, progressive welfare inference translates holistic welfare theory into continuous monitoring systems, enabling a scalable and increasingly high-fidelity assessment of animal welfare using infrastructure already present on commercial farms.

A48 TALK · THU 25 JUNE, 14:20–14:40 · BEVERIDGE (TRACK A)

Validity criteria for indicators of affective states at the individual level

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Despite the lack of consensus on the definition of animal welfare, affective states are widely recognised as central to how animals fare. Assessing affective states requires valid indicators, that is, behavioural, physiological, or neural measures that accurately reflect an individual's affective state. Here, I will describe a theoretical framework for evaluating the validity of affective state indicators developed by the EU COST Action AFFECT-EVO: An evolutionary view to understanding affective states across species (https://affect-evo.eu/). This framework accommodates the two main conceptualisations of affective states: the dimensional approach, which considers affective states as varying continuously along dimensions (with valence being the most relevant dimension for welfare assessment), and the discrete approach, which posits the existence of distinct affective states in animals (e.g., fear, disgust, pain). Based on operational definitions of dimensions and specific discrete emotions, we derived criteria that a measure (or combination of measures) must fulfil to be considered a valid indicator of affective state valence, fear, disgust or pain. These criteria were further refined to distinguish absolute from relative indicators—namely, indicators that allow one to detect the presence or absence of an affective state (e.g., whether an individual is fearful or not, or is in a negative affective state or not) versus those that signal changes in the intensity of an affective state (e.g., whether an individual is more fearful, or in a more negative state, in one situation compared to another). This framework can now be used to identify valid indicators of different affective states across species, ultimately supporting improvements in animal welfare.

A49 SHORT TALK · THU 25 JUNE, 14:40–15:00 · BEVERIDGE (TRACK A)

Deciphering the neural basis of individual differences in reward sensitivity in pigs

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Characterizing farmed animals as individuals with their own needs is of great societal concern and a scientific challenge. Understanding personality can provide insight into what different animals like and want. We developed a behavioural test (the BIBAGO) to assess individual differences in approach and avoidance tendencies in pigs, theorised to reflect personality differences at the neurocognitive level. This study aimed at validating the BIBAGO using brain imaging approaches, where we expected to find neural correlates of approach-avoidance conflicts (presupposedly regulated by the Behavioural Inhibition System: BIS) and reward sensitivity (presupposedly regulated by the Behavioural Activation System: BAS). Twenty piglets (5 weeks of age) underwent magnetic resonance imaging (MRI) sessions under general anaesthesia using a refined protocol optimised for BOLD (Blood- Oxygen-Level-Dependent) image acquisition. Each scanning session lasted approximately 60 min and the MRI protocol included structural and functional imaging. The BOLD functional imaging included "resting-state-functional MRI (rs-fMRI), which aimed to assess the general neuronal activity and functional connectivity within the pigs' brain. The pigs were later submitted to the BIBAGO test at 7 and 9 weeks of age. During this test, pigs were simultaneously confronted with a familiar reward (a treat ball) and a mild negative stimulus (i.e. waving a plastic bag for approximately 3 seconds) in a novel arena. Based on our previous study, we selected the duration of vocalization interruption after the introduction of the stimuli as a BIS indicator and the duration of interacting with the ball containing food treats as a BAS indicator. We applied a general linear model with the BIS and BAS behavioural indicators as predictors and the grey matter volumes (structural MRI) and functional connectivity correlation coefficients (rs-fMRI) as dependent variables. The structural MRI analyses showed that the behavioural indicator of BAS was associated with greater volume of brain structures involved in reward processing, such as the dorsal striatum (putamen, caudate) and the prefrontal and orbitofrontal cortex. This finding was confirmed by rs-fMRI analyses showing that these same cortico-stratial brain structures displayed more functional connectivity for high BAS scores. This study is the first to combine behavioural indicators of personality (BIBAGO) with measurements of brain structures and functional activity and connectivity using MRI in a non-human animal. This project represents a milestone for the neurosciences of personality in non-human animals and may contribute to more positive animal welfare research through a stronger focus on individual differences in reward sensitivity.

A50 SHORT TALK · THU 25 JUNE, 14:40–15:00 · BEVERIDGE (TRACK A)

Is welfare only a matter of the hedonic value of the environment?

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Animal welfare was initially conceived as the absence of suffering. More recently, the importance of positive affects was recognised. This suggests a continuum from very poor welfare, where suffering predominates, to very good welfare, where positive affects predominate, and that the intrinsic hedonic value of the environment, i.e. whether it is pleasant or not, determines the level of animal welfare on this continuum. We question whether environments with a high intrinsic hedonic value are enough to allow a high level of welfare. Indeed, pleasant but monotonous environments can induce boredom, which is likely to affect animals negatively. By contrast, complex environments, i.e. variable in place or time, stimulate information processing and encourage engagement. In addition, environments that limit behavioural expression or make behaviour inefficient can lead to frustration and apathy. By contrast, environments that give freedom of action and make these actions efficient encourage animals to exert their agency – through choices, control, problem solving, free action, or exploration. Thus, the possibility to act freely and efficiently also plays a role. We argue that to promote a high level of welfare in farmed or captive animals, one should ensure not only that the animals find the environment predominantly pleasant, but also that it offers sufficient complexity in space and time, and that animals can act freely and efficiently. However, a constant high level of hedonic value may result in a decrease in the hedonic value perceived by the animal. An overly complex environment or one that affords too wide a variety of actions may overwhelm animals. Therefore, the level of hedonism, complexity and possibility to act should be adapted according to animals' characteristics, e.g. species, age, physiological status, or individual traits. The ultimate objective would be to design environments that allow each individual to make choices and to express agency in a way conducive for its own welfare.

Intra- and inter-observer reliability of scoring pig tear staining using tVAS after observer training

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During the last decade, research on tear staining (TS) in pigs has provided evidence that it may be a potential new welfare indicator, with TS associated with certain stressors and other welfare issues. However, questions remain on how reliably tear stains can be scored. Existing scoring scales are discrete and compare the size of the stain relative to the eye. While in reality, TS size varies along a continuum. Further, our previous work with naïve assessors scoring with a continuous scale resulted in weak to moderate reliability. Therefore, this study assessed intra- and inter-observer reliability after training using a 0 to 100 mm continuous tagged Visual Analog Scale (tVAS) based on the discrete DeBoer-Marchant-Forde 6-point scale. The test was performed using videos of both left (L) and right (R) side stains on pigs taken before the scalding tank at a Dutch slaughterhouse. A trained person preselected pigs across the available scoring range, which were in turn scored by two other trained people. Their three scores were averaged as a silver standard. After selection, an intra- and inter-observer reliability testing video was produced with 44 pigs (28 unique pigs + 16 repeats), with a score range of 1 to 65 mm for L and 1 to 63 mm for R. Ten assessors with varying experience in scoring pig welfare were trained, via one in-person session with live pigs (familiarisation with scale and pig morphology) and five online exercises (step-wise scoring familiarisation and calibration). The intra- and inter-observer reliability of the assessor scores of the final test was analysed using intra-class correlation coefficients (ICC [95% CI]) for L and R stains separately and combined. Inter-observer reliability was deemed moderate to good across the L (0.706 [0.585, 0.822]), R (0.689 [0.565, 0.810]), and the overall dataset (0.694 [0.607, 0.780]). The general intra-observer reliability across raters (Eliasziw et al.'s 1994 model; no 95% CI) was good for L stains (ICC: 0.807), and moderate for R stains (ICC: 0.640) and overall (ICC: 0.724). This indicates that assessor-related variability remains important when drawing conclusions from TS results scored with a tVAS, even after training. Compared with naïve assessors, training and calibration do seem crucial for improving reliability. Improving training and the tVAS could potentially even further advance this. In conclusion, trained assessors can score TS using a continuous scale with moderate to good reliability.

Beyond good handling: behavioural evidence for the welfare value of training during anaesthesia induction in pigs

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Gentle handling is a cornerstone of refinement in laboratory animal science and is widely recognised for reducing fear and stress-related biological variability, thereby supporting welfare and research outcomes. Consistent, calm interactions between animals and personnel systematically shape behavioural responses to husbandry and experimental interventions, making handling practices a critical component of daily welfare management. Beyond that, positive reinforcement-based laboratory animal training has emerged as an additional refinement strategy, aiming to prepare animals to voluntarily cooperate during potentially aversive procedures. Both good handling and positive reinforcement training are widely promoted as best practice. However, it remains unclear whether refined handling alone can sufficiently mitigate negative affect during aversive procedures such as anaesthesia induction, or whether positive reinforcement training confers measurable additional welfare benefits. This study evaluated the effect of refined handling and structured training in a porcine surgical model, focusing on anaesthesia induction as a context of acute procedural challenge. Twenty-eight female German Landrace pigs received habituation-based handling characterised by consistent, gentle human interaction. Control animals received handling only, whereas experimental animals additionally underwent systematic positive reinforcement training to promote voluntary cooperation during handling and intramuscular injections. Behaviour during anaesthesia induction was analysed using predefined ethograms and composite behavioural scores based on video-recorded data. As the subjective mental states underlying animal welfare cannot be accessed directly, behavioural indicators were used to infer affective responses during induction, consistent with the use of valid indicator measures in animal welfare science. Measures included immediate responses to needle insertion, behavioural time budgets prior to recumbency, behavioural responses during drug administration, and temporal parameters of induction. Although all animals were managed using refined handling techniques, trained pigs showed significantly fewer startle responses at needle insertion and lower behavioural agitation scores during drug application, indicating reduced negative affect. Trained animals also reached recumbency earlier following drug administration, suggesting a calmer induction process. These findings demonstrate that good handling is fundamental for animal welfare, with positive reinforcement training offering further welfare gains during highly invasive or acutely aversive procedures. In such situations, training provides additional welfare benefits by enhancing predictability and perceived control, with positive implications for animals, experimenters, and procedural consistency. Behavioural indicators derived from systematic video analysis proved particularly sensitive for detecting these differences, supporting their valid use within comprehensive welfare assessment frameworks. Together, these results support refinement strategies that benefit both animal welfare and scientific reproducibility.

A new textbook on construct validation of potential indicators of affective state

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The latest book to be published in the Science for Animal Welfare series, Assessing Animal Welfare – a Guide to the Valid Use of Indicators of Affective States, is a textbook for use in animal welfare science teaching that promotes the use of well-validated indicators in animal welfare research. Two introductory chapters set the scene, followed by eleven chapters on specific indicators and their validity as proxy measures for affective states: the subjective positive and negative experiences that underpin animal welfare, and that span emotions (plus homeostatic feelings such as hunger or pain) moods, longer-term affective disorders, and cumulative affective experience across a lifetime. The book's emphasis is on construct validation: the logical process of determining whether a measurable variable (e.g. an aspect of behaviour, physiology, or cognition) accurately, truthfully reflects a given underlying affective state. Five complementary tests (drawn from veterinary and biomedical research as well as welfare science) form the foundation of sound validation. Test 1 examines whether the indicator tracks self-reported affect in humans, while Tests 2–5 focus on animals themselves, assessing whether indicators change in response to preferred or avoided stimuli, ancestrally fitness-relevant situations or affect- modulating drugs, and whether they correlate with other well-validated indicators. Each test relies on different assumptions, making them complementary. They may also reveal different strengths or weaknesses in an indicator; important because validation is not only about confirming accuracy, but also about understanding two other key properties of indicators: their responsiveness and their selectivity. A responsive indicator changes proportionally with variations in affective intensity. Poor responsiveness can therefore lead to false nulls—instances where real affective changes go undetected. A selective indicator responds uniquely to the target state. Poor selectivity can therefore create false leads, where changes in an indicator are mistakenly attributed to a specific affective state, when instead they reflect arousal, unrelated biological factors, or entirely different affective states. The book finishes with a chapter on indicator selection and future perspectives. By integrating validation tests with an understanding of responsiveness and selectivity, welfare scientists can choose indicators (or strategic combinations) that best suit their specific research aims. Although no indicator is perfect, thoughtful construct validation should enable more accurate, transparent, and scientifically robust assessments of animal affect—an essential foundation for improving welfare in ways that matter to animals, and for ensuring reliable, replicable research. Mason GJ, Nielsen BL & Mendl MT, eds. (2026) Assessing Animal Welfare – a Guide to the Valid Use of Indicators of Affective States. Science for Animal Welfare Series; Wiley- Blackwell, UK.

B1 TALK · TUE 23 JUNE, 14:00–14:20 · CHANCELLOR'S (TRACK B)

Stakes and states: what can risk-sensitive foraging tell us about affect in rats?

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Understanding the adaptive function of affect greatly facilitates its measurement and hence the measurement of animal welfare. A key proposed function of affect is the optimisation of decision-making in response to internal and external conditions. Decisions about risky options are known to be sensitive to such conditions across species. We investigated the relationship between affect and decision-making in rats using a novel risk-sensitive foraging bandit task. In this task, thirty-two rats (16 male, 16 female) completed 33 sessions choosing between three ports in a Raspberry Pi–controlled operant box: a safe port that always delivered milkshake, a risky port that delivered milkshake on 50% of visits, and a no-reward port that never delivered milkshake. Milkshake volumes at the safe and risky ports followed the same random walk (a positive or negative random increment applied on each trial), but with the latter scaled by twice that of the former (to equalise mean rewards). We manipulated affective state by Enrichment Reduction (ER). To test the hypothesis that more negative affective states influence risk-sensitivity, behavioural flexibility, and motivation, we combined the bandit task with additional manipulations in two separate ER periods: within-task presence of a positive conditioned stimulus (PIT) and switching the location of the safe and risky port (R). We additionally pre- fed rats (PR) and altered within-task reward volume (V) outside ER periods to further examine motivational effects. Within each manipulation period, there was randomisation and counterbalancing of treatment or treatment order. We analysed choice behaviour ('safe', 'risky' or 'no reward'), choice persistence ('stick' or 'switch'), and trial number across manipulation periods. Analyses were conducted blinded to ER allocation, and remain blinded as analyses are not complete. We found that ER directly influenced choice behaviour during the PIT manipulation and interacted with R to influence choice persistence during R, with no significant change in trial number. This suggests that affective state alters both risk sensitivity and behavioural flexibility in the bandit task. The PIT and V manipulations also significantly altered choice behaviour, while PF did not. However, the PIT and PF manipulations significantly altered trial number. This indicates that these manipulations (PF & PIT) altered motivation, and PIT had additional effects on risk-sensitivity. Rats also showed strong individual differences in decision-making. Our novel variant of the bandit task may be a useful tool for welfare assessment, but careful consideration needs to be given to individual differences.

B2 TALK · TUE 23 JUNE, 14:20–14:40 · CHANCELLOR'S (TRACK B)

Does N-acetylcysteine treat stereotypies in laboratory mice?

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Abnormal repetitive behaviors are a persistent concern for the welfare of captive animals, yet we have little understanding of their developmental physiology, and lack effective treatment options. Stereotypies are the most common form of abnormal repetitive behavior and are characterized by unvarying and idiosyncratic repetitive behavioral patterns with seemingly no goal or function. Historically, ethological research has focused on the motivation for these behaviors, such as attempts at escape and coping mechanisms for life in captivity. In contrast, our research group has used a neuroethological framework to focus on stereotypies as a pathology. We recently demonstrated that the severity of stereotypies in laboratory mice is significantly correlated with traditional blood-based biomarkers of oxidative stress, and also novel proteomic biomarkers. Identifying oxidative stress as a potential causal mechanism raises the possibility of developing a novel targeted intervention for stereotypy. In particular, N-acetylcysteine (NAC) has successfully treated other abnormal repetitive behaviors in both humans and mice. NAC is a precursor to glutathione, the main antioxidant in the brain. If the correlation between stereotypies and oxidative stress is indeed causal, we predict that NAC should treat stereotypies. To test this, we ran a 2x2x2 factorial experiment in which female or male pairs of adult C57BL/6 mice (N = 23 cages) were given either standard drinking water or water supplemented with NAC and housed in cages with or without additional environmental enrichment (different bedding material, climbing/hiding structures, and gnawing materials) for eight weeks. Given the known impacts of housing conditions on prevalence of stereotypies, the environmental enrichment condition was used as a positive control, whereas the conventional cage with standard water served as a negative control. Our primary outcome measure is the proportion of active time spent displaying stereotypies, which is currently being analyzed in conjunction with several biomarkers of oxidative stress: urine total antioxidant capacity, blood glutathione levels, and blood proteomic biomarkers to assess oxidative stress biology. Data analysis is ongoing, but we predict that NAC treatment will reduce stereotypies by aiding in the production of antioxidants, as evidenced by the aforementioned biomarkers. Our study will broaden understanding of the underlying effects of oxidative stress on stereotypies, guide selection of dietary and/or environmental intervention strategies, and assess whether proteomic biomarkers can serve as a novel welfare indicator. These advances, in turn, will help improve the welfare of laboratory mice and other captive animals.

B3 TALK · TUE 23 JUNE, 14:40–15:00 · CHANCELLOR'S (TRACK B)

Rabbit ear disease and welfare: Identifying conformation-related risks and indicators of hidden disease

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Rabbit ear disease can be common, painful and debilitating, yet the conformational risk factors and clinical relevance of aural abnormalities are insufficiently understood. This study first examined conformational risk factors for aural pathology in pedigree rabbits, before assessing clinical and behavioural indicators. A total of 435 rabbits were examined at British Rabbit Council shows and studs, undergoing detailed physical and otoscopic assessment. Behavioural reactivity to ear examination was also recorded. Generalised estimating equations evaluated associations between ear conformation, head shape, and the presence of ear canal stenosis (narrowing), redness and erythema, crusts (e.g. scabs), and discharge. Lop-eared rabbits had increased scores and odds for 9/11 ear abnormalities tested compared to erect-eared rabbits, including red or erythematous ear canal colour ($P < 0.001$), ear canal stenosis ($P < 0.001$), multiple types of aural discharge (all $P \leq 0.035$), and behavioural reactivity to ear examination ($P = 0.050$). Head shape also contributed, but in conflicting directions: more brachycephalic rabbits had higher scores for ear canal stenosis ($P = 0.008$), whilst more dolichocephalic rabbits had higher odds of diverticulum crusts, potentially resulting from ear-scratching ($P = 0.013$). We then assessed the diagnostic and welfare relevance of commonly observed excess cerumen and stenosis; 376 of the rabbits (86.44 %) had flaky discharge in the upper canal, and 183 (42.07 %) displayed a degree of ear canal stenosis. Welfare-relevant abnormalities—including diverticulum crusts, canal erythema, and red or wet discharge— were consistently associated with both stenosis and excess cerumen (all $p \leq 0.035$). Behavioural reactivity showed similar patterns, with 6/8 reactivity measures associated with stenosis, and 7/8 with excess cerumen. Rabbits who reared up during examination had markedly higher odds of diverticulum crusts ($p=0.004$), ear canal erythema ($p=0.015$), and upper-canal crusts/red discharge ($p=0.036$). Rabbits who moved their body away had similarly increased odds of crusts in the diverticulum ($p<0.001$) and crusts or red discharge in the upper canal ($p=0.003$). Also, rabbits who displayed any reactivity ($p=0.003$) or shook their heads briefly ($p=0.037$) had higher odds of crusts or red discharge in the upper canal. These findings suggest that resistance behaviours provide useful, non-invasive indicators of possible aural pain and pathology. Overall, this study demonstrates that both conformation and seemingly minor otoscopic findings have important implications for rabbit ear health and welfare. Lop-eared phenotypes are at heightened risk of pathology, while stenosis, excess cerumen, and examination reactivity serve as valuable indicators of disease.

B4 SHORT TALK · TUE 23 JUNE, 15:00–15:20 · CHANCELLOR'S (TRACK B)

Opening the cage on pet rat introductions

Caitlin Walburn, Michael Mendl, Emily Blackwell

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Introduction: Rats are a highly social species, with a variety of studies describing the social behaviours of wild and laboratory rats. In contrast, the social environments of pet rats have received limited scientific attention. Due to their relatively short lifespans, owners are often left with a single surviving rat and choose to introduce unfamiliar conspecifics to reduce the potential welfare impacts of social isolation. However, there is no evidence-based guidance regarding pet rat introductions, and anecdotal accounts indicate that such introductions can be challenging, raising potential welfare concerns. Methods: To better understand how owners introduce pet rats, an online questionnaire, containing closed and open questions, was used to collect information on rat introductions between unfamiliar groups. Owners reported the reason for introductions, methods used and perceived success. Descriptive statistics and chi-squared analyses were applied to quantitative data, while free-text responses were analysed using reflective thematic analysis. Results: Questionnaires were completed by 245 owners. Owners most commonly introduced rats to avoid housing one rat on its own. Over half of owners (n=153; 62.4%) used a method where unfamiliar rats are placed inside a confined space ('carrier method'), with most introductions taking between 25 hours and one week (n=125; 51.0%). Owners defined successful introductions by social integration, positive social interactions, and perceived group stability. Unsuccessful introductions were identified by overt aggression (e.g. fighting) and a lack of mixing. The majority of owners reported that their introductions were successful (n=220; 89.8%) and that all of the rats were housed in one cage at the end of the introduction (n=226; 92.2%), however many reported problematic behaviours during the introduction process. Reflective thematic analysis revealed that problematic behaviours were primarily aggressive behaviour. No significant association was found when comparing the presence of problematic behaviours to different introduction methods, but the presence of problematic behaviours was significantly associated with the success rating of the introduction ($\chi 2$ = 13.419, df = 1, p-value = 0.0002491). Problematic behaviours were present in all unsuccessful introductions and remained common even among successful introductions. Discussion: It therefore appears that some owners accept problematic behaviours as a normal part of the introduction process, raising a potential welfare concern. It is therefore important to investigate whether problematic behaviours are an acute episode within the introduction process or more long lasting and detrimental to longer term welfare.

B5 SHORT TALK · TUE 23 JUNE, 15:00–15:20 · CHANCELLOR'S (TRACK B)

Improving welfare via a strategic approach to Replacement: why and how.

Celean Camp, Juliet Dukes, Amy Beale

Replacing Animal Research, Nottingham, United Kingdom

At its most basic level, the best welfare for laboratory animals is not to be used in research. Embedding an Institutional 3Rs Strategy with an upfront commitment to Replacement is essential for delivering optimal welfare outcomes and sustaining an effective Culture of Care. A clear strategic focus on Replacement ensures that non-animal research is recognised as scientifically essential—not supplementary—and that opportunities to avoid animal use are proactively identified, supported, and prioritised across all research activities. A formal institutional strategy centred on Replacement visibly demonstrates this commitment to staff, students, funders, and the wider public and helps ensure that the Culture of Care expectation to apply the 3Rs—starting with Replacement—is consistently met. Replacement has always been the central pillar of the 3Rs within ASPA and consequently an issue of legal compliance for establishments. This is further emphasised by the government's recently published Replacing Animals in Science strategy, as well as the national and global direction of travel. Additionally, public and funder expectations increasingly emphasise that researchers and institutions must fully explore and justify alternatives before deciding whether to use animals. Integrating a Replacement focused 3Rs strategy into research governance ensures that the principle of actively seeking nonanimal approaches is embedded, systematic, and continuously reinforced and that all those working within the regulatory frameworks have the knowledge, skills and institutional support to meet the Replacement obligations of their role or remit. We will present practical steps that conference delegates can take to open strategic conversations about Replacement at their establishments and ultimately support the development of an effective institutional strategic approach to Replacement.

B6 SHORT TALK · TUE 23 JUNE, 15:00–15:20 · CHANCELLOR'S (TRACK B)

Animal Welfare Science in Veterinary Education: A mixed-method study of curriculum frameworks and teaching practices in Austria, Germany and Switzerland

Carolin Breitenbach

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Animal welfare science (AWS) has become an essential component of veterinary education, preparing future veterinarians for their central role in animal welfare. However, little systematic evidence exists on how AWS is embedded within veterinary curricula in the DACH region (Austria, Germany, and Switzerland). This study aimed to map the structure, content, and implementation of AWS teaching across all veterinary schools in these countries to provide a baseline for future development. A mixed-method design was used, combining structured curriculum analysis with a semi- structured survey of AWS lecturers. Curricular data were collected from publicly available course documents, and survey questions addressed institutional structures, teaching content, resources, and perceived challenges and innovations. AWS was represented in all curricula via dedicated core subjects, integration into other modules, and elective or extracurricular courses. Commonly taught themes included welfare assessment, ethological and physiological principles, and animal housing and husbandry. By contrast, theoretical foundations of welfare science, as well as training in applied welfare improvement strategies, were less systematically embedded. Lecturers reported strong student interest but noted that scheduling constraints, limited staffing, and insufficient opportunities for interactive or practical teaching reduced participation. Many innovative approaches depend on individual lecturers' initiative and lack coherent structural integration. The study provides the first comprehensive mapping of AWS education at veterinary schools in the DACH region. The findings highlight the need to strengthen the theoretical scientific basis as well as implementation strategies for animal welfare to consolidate the profile of AWS as an applied science. At the same time, they reveal clear potential in existing teaching approaches and initiatives. Greater institutional support and increased exchange among lecturers could foster a more integrated and visible AWS curriculum, thereby strengthening the subject's profile and better preparing future veterinarians as technically competent advocates for animal welfare. Keywords: Animal welfare science education, veterinary curriculum, DACH, animal welfare science

B7 TALK · TUE 23 JUNE, 16:10–16:30 · CHANCELLOR'S (TRACK B)

Turning science into enforceable law: the case for embedding indicators in new and revised EU legislation

Elena Nalon, Helen Lambert, Robyn Sahota

Eurogroup for Animals, Brussels, Belgium

The European Union is currently navigating a critical legislative window with the comprehensive revision of its animal welfare standards, presenting a unique opportunity to move from "assumed welfare" based on inputs to "lived welfare" based on measurable outcomes. While animal welfare science has long advocated for the use of indicators, we are now making the case that these tools must be embedded directly into the new regulatory architecture to ensure the revised laws are actually enforceable. For broiler chickens, breed selection and stocking density emerge as powerful policy indicators; scientific evidence demonstrates that fast-growing breeds are irrevocably linked to negative outcomes such as lameness and cardiovascular disease, while high stocking densities exacerbate heat stress and painful contact dermatitis. In the aquaculture sector, a robust framework requires a triad of indicators: dissolved oxygen stability acts as a vital preventative resource-based signal, while animal-based measures like external fin damage and mortality rates capture chronic and retrospective system-level failures. Complementing these on-farm metrics, the slaughterhouse provides a high-volume data node. As demonstrated by the aWISH project, automated sensors can standardise the collection of animal-based indicators such as pulmonary lesions and stress vocalisations for pigs and poultry. To enact this transition, the European Commission has several potential legal pathways, such as referencing animal- based indicators (ABIs) in species-specific legislation to support risk-based official controls; linking verifiable welfare performance to Common Agricultural Policy (CAP) conditionality and payments; and establishing a central EU-level data governance framework to ensure cross-border comparability. However, the case for this transition is still being won; indicators are tools for verification, not standalone solutions. They cannot "fix" systems that are inherently incompatible with good welfare, and they are only effective when embedded in an ambitious legal framework that first phases out poor systems, such as cages or breeds with compromised biological health. This presentation concludes that by anchoring scientifically validated indicators within the revised EU law, the Union can finally create a cohesive system where data actively drives meaningful welfare reform.

B8 TALK · TUE 23 JUNE, 16:30–16:50 · CHANCELLOR'S (TRACK B)

AI governance and innovation for animal welfare: Veterinary, professional and ethical aspects in animal agriculture

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Artificial Intelligence (AI) will play an outsized role in the future in strengthening farm animal practices. It promises to improve animal welfare and sustainability and promote healthier human-animal-environment relationships. As veterinarians and other animal agriculture professionals develop specialized competencies to operate in an AI-dominant world, they must also develop fluency in AI governance and ethics. However, AI governance and responsible innovation principles for animal welfare is still nascent. The use of AI does not resolve the problem of conceptualizing animal welfare; a philosophical problem hinging on a normative judgment about what matters to animals. Also, AI raises a number of practical and ethical challenges for animal agriculture. For example, professional judgment will be needed to evaluate where AI is applicable and guarantee data quality and reliability, and to manage data and minimize errors in AI-driven decision-making. The use of Large-Language- Models (LLMs), precision livestock farming (PLF), and digital technologies like computer vision systems for veterinary care or on-farm recommendations will require a 'veterinarian- in-the-loop' for analysis and interpretation and a strong relationship with farmers. AI systems can be opaque, and the lack of transparency or rationale can decrease trust in AI in critical decision-making processes. Data collected on animals and farms also raises concerns about privacy and ownership. More importantly, AI systems may not always be inclusive of animals' perspectives, and 'smart' prototypes, processes and products can fail if veterinarians are not part of their development. To encourage further discussion and development of AI governance and innovation for animal welfare we propose the ARETE framework: Agency, Responsibility, Engagement, Transparency and Trust, Empowerment. The framework draws on principles of Responsible Research and Innovation (RRI). Through a case study, we discuss real-world opportunities and challenges associated with using AI that shape how animal welfare is balanced against ethical considerations, training needs and barriers to adoption. We explore the roles that AI can play in animal welfare and highlight how AI development can benefit from veterinarians' expertise to improve health, welfare, disease surveillance, increase productivity and growth rates, monitor behavior, aid in risk assessment and management, and address One Health and sustainability challenges. Governance principles are important since AI and PLF can obscure close attention to animals' welfare, and some AI monitoring devices may induce distress and also hinder how animals communicate and manifest their preferences.

A scientific framework for navigating horse welfare science for the next 100 years?

Karen Luke[1], Jo Hockenhull[2], Tamzin Furtado[3], Naomi Ainley[4], Meta Osborne[5]

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Is it time for a revolution in animal welfare science? Animal welfare science has seen remarkable achievements since its emergence as a distinct field of study, not least the legal recognition of animal sentience in a growing number of countries. Despite these achievements and the exponential growth in animal welfare publications, some would argue the translation of animal welfare science into practice has been too slow, especially for horses used for sport, leisure, and therapy. While scientists recognise the need for strategies that go beyond providing information and raising awareness, there is scant research specific to animal welfare to accelerate the translation of science into practice. In its 100 year history, animal welfare science has relied heavily on traditional reductionist science which assumes the world can be studied by breaking it up into small, static pieces; however, over- reliance on one paradigm unnecessarily limits how problems are framed and the range of solutions deemed possible. Moreover, there is growing recognition of the need for diverse scientific approaches, such as systems thinking, to address complex problems like animal welfare. Addressing these challenges, this paper recasts the influential systems thinking framework, the Meadows 12, for animal welfare science, focusing on the horse industry. The resulting framework, the Horse Welfare 12 (HW12), which can be adapted to any species or animal-use industry, identifies places to intervene in a system to facilitate better animal welfare, ranking them from least effective (parameters) to most effective (paradigms). The HW12 offers researchers another scientific approach with which to approach animal welfare challenges that is accessible and practical. Unlike traditional science which focuses on a very narrow view of animal welfare problems, the HW12 offers a 'big picture' vantage point that can reveal previously unrecognised relationships and intervention points. Examples are provided to demonstrate how the HW12 allows researchers, practitioners and stakeholders to: (1) determine the strength of leverage point(s), (2) identify new leverage points, (3) develop multi-level interventions that take advantage of synergies, and (4) more accurately predict the likely effectiveness of proposed projects and interventions. In addition to providing another perspective and practical research tool, the HW12 is a comprehensive framework that can unite diverse scientific approaches and provides a map for creating meaningful change for animals by accelerating the translation of science into practice, arguably the missing piece of the animal welfare science puzzle, which could advance animal welfare science for the next 100 years.

B10 SHORT TALK · TUE 23 JUNE, 17:10–17:30 · CHANCELLOR'S (TRACK B)

Grounded in science: The value of animal welfare science from an end- user perspective

Kate Fletcher, Jo Hockenhull

The Donkey Sanctuary, Sidmouth, Devon, United Kingdom

It can be easy to get disillusioned as an animal welfare scientist, chipping away at small pieces of the puzzle and rarely getting to see the positive impacts of your labour on animal lives. But this research is essential. Animal welfare science is a dynamic body of knowledge fed by a broad spectrum of research projects from across the globe. Single or amalgamated findings can be applied directly to improve animal welfare at ground-level by informing husbandry changes, and indirectly by evidencing calls for systemic change. Application of findings may improve the life of an individual animal or the lives of many tens of thousands of animals depending on uptake, incorporation into policy and legislation, and adoption into common practice. Like many animal welfare non-governmental organisations (NGOs), The Donkey Sanctuary (TDS) began life as a small charitable endeavour providing care for donkeys in need and a home for the remainder of their lives. Today TDS is an international NGO supporting donkeys and the people who care for and rely on them across the globe. Animal welfare science has been critical to this development, informing our practices of care, our positioning and how we advocate for donkeys in campaigns and advocacy. As international animal welfare NGOs increasingly move away from transient reactive models of practice where western staff are flown into areas to provide veterinary treatments on a short-term basis, towards more proactive, self-sustaining approaches grounded in changing human behaviour, they are ever more reliant on a robust scientific evidence base upon which to build their strategies and practices. Animal welfare science is used across organisational teams from those working within local communities to directly facilitate welfare improvement, to the directorate, informing the direction and detail of advocacy, education, communication and research activities. Animal welfare science has strengthened our work to improve the lives of donkeys and their hybrids. It provides robust evidence that animal lives matter and supports all aspects of TDS activity. As we mark the centenary of UFAW, we would like to acknowledge the immense contribution of those conducting science in the service of animal welfare to NGO endeavours, and say thank you to all.

B11 SHORT TALK · TUE 23 JUNE, 17:10–17:30 · CHANCELLOR'S (TRACK B)

"Somewhat scientific": UK undergraduate views of animal welfare as a concept and scientific discipline

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The study of animal welfare is essential for undergraduate students seeking to pursue careers with animals, but pedagogical research on this topic is limited. While animal welfare is an accepted, though relatively new, scientific field of inquiry, students' views on animal welfare are under-explored. Here we share findings from a mixed-methods action research project at Harper Adams University (HAU), United Kingdom. Undergraduate student questionnaire responses (n=123), analysed through inferential statistics, exploratory factor analysis, and a constructionist thematic analysis, revealed key attitudinal constructs capturing how students conceived of animal welfare as a concept and a discipline. Students overwhelmingly defined animal welfare in terms of physical health, but rural (vs. urban) students more often perceived naturalness as important to notions of good welfare. Student attitudes also revealed deeper epistemological assumptions on the meaning of 'science,' such that natural sciences were seen as trustworthy and some students invoked the scientific method and other biological fields (e.g. neurobiology) to justify animal welfare as a legitimate science. For others, ethical or sociological implications of animal welfare, which may be addressed by social science inquiry, meant that animal welfare was also dismissed as 'unscientific.' Based on these findings, we offer recommendations for the field, including: research on educator attitudes, strategies for engaging with dissatisfied student groups, and integration of the social sciences within animal welfare training.

Consumer demand, intervention efficacy and potential canine welfare implications of the puppy trade: Evidence from temporal and linguistic patterns in classified online adverts

Katharine Eloise Ross[1], Stella Mazeri[1], Verity Bowell[2], Kirsten M. McMillan[3]

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The UK puppy trade's move online, enabled by a paucity of legislative reform, has facilitated the evolution of an incipient, anonymous and profit-driven trade. Stakeholders routinely identify multi-level fraud, criminality and canine welfare issues within a market whilst an annual~1 million untraceable puppies are supplied to consumers exhibiting high-risk, trend- driven buying behaviour. This study investigated breed-focused patterns in adverts posted by puppy traders on two popular websites between 2017-2024, yielding insights into the scale of the supply market, the consumer culture that sustains it, and the efficacy of historic intervention/legislation. Web-scraped adverts were defined by: URL, seller ID, advertisement ID, estimated litter size, verbose description, date posted, and breed. Observational iteration allowed development of programmatic data-cleaning and quality-assurance pipelines excluding non-unique or ambiguous entries leaving 1,655,512 unique adverts advertising 881 purebred, designer and non-designer crossbreeds (breeds). Statistical methodology included exploratory, descriptive and inferential as appropriate. Overall, ~70 % of all adverts featured only 30 breeds. Brachycephalic breeds represented >37% of all adverts, declining acutely from late 2019 (~ -12%), coinciding with a series of brachycephalic-focused interventions/educational campaigns. Supervised analysis showed this decline was led almost entirely by Pugs and Chihuahuas, while French Bulldogs maintained a majority share (~10%) of the market throughout and observed a coinciding increase in market proportion of mesocephalic breeds at high-risk of chondrodystrophy/spinal disease (e.g. Dachshunds) (~ +47%), displaying a potential 'risk displacement' phenomenon, wherein popularity for breeds at risk of one disorder were replaced by breeds at risk of another. The XL Bully Ban coincided with a decrease in 'XL' bulldog adverts but preceded the emergence of miniaturised bull-types including 'micro', 'exotic' and 'pocket' bull-breed ads, whilst term frequency analysis for 'guarding', 'protection', 'intimidation' and 'bite-force' terminology displayed increased usage by advertisers. Seasonal spikes in adverts were observed for Arctic Breeds from October-December, whilst working breed adverts increased April-June. Price elasticity suggested consumer willingness- to-pay premiums for breeds categorised as high-risk for conformation/inherited disorder, with breeds listed as UK Kennel Club Breed Watch Category 3 advertised at prices, on average,~£500 higher than those at moderate risk (Category 2) and ~£900 higher than non- listed breeds. Classified adverts for puppies provided a valuable proxy model for consumer preference and market dynamics, corroborating existing evidence of the significant shortcomings of puppy trade legislation and historic inefficacy of intervention allowing canine welfare issues to persist and proliferate, and providing crucial evidence for future improvements to canine welfare.

B13 SHORT TALK · TUE 23 JUNE, 17:10–17:30 · CHANCELLOR'S (TRACK B)

When dogs play, they sound different: distinctive acoustic features of Play-Panting in dogs.

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With rising awareness of positive animal welfare, the study of positive animal emotions has received increasing attention. Consequently, identifying reliable indicators of positive inner states remains a key area of research. Because animals cannot provide self-reports, researchers must assess emotions using alternative methods. Among these, the study of vocalizations, which convey information about an individual's inner state, has proved particularly valuable. Indeed, several species have been found to emit calls during playful and affiliative interactions, which are considered homologous to human laughter and an indicator of a positive inner state. Dogs (Canis familiaris) display a particular vocalization during play, the so-called play-pant, which may represent the same type of call. Despite its potential, dogs' play-panting remains poorly understood. One previous study showed that play-panting differs acoustically from post-exercise-panting; however, it remains unclear whether play-panting also differs from panting produced in other emotionally loaded contexts. The present study aimed to acoustically compare panting produced by dogs across contexts of varying emotional valence. In line with previous findings, we hypothesized that play-pants represent a domain-specific, positively valenced vocalization produced during playful interactions. 27 adult family dogs were exposed to five contexts: one neutral (exploration), two positive (play and greeting), and two negative (separation from the owner (distress) and threatening stranger (agonistic). We analyzed several acoustic parameters, including pitch (center of gravity), noisiness (Wiener entropy), and formant dispersion (dF). Preliminary results revealed that play-panting differed acoustically from pants from the other contexts. Pants from playful interactions had the highest center of gravity and were the noisiest; those from negative and greeting contexts had the lowest center of gravity and were the least noisy, and neutral pants fell in between. These results are consistent with Morton's structural-motivational rules. The formant dispersion of play-pants, together with neutral pants, was the highest, which might suggest that dogs were communicating a smaller apparent body size. These findings support the hypothesis that pants produced during playful interactions differ acoustically from those in other emotional contexts, including positive ones. Play-panting may therefore represent a context-specific acoustic indicator of positive emotional states in dogs, with meaningful implications for assessing and promoting canine welfare.

Knowledge isn't power? Awareness and experience of intervertebral disc disease does little to deter acquisition and re-acquisition of Dachshunds and French Bulldogs

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Welfare-compromising health disorders associated with extreme conformation in dogs are now underpinned by extensive scientific evidence and recognised as one of the biggest companion animal welfare concerns by veterinary and animal welfare organisations internationally. Despite this, demand for innately unhealthy breeds remains persistently high. Ownership of French Bulldogs and Dachshunds has surged internationally over the past decade despite their well-evidenced predisposition to debilitating intervertebral disc disease (IVDD), and the extremely high allele frequency of the CFA12-FGF4 retrogene in both breeds, which is strongly associated with chondrodystrophic (short-limbed) conformation and IVDD- susceptibility. This study explored the influence of knowledge, perceptions and experience of IVDD in their breed upon acquisition/re-acquisition decision-making of French Bulldog and Dachshund owners. A cross-sectional survey of UK French Bulldog and Dachshund owners was conducted between 21/02/25-3/3/25. Owners were recruited via online snowball sampling, including breed-specific forums and social media groups. The survey explored owner awareness of IVDD-risk in their breed, experiences of IVDD in their own dog(s), and (re)acquisition decision-making. Valid responses were received from n=3931 owners (n=2705 Dachshunds, n=1226 French Bulldogs). Dachshund owners (84.9%) were significantly more likely to be aware of their breed's IVDD predisposition pre-purchase than French Bulldog owners (46.0%) ($p<0.001$). Among owners aware of IVDD risk pre-purchase, similarly high proportions of Dachshund owners (72.4%, n=1490) and French Bulldog owners (72.5%, n=501) reported that this knowledge did not influence their breed choice ($p=0.911$). French Bulldog owners estimated 50.0% (IQR:35.0- 65.0%) of their breed was affected by IVDD, compared with 25.0% (IQR:15.0-45.0%) of the general dog population affected. This was significantly higher than Dachshund owners who estimated 45.0% of their breed (IQR:30.0-60.0%) vs. 25.0% (IQR:10.0-35.0%) of the general dog population (n=3555, $p<0.001$). Significantly fewer Dachshund owners (31.1%) had owned an IVDD-affected dog than French Bulldog owners (44.1%; $p<0.001$). Following owning an IVDD-affected dog (n=1078), half (48.4%) of Dachshund owners and one-third (33.2%) of French Bulldog owners wished to re-acquire their breed. Despite major welfare impacts from IVDD, knowledge and even direct experience of this condition does not deter many owners from acquiring or re-acquiring these high-risk breeds. IVDD appears to be widely accepted as a breed-typical trait, with owners even over- estimating the risk but still desiring ownership. This cognitive dissonance should be considered in future attempts to reduce breed ownership, as education alone is unlikely to be sufficient. More robust behaviour change strategies, including regulatory approaches, may be required to address this pressing issue.

B15 TALK · WED 24 JUNE, 10:10–10:30 · CHANCELLOR'S (TRACK B)

Just toss in a toy? A meta-analytic appraisal of captive primate environmental enrichment

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Environmental enrichment is widely used to improve the welfare of captive primates, yet its application is often guided by trial-and-error approaches, assumptions of generalisability and subjective interpretation of outcomes. Although enrichment is broadly regarded as beneficial, inconsistent results and uneven reporting standards highlight the need for a more predictive, evidence-based framework. We conducted a meta-analysis to critically appraise enrichment practices for captive primates, identify factors associated with welfare outcomes and develop a comparative metric for evaluating enrichment efficacy across contexts. A comprehensive literature search for peer-reviewed studies published up to December 2023 that assessed primate enrichment using baseline comparisons and statistical analyses was done. After screening, 172 articles comprising 248 distinct enrichment protocols were included. These protocols represented 55 primate species, although the literature was taxonomically biased toward Afro-Eurasian primates, particularly rhesus macaques, chimpanzees and western gorillas. Most studies were conducted in zoo or laboratory settings, with feeding enrichment, enclosure modification and social enrichment being the most common interventions. To compare enrichment efficacy we developed a novel enrichment efficacy index and applied this metric throughout. Enrichment produced a net positive welfare effect with training-based enrichment yielding the highest efficacy scores. Non-training interaction-based approaches were least effective and warrant further investigation. Enrichments providing cognitive stimulation, biological relevance or opportunities for control and choice were associated with greater welfare benefits. Social context also emerged as a significant predictor: individuals housed in socially limited conditions showed larger gains from enrichment than group-housed animals, suggesting that social interaction may buffer captive stress. A weaker but significant relationship was found between enrichment efficacy and species' natural minimum group size. Our findings reveal persistent taxonomic and contextual biases, an underreporting of negative or inconclusive outcomes and inconsistent reporting practices in the enrichment literature. Nevertheless, the proposed efficacy index offers a practical tool for comparative evaluation and supports movement toward a predictive science of enrichment. Advancing primate welfare will require targeted investigation, transparent reporting and context-sensitive enrichment strategies grounded in empirical evidence.

B16 TALK · WED 24 JUNE, 10:40–11:00 · CHANCELLOR'S (TRACK B)

Associations between judgement bias and other indicators of affective state: a way to advance wild animal welfare science?

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Judgement bias tests are now widely used and considered valid tools for assessing affective state across animal species. However, their application is not yet feasible outside captive settings, which strongly limits our ability to precisely assess how the countless animals living in the wild experience their lives. Identifying other markers commonly measured in the wild and that reliably correlate with judgement bias outcomes may help overcome this limitation by clarifying their validity as welfare indicators. To this end, we conducted a systematic review followed by a meta analysis to quantify associations between judgement bias test outcomes and somatic, behavioural or cognitive markers measured across species and experimental settings. Our systematic literature search was conducted in PubMed and Web of Science. Studies were included if they reported conclusive judgement bias testing and at least one additional somatic, behavioural or cognitive marker measured under specific experimental conditions. Only markers, which measurement is feasible in wild settings, were retained for further analyses. With this approach, the most common measures that we found to be reported at the same time as judgement bias test outcomes were glucocorticoids, temperature and body condition among somatic markers, locomotor activity and vocalisations among behavioural measures, and attention bias among cognitive measures. Meta-analytic models were then used to quantify the associations between these markers and judgement bias outcome. During this talk, we will present the results of our systematic review and meta-analysis, and discuss the potential use of markers reflecting judgement bias outcome for assessing affective state and welfare in wild animal populations. We will conclude with a discussion of less common indicators that, although not included in the statistical analyses due to limited data availability, appear promising and show patterns consistent with judgement bias outcomes.

B17 SHORT TALK · WED 24 JUNE, 10:50–11:10 · CHANCELLOR'S (TRACK B)

Impact of resource availability on health and welfare of community cats across colonies

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Free-roaming, or "community cats (CC)", rely on resources found in surrounding environments, which may include existing outdoor items or those provided by human caretakers. Quality and accessibility of these resources and management of colonies vary between communities, and the impact of these factors on cat health and welfare is unknown. This study aimed to evaluate the relationship of resource and management-based factors with individual CC health outcomes, thereby addressing three of the five animal welfare domains: nutrition, environment, and health (Mellor et al., 2020). These indicators were used to approximate CC individual-level welfare outcomes across colonies, with future research including further domains of behavior and mental state. For the aforementioned study, caretakers managing CC colonies in the United States were asked to report resource availability and quality, and to evaluate individual cat health using five validated visual indicators: body condition, coat condition, nasal and ocular discharge, ear crusting, and injury status (Zito et al., 2019). A total of 137 participants contributed data on 712 cats with an average of 5.3 ± 2.7 cats per respondent (range: 1–15). Associations between resources (e.g., food, water, shelter) and health outcomes were analyzed using multiple linear mixed-effects models. Data were checked for normality, and models accounted for clustering of CC within colonies. Results indicated that higher total health scores were associated with more consistent and cleaner water resources ($\beta = 0.21 \pm 0.11$, $p = 0.050$). Poorer body condition scores were associated with cats with unknown sterilization dates ($\beta = -1.34 \pm 0.58$, $p = 0.020$) and those sterilized more than 4 years ago ($\beta = -0.85 \pm 0.40$, $p = 0.033$), which may reflect increased cat age. Coat conditions varied across colony sizes; cats living in colonies of 10 - 15 and colonies of 1 - 5 had higher coat condition scores ($\beta = 2.29 \pm 0.95$, $p = 0.001$; $\beta = 1.07 \pm 0.57$, $p = 0.060$) than those living with 6-9 other cats. Overall, these findings suggest that water quality and availability, and date of sterilization are important predictors of CC health, emphasizing the need to prioritize consistent access to clean water in colony management.

Assessing reliability of cat health measurements collected in-home by caregivers

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Routine veterinary care is vital for maintaining cat welfare; however, many barriers limit access, which veterinary telehealth may help overcome by expanding access to care. No research has evaluated the reliability of cat health measurements collected by caregivers at home, which contributes to veterinary professionals' concerns regarding telehealth. Therefore, the aim of this study was to assess reliability of caregiver versus expert collected health measurements using mock examinations. Caregivers performed a mock examination on their cat (N=26) via video (telehealth) while a trained research assistant instructed them to collect a variety of non-invasive health measurements, including assessment of the eyes, nose, ears, feet, body condition score (BCS), and respiratory rate. A trained expert and a 2nd research assistant then collected the same measurements on the cat in the caregiver's home. Caregivers completed an online questionnaire before and after the visit to collect information about their own and their cat's previous experiences with in-clinic and telehealth veterinary appointments, along with Likert-scale ratings on the ease of taking each measurement on their cat. Reliability of caregiver versus expert collected categorical measurements was evaluated using a Prevalence and Bias Adjusted Kappa (PABAK), while continuous measurements were evaluated using Intraclass Correlation Coefficients (ICC). Kendall's coefficient W assessed reliability of BCS. Wilcoxon Signed-rank tests assessed changes in questionnaire responses before versus after participation. Participants were primarily women (80.8%), with a mean age of 37.7 years (range: 21-72 years old), living in suburban areas (61.5%). Cats included 14 neutered males and 12 spayed females, with a mean age of 6.6 years (range: 1-18 years old). No participants had used video conferencing for veterinary care previously, although most (92.3%) indicated they were 'very' or 'somewhat' interested in using it for their cat's healthcare. Most participants indicated telehealth would 'greatly' or 'somewhat' decrease their cat's stress during exams (80.7%) and increase access to veterinary care for their cat (65.4%). Caregivers showed high reliability with experts in assessment of their cat's nose (PABAK=0.87, $p<0.001$), coat (PABAK=0.76, $p<0.001$), weight (ICC=0.8, $p<0.001$), respiratory rate (ICC=0.96, $p<0.001$), and BCS (W=0.76, $p=0.05$). Overall, caregivers perceived video appointments as a way to reduce their cat's stress, improve access to veterinary care, and were able to reliably collect some cat health measurements. The results may be applied across telehealth applications, from teletriage to video telemedicine, as a welfare-centered strategy to expand access to veterinary care and reduce clinic-related stress for cats and their caregivers.

B19 SHORT TALK · WED 24 JUNE, 10:50–11:10 · CHANCELLOR'S (TRACK B)

Support-seeking and rehoming pathways differ by surrender circumstances among companion animal guardians

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Companion animals housed in shelter facilities are at increased risk of poor welfare, highlighting the need for strategies that reduce intake. Guardians faced with the decision to surrender their animal may pursue various pathways, such as seeking support to retain their animals, independently rehoming their pets (self-rehoming), or relinquishing them to an animal shelter. Limited research examines how the circumstances surrounding surrender (e.g., reasons for surrender, length of guardianship) influence whether guardians pursue support and which surrender pathways they select. This mixed-methods study surveyed U.S. and Canadian adults who rehomed a companion animal within the past five years (n = 452) about the circumstances of their most recent surrender, desired or accessed pet retention supports, and the rehoming methods used. Latent class analysis identified three groups of pet guardians with similar surrender circumstances: Behavioural Incompatibilities (9.5%), New Acquisitions (42.9%), and Owner Hardships (47.6%). Class membership was associated with whether assistance was sought to retain the animal ($p < 0.001$, Cramer's $V = 0.23$) and with the rehoming pathways used (e.g., shelter relinquishment vs. self-rehoming; $p = 0.002$, Cramer's $V = 0.16$). Respondents in the Behavioural Incompatibilities class were most likely to attempt shelter relinquishment but ultimately self-rehome and least likely to seek pet retention support. Respondents in the New Acquisitions class were most likely to relinquish to a shelter and to seek pet retention support. Respondents in the Owner Hardships class were most likely to successfully self-rehome. Qualitative analysis revealed that respondents sought various supports including behavioural assistance, temporary care, and veterinary services; however, few sought help from animal shelters. This research shows that circumstances driving animal surrender are not homogeneous, which is important to consider when developing strategies to reduce relinquishment to animal shelters.

B20 TALK · WED 24 JUNE, 11:50–12:10 · CHANCELLOR'S (TRACK B)

Hatchery design matters: reducing otolith deformities through environmental enrichment in coho salmon

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Pacific salmon hatcheries play a central role in conservation, yet standard rearing practices often expose fish to simplified, highly artificial environments that compromise welfare. Coho salmon (Oncorhynchus kisutch) are commonly reared in barren circular tanks with constant, unidirectional water flow, conditions that differ markedly from the dynamic and structurally complex habitats found in the wild. One important, underrecognized welfare consequence of these conditions is the formation of vateritic otoliths. Otoliths are paired sensory structures in the inner ear that enable hearing and balance. While wild salmon rarely exhibit otolith abnormalities (<10%), 50–80% of hatchery-reared salmon develop vaterite, an abnormal calcium carbonate polymorph. Vaterite formation is irreversible and results in chronic sensory impairment, including reduced hearing, altered behaviour, and weakened predator evasion. Because these deformities arise under human-controlled conditions, they represent a preventable welfare issue. We combined results from four years of production-scale hatchery experiments to test whether environmental enrichment reduces vateritic otolith formation. First, we examined whether post-ponding tank water flow direction influences otolith development by rearing coho fry for 400 days under standard hatchery conditions of constant, unidirectional flow (clockwise or counter-clockwise) or under an enriched treatment with alternating flow direction (weekly reversal), over two years. At release, smolts reared under alternating flow had significantly lower vaterite prevalence than those reared under constant flow ($p < 0.001$). Second, we tested the effects of physical enrichment across early and later life stages over two years. During pre-ponding incubation, fish were reared either in standard Heath trays (control) or enriched artificial gravel nests. During post-ponding tank rearing, fish were reared either in barren tanks (control) or tanks containing structural enrichment (plants, barrels for swim-through, and river rocks). This design produced four treatment groups: no enrichment at either stage (control–control), enrichment at both stages (enriched–enriched), enrichment only after ponding (control–enriched), and enrichment only during incubation (enriched–control). At release (day 400), vaterite prevalence was highest in control–control fish (74%), intermediate in control–enriched fish (33%), and lowest in enriched–control and enriched–enriched fish (12–16%), demonstrating that early-life enrichment had the strongest and most persistent protective effect ($p < 0.001$). Together, these results provide the first evidence that alternating water flow direction and early-life physical enrichment reduce vateritic otoliths in hatchery-reared coho salmon. These findings highlight practical, scalable interventions that can substantially improve fish welfare while enhancing the effectiveness of salmon conservation and restocking programs.

B21 TALK · WED 24 JUNE, 12:10–12:30 · CHANCELLOR'S (TRACK B)

Reducing chronic welfare compromise in farmed Nile tilapia through water quality management and farmer awareness in Egypt

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Chronic exposure to suboptimal water quality is a major but often under-recognised source of welfare compromise in semi-intensive tilapia aquaculture, particularly in low and middle income producing countries. In Egypt, one of the world's largest producers of Nile tilapia (Oreochromis niloticus), inadequate monitoring of dissolved oxygen, ammonia and related parameters can lead to prolonged stress, impaired health and avoidable suffering long before overt disease or mortality occur. This study assessed whether improved water quality monitoring combined with structured farmer welfare awareness could function as an upstream intervention to reduce chronic welfare compromise in commercial tilapia farms. A multi-site applied field study was conducted across 12 commercial farms representing four major aquaculture regions in Egypt, with three farms per region. Instrumented farms monitored temperature and dissolved oxygen daily and measured total ammonia nitrogen, pH, nitrite, alkalinity and Secchi disk visibility at defined intervals. Fish welfare was assessed using routine biometric and environmental indicators recorded through the FAI Tilapia Welfare App, allowing longitudinal tracking of welfare-relevant conditions under commercial production. Farmer engagement focused on interpreting water quality data in relation to fish behaviour, condition and health rather than production outcomes alone. Farms equipped with monitoring tools and welfare recording showed improved capacity to detect and respond to emerging low oxygen events, ammonia accumulation and deteriorating pond conditions. This was associated with reduced frequency and duration of suboptimal water quality exposure, lower mortality and improved fish condition over the production cycle. Importantly, participating farmers demonstrated a marked shift in their understanding of water quality as a determinant of fish welfare rather than solely growth or survival, leading to more proactive management decisions during periods of environmental risk. These findings indicate that relatively low-cost water quality monitoring combined with targeted welfare awareness can materially reduce chronic welfare compromise in farmed Nile tilapia under real-world conditions. Embedding welfare-oriented water quality management into routine farm practice offers a scalable approach to improving fish welfare in semi-intensive aquaculture systems in the Global South, where the majority of farmed fish are produced and where chronic, sublethal welfare impacts are most likely to go unaddressed.

B22 TALK · WED 24 JUNE, 12:30–12:50 · CHANCELLOR'S (TRACK B)

Substrate deprivation as a major unrecognized welfare challenge in the world's most farmed aquatic species (Litopenaeus vannamei)

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Virtually all intensive production of Litopenaeus vannamei, the most farmed marine shrimp species globally, accounting for more than half of worldwide farmed shrimp output, operates without natural substrate. This near-universal exclusion has been driven by operational considerations including biosecurity, waste removal, and harvesting efficiency, but it has also been sustained by the widespread characterization of L. vannamei as a species with a low tendency for burrowing. However, this classification reflects narrow definitions that equate substrate use with deep excavation and full body burial, excluding a broader repertoire of substrate-associated behaviour from consideration, including partial burial, prolonged ventral substrate contact, and active manipulation of sediment particles. We argue that this definitional framing has led to a systematic underestimation of substrate relevance for the welfare of farmed shrimp. We demonstrate that substrate access does not require deep burrowing to be biologically relevant, with deprivation leading to measurable consequences for welfare and performance. When substrate is available, L. vannamei allocates 60 to 70% of the 24h cycle to substrate-associated states. Observations from structurally enriched intensive systems further show that shrimp preferentially associate with available structures rather than occupying open water or bare tank bottoms. Together, these findings indicate that interaction with substrate, including attachment to available structures, represents a dominant behavioural mode. Experimental evidence further suggests that substrate access supports multiple biological functions, including sensory regulation, structured rest and circadian stability, nutritional supplementation, protection during moulting, expression of exploratory and manipulative behaviour, tactile engagement, social buffering, and environmental agency. Accordingly, several studies report improved growth performance, survival, and immune competence in shrimp reared with substrate. Barren environments may therefore represent an environmental mismatch that alters behavioural organization and energetic allocation.We further map these functional deficits onto measurable welfare indicators, including activity allocation patterns, molt-concentrated mortality, aggression-related injury patterns, and physiological markers of energetic state. Together, these findings suggest that substrate deprivation constitutes a major, largely unrecognized welfare challenge in intensive shrimp aquaculture, potentially affecting billions of animals annually. Re-evaluation of substrate provision, whether through direct incorporation, partial coverage, or functionally informed enrichment design, is warranted, as is recognition that narrow behavioural definitions can obscure fundamental environmental needs in farmed species.

EFSA's welfare assessment of animals kept for fur production

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The European Food Safety Authority (EFSA) was mandated in 2023 by the European Commission (EC) to provide an independent view on the welfare of the main five species kept for fur production in Europe: American mink (Neogale vison), red fox (Vulpes vulpes), Arctic fox (Vulpes lagopus), raccoon dog (Nyctereutes procyonoides) and chinchilla (Chinchilla lanigera). The request asked to update knowledge on the biology, current husbandry systems and farm practices for keeping animals for fur production (a.k.a. "current system"). On this basis, the mandate was to identify, for each species, the five most relevant welfare consequences (WCs) from the EFSA (2022) guidance list and to assess whether they can be prevented or substantially mitigated in current systems. This mandate was issued in the context of EC's commitment to respond to the European Citizens' Initiative Fur Free Europe, which calls for a ban on fur farming and the marketing of fur products across the EU. The assessment was based on literature review, stakeholder consultation, and EFSA expert evaluation. Current systems in fur production are wire-mesh cages of standard dimensions, typically including temporary or permanent nestboxes (depending on the species) which do not allow the incorporation of adequate enriching resources and substantially limit the expression of fundamental species-specific behaviours (EFSA, 2025). The current systems and farm practices appear standardised, and no alternative systems are currently in large-scale commercial use. As generally true across farms animals, the domestication process has not essentially altered species' behavioural biology or fundamental needs. The most relevant WCs across fur- farmed species include "restriction of movement", "inability to perform exploratory or foraging behaviour", and "sensorial under- and overstimulation", due to common hazards linked to current cage size and barrenness. Species-specific WCs include "integument damage" and "handling stress" (foxes and American mink), "locomotory disorders" (Arctic fox, raccoon dog), "group stress" (red fox), and "inability to perform comfort behaviours" and "predation stress" (chinchilla). For most WCs, prevention or substantial mitigation within the current cage system is not possible. Limited mitigation is sometimes achievable, but a substantial improvement of animal welfare would require a change to a different type of enclosure, offering sufficient three-dimensional space, environmental complexity, and resources to allow the expression of fundamental behaviours. For WCs unrelated to housing, such as "handling stress", multifaceted interventions (e.g. adjusting breeding, feeding, or management practices) are needed. The assessment identified significant gaps in knowledge, especially on alternative husbandry systems and related quantitative requirements.

Behavioural freedoms or freedom to suffer? Evaluating the welfare of free-living animals

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Free-living animals (wild or feral) are often not covered by legislative requirements to care for their welfare, but definitions of welfare that are related to emotional state clearly also apply to sentient animals not under human control. A method to assess the welfare of free- living animals is important to understand the impact of human activities on these animals. In addition, it can identify whether any interventions are needed in cases where there is human responsibility for welfare. In the UK, there are different groups of free-living ungulates with varying degrees of human responsibility: 1) red deer which, although wildlife, are routinely culled to manage numbers; 2) feral populations of sheep, goats and cattle, which have been under human control but then left to live as wild animals; 3) sheep and goats that are used for conservation grazing; 4) extensively managed sheep which are farmed but may live on unfenced pastures and only have close human observation on 3-5 days per year. Opportunities for assessing their welfare are typically limited by their inaccessibility and reactivity to humans. In a pilot study of extensively managed sheep as a model for other forms of free-living ungulates (unmarked, observed at a distance which did not cause flight responses), we assessed 7 welfare indicators in 60 randomly selected ewes per day over 9 observation days in spring in two glens in the Scottish Highlands. Indicators focused on physical health issues (lameness, faecal soiling, fleece loss, visible disease or injury), two indicators of social interactions (distance to nearest lamb, distance to nearest ewe) and Qualitative Behaviour Assessment (QBA). Time to observe 60 ewes averaged 4.2±1.04 and 4.5±0.71 hours per glen. An average of 11.9 ewes were recorded as having 1 health issue on each day (19.8% of all animals), and 0.67 ewes (1.11%) had two health issues. No ewes were observed with more than 2 health issues. Sociability distances were not affected by health condition of the ewe. Ewes without health issues were more likely to be scored as relaxed and content in the QBA analysis (PC1, $P<0.001$) compared to ewes with health conditions which were more likely to score as physically uncomfortable and frustrated (PC2, $P<0.001$). The data suggest that health assessments and QBA may be useful indicators of welfare in free-living ungulates but a greater understanding of the value animals place on behavioural freedoms is needed to assess welfare in this situation.

B25 SHORT TALK · WED 24 JUNE, 14:40–15:00 · CHANCELLOR'S (TRACK B)

Doing better for zoo-housed birds - key considerations for welfare assessment frameworks

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Birds may be the most diverse vertebrate taxonomic group managed in zoological collections, yet their welfare assessment needs remain comparatively underdeveloped. Much of zoo welfare science is shaped by mammalian models, creating a taxonomic bias that can limit the validity of frameworks applied to avian species. As a result, existing tools may overlook key elements of avian biology and ecology, misinterpreting species-typical behaviours or physical characteristics within welfare assessments. By exploring how we can "do better" for zoo-housed birds, welfare assessments can be designed to be species- specific, ecologically grounded, and practically applicable. Bird species differ widely in cognitive capacity, social systems, developmental mode, foraging ecology, and reliance on flight. Such diversity means that a one-size-fits-all approach to welfare assessment is unlikely to generate meaningful outputs. Behaviours central to avian biology may be constrained in captivity, but any potential negative welfare impacts are likely to be species-specific rather than generic. Analysing the meaningful expression of behaviour within enclosure constraints, alongside comparisons with wild time-activity budgets, can provide useful benchmarks for welfare inferences. A mixed-methods approach integrating physical, behavioural, and psychological indicators should be developed, with particular attention given to the distinction between appetitive (motivational, goal-directed) and consummatory (goal- completion) behaviours. Seasonality, social context, and life-history stage must also be considered, as these factors influence physiological and behavioural traits. A review of the zoo bird welfare literature reveals relatively few structured, species-specific assessment protocols. Many studies focus on individual measures, such as glucocorticoids or behavioural responses to specific conditions, rather than holistic, repeatable frameworks. This highlights the need for practical toolkits that can be implemented by practitioners. Valuable lessons can be drawn from agricultural, laboratory, and companion animal welfare science, where structured scoring systems and validated indicators are more established. When adapted carefully, these approaches can inform avian welfare assessment in zoos. Additionally, the experiential knowledge of keepers should be systematically incorporated into framework design. Improving bird welfare assessment requires embracing avian diversity, reducing mammal-centric bias in background research, and building species-informed tools for practitioners. By aligning welfare frameworks with avian evolution, ecology, and behaviour, zoos can generate more accurate welfare insights and make better-informed management decisions for each species in their care.

Increasing the visibility of animal welfare impacts in prosecutions for illegal wildlife trade through the use of species victim impact statements

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Prosecutions for illegal wildlife trade rarely involve recognition of the welfare impacts on the animals involved. Conservation concerns routinely provide the lens through which wildlife crimes are identified, prosecuted and sentenced. In most jurisdictions, wildlife crimes are classified as offences threatening the survival of species under CITES controls and are rarely identified as crimes involving individual animals with welfare implications. Even when an animal has been live-trafficked, cruelty charges are unlikely to be laid alongside charges for smuggling and the welfare impacts of poaching on the individuals trafficked are rarely mentioned in judges' reasons for sentence. This problem is magnified by the difficulties prosecuting authorities and judges face in reliably determining whether the welfare needs of trafficked animals have been compromised by the defendant's actions. International peer reviewed scientific studies of the welfare needs of wild animals are far fewer than for domestic species. This is a particular concern for endangered animals, which are often rare and less likely to have been the subject of extensive studies. Even for those species which have been the subject of studies, there are few internationally agreed standards of acceptable welfare. For these reasons, the extent of welfare harms to animals in trade are extremely difficult for enforcement authorities to assess and for judges to objectively determine. Even where sufficient reliable data exists to make welfare assessments, these may be unknown outside of scientific circles and therefore go unrecognised by busy judges. To address this problem in Hong Kong, recognition of wild animals as victims of crime is supported by enforcement authorities use of victim impact statements for widely trafficked endangered species. Along with conservation concerns, these victim impact statements highlight the welfare challenges to animals in capture and transport for illegal wildlife trade. Developed by the Faculty of Law and the School of Biological Sciences at the University of Hong Kong, the Species Victim Statement Initiative currently provides law enforcement authorities in ten jurisdictions with up- to-date conservation and welfare studies for 150 endangered species commonly seized in illegal trade across Asia. Utilising these statements, the Hong Kong judiciary increasingly address not only the conservation impacts but also the welfare compromises to smuggled wild animals in their sentences for wildlife offending, increasing crime deterrence and promoting greater recognition of the long-overlooked welfare concerns in conservation crime.

B27 SHORT TALK · WED 24 JUNE, 14:40–15:00 · CHANCELLOR'S (TRACK B)

Integrating psychosocial resilience into humane endings for livestock

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The veterinary profession maintains a professional and ethical mandate to provide humane, painless, and distress-free transitions for animals when suffering becomes untreatable or unsustainable. This responsibility extends beyond veterinarians to include stockpersons, law enforcement, and first responders. However, achieving successful outcomes depends on more than technical proficiency; it requires navigating a complex landscape of cultural, environmental, and organizational factors, alongside individual stressors. While mastering the technical methodologies for euthanasia, slaughter, and depopulation is fundamental, technical knowledge alone is often insufficient to ensure timely and effective humane endings. Not every individual, regardless of their skill level, is temperamentally suited to shoulder the psychological weight of these responsibilities. The American Veterinary Medical Association (AVMA) provides comprehensive guidance for humane endings and identifies the mental health of practitioners as a top priority. Current scientific literature indicates that while resources for managing stress and compassion fatigue are improving, significant research gaps remain, specifically regarding: the limitations of existing tools to measure compassion fatigue, inconsistencies in humane-endings education and the unique, long-term cumulative effects of moral injury. Mental preparation for these events can be bolstered by proactive training designed to foster resilience—a learnable skill rather than a fixed trait. Because resilience is rarely mastered in a single session, there is an ongoing need for: iterative training: moving beyond short courses to long-term developmental programs, practical tools: equipping professionals to manage extreme grief, guilt, and moral distress, and pre/post-event support: establishing robust systems for those navigating the significant psychological burden of animal welfare work. Ultimately, supporting those guided by animal welfare standards is essential to maintaining the integrity of humane endings for livestock and the well-being of the people who perform them.

B28 TALK · THU 25 JUNE, 11:20–11:40 · CHANCELLOR'S (TRACK B)

Cold nose, warm heart? Rethinking primate nasal temperature decreases in relation to affect

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Surface temperature, assessed through Infrared Thermal Imaging (IRT), is considered a putative welfare indicator due to autonomic nervous system–mediated changes associated with affect. In primates, IRT is frequently used to detect decreases in nasal temperature, thought to reflect affective states. However, the specific affective component indicated by these temperature changes remains uncertain: previous studies have linked them to discrete emotions (e.g., fear, frustration), negatively valenced high-arousal states, or high arousal without reference to valence. This experiment examined whether nasal temperatures could predict the valence of naturally occurring affective states as indicated by a judgement bias task. Establishing this link is essential if surface temperatures are to be used as welfare indicators in primates. Seven zoo-housed bonobos were trained on an active choice visual discrimination judgement bias paradigm. Experimental sessions were recorded with an IRT camera, and nasal temperatures were taken from a one-second window before each trial. Self-directed behaviors (SDBs) were also recorded during inter-trial intervals to validate the task's ability to detect short-term affect. Results from frequentist and Bayesian models indicate that SDB rates did not predict pessimism. However, there was a significant interaction between nasal temperature, the conditioned stimulus, and one ambiguous stimulus. This interaction was present in all models; compared to the conditioned stimulus, optimistic choices to the Middle ambiguous stimulus were associated with cooler noses, while pessimistic choices were associated with warmer noses. If these findings represent naturally occurring affective states, they conflict with suggestions that nasal temperature drops correspond to negative valence or to high arousal regardless of valence. However, if elicited by task stimuli, they could reflect animals experiencing positively valenced high-arousal emotions in anticipation of their preferred reward.

B29 TALK · THU 25 JUNE, 11:40–12:00 · CHANCELLOR'S (TRACK B)

Large numbers of very small animals: when, how, and why do neonatal laboratory mouse pups die?

I. Anna S. Olsson[1], Gabriela Morello[1], Sara Capas-Peneda[1], Elin Weber[2], Sophie Brajon[3], Colin Gilbert[4]

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Pre-weaning mortality in laboratory mice is a major but often under-recognized welfare and scientific problem, with substantial ethical and 3R implications. The questions of when, how, and why neonatal mice die have been the subject of our research for over 15 years, with focus on mice of the widely used C57BL/6 strain where the problem of neonatal mortality is manifestly widespread. Large-scale data mining from breeding colonies identified litter overlap, advanced dam age, and very small or very large litters as major risk factors for pre-weaning death (Morello et al., 2020). Behavioural and social-environment studies using detailed video observation showed that suboptimal maternal behaviour, possibly in combination with prolonged or complicated parturition, is associated with litter loss (Weber et al., 2016). Particular social configurations, particularly reproductive asynchrony (older litter present at birth), are especially risky (Brajon et al., 2019, Morello et al., 2020). Work comparing data from high-resolution behavioural monitoring with standard pup counting methods has demonstrated that routine daily cage checks substantially underestimate perinatal deaths because cannibalism rapidly removes dead pups, while video evidence indicates that infanticide is rare (Brajon et al., 2021). Parallel post-mortem analysis using a standardized neonatal necropsy protocol provide information on causes of death, highlighting starvation and stillbirth as dominant categories among pups found dead and providing a practical diagnostic tool for facilities (Capas-Peneda et al., 2021; Capas-Peneda et al., 2020). A new prospective study links these social risk factors to cage micro-environment, showing that appropriate temperature and nest quality can mitigate some socially driven risks, offering concrete refinement strategies (Morello et al., 2024). Collectively, this body of work reframes pup mortality from an unavoidable “background loss” to a largely modifiable outcome shaped by social configuration, micro-environment, and periparturient care. Given that laboratory mouse breeding started in the 1920s, with the C57BL mice that are the focus of our research, it is plausible that the problem we study is actually as old as UFAW itself. In contrast, very recent technology was used to produce the abstract: the research summary is a slightly edited version of the output generated by the AI tool Consensus on basis of our published original research papers. In the spirit of the centenary of science for improved animal welfare in practice, I will also reflect on the journey from being the first to study this overlooked welfare problem to gaining access to datasets and collaborations with major laboratory animal facilities.

B30 TALK · THU 25 JUNE, 12:00–12:20 · CHANCELLOR'S (TRACK B)

From law, through policy, to welfare: lessons learnt from the new EU law on welfare of Canis familiaris and Felis catus

Iwona Mertin, Iza Arrieta

Eurogroup for Animals, Brussels, Belgium

In the course of the past three years the EU has been working on the new law on the welfare of dogs and cats, and their traceability. The reason to focus on this topic was a social pressure alongside concerns of EU Member States on the cost of illegal trade, both from the perspective of enforcement, as well as from the point of welfare and health of traded animals. The objective of this proposal was to limit the illegal trade and regulate the breeding aspects in order to improve the welfare of kept dogs and cats. Throughout the legislative process, we applied a number of advocacy techniques in order to obtain the best possible outcome for the dogs and cats. During our talk we would like to make a case for effective advocacy, raise the importance of the continuous dialogue between researchers and policy makers at EU and national levels, as well as present the outcome of the proposal that will be voted on 25 March 2026, together with its potential impact on the welfare of dogs and cats. By presenting the shortcomings of the upcoming EU law, we also would like to point out to the future areas of improvement and which animal welfare issues might potentially not get resolved. The basis of our presentation will be a qualitative analysis.

B31 SHORT TALK · THU 25 JUNE, 12:20–12:40 · CHANCELLOR'S (TRACK B)

Huts as a refined handling method for laboratory mice

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Mice are widely used in research and commonly handled by their tail, despite evidence that this method is aversive. Handling mice with cupped hands or tunnels has been linked to welfare improvements, including increased voluntary interaction with the handler and reduced anxiety. However, tail handling remains prevalent, with laboratories reporting barriers to adopting refined handling methods, including concerns about increased handling time, perceived incompatibility with routine procedures, and tunnel costs. Practicality may be improved by using available in-cage objects, such as mouse huts, as handling devices. Our aim was to compare hut handling with established refined handling methods, namely cupping and tunnel handling. Mice (n = 51) were randomly assigned to a handling method (cupping, tunnel, or hut) and underwent 9 days of brief handling sessions. Voluntary interaction tests were performed on days 1, 5, and 9. After the 9 days of handling, mice were individually tested in an elevated plus maze (EPM) to assess anxiety. We found that voluntary interaction with the handler varied with handling object: hut- handled mice spent the most time interacting with the handler, followed by tunnel- handled and cupped mice (41.7 ± 1.5 s, 36.1 ± 1.4 s, and 33.0 ± 1.5 s, respectively). We found no effect of the handling method on responses to the EPM. In a second study, we assessed whether gentle tail restraint during hut handling, to reduce the risk of escape from the hut, was a less aversive alternative to tail handling. Mice (n = 83) were randomly assigned to a handling method (tail, hut, or hut with tail restraint), and underwent handling sessions, voluntary interaction testing, and EPM testing as in the first study. Mice handled using a hut, with or without tail restraint, engaged in more voluntary interaction with the handler compared to tail-handled mice (47.0 ± 1.6 s, 48.4 ± 1.6 s, and 28.8 ± 1.6 s, respectively). Hut-handled mice demonstrated the least anxiety as evidenced by the most time spent in the open arms of the EPM, followed by hut-handled mice with tail restraint, and tail-handled mice (64.5 ± 4.9 s, 53.8 ± 4.8 s, and 46.9 ± 4.8 s, respectively). We conclude that hut handling is an effective and practical refined handling alternative, particularly in facilities that already have access to huts. Further, hut handling can be adapted for more fearful mice who would otherwise likely be tail-handled.

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Reproducibility matters: Why image integrity is essential for animal welfare

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Scientific progress depends on the reliability of the available evidence. When results are unreliable due to error or fraud, others might be unable to reproduce the results, thereby wasting time, money and animal lives. The Rat Grimace Scale (RGS) offers an objective, straightforward way of assessing pain in laboratory rats through facial expressions. The RGS is being used widely as a method in pain and animal welfare research. During a systematic review on the RGS, we encountered publications that featured repeated or altered images. What began as isolated observations soon grew as we encountered more problematic images. We decided to quantify and characterize these issues by screening our database for problematic images using automated software (Imagetwin). A total of 30 out of 182 included articles (16.5%) were labeled as 'problematic', which means that they contained one or more figures with inappropriate image duplications or manipulation. These ranged from simple within-paper duplications (identical images repeated in different or the same figure(s)) to altered images (an image manipulated via cropping, rotation, or distinct changes) and between-paper duplications (same image reused across separate publications). We examined citation counts and journal impact factors in an attempt to identify potential patterns or trends in the image issues, but nothing that could help predict where these problems may occur was found. As our systematic review combines the results of numerous publications, we are currently assessing whether including the problematic papers has an effect on the outcome. Our findings indicate that simple duplications and even alterations of images are concerningly common in preclinical pain research – threatening reproducibility and the ethical foundation of animal studies. Whether the issue is the result of carelessness when preparing the report, or a malicious actor with intent to deceive slipping up, the reliability of the findings in the report is questionable. Reports of this kind do not just damage scientific credibility; if we are indeed witnessing manipulation of data, this is an erosion of trust – ultimately harming the animals we use and have an ethical obligation to protect. Ensuring transparent, trustworthy, and reproducible data is essential if our research is to lead to real improvements in how we care for our laboratory animals. Acceptance type: Talk

B33 SHORT TALK · THU 25 JUNE, 12:20–12:40 · CHANCELLOR'S (TRACK B)

Handling rabbits: Impact of technique on the behaviour of exhibition rabbits during and after judging

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Evidence-based guidance on low-stress rabbit handling is needed because 61% of companion rabbits reportedly struggle during handling, while owners and veterinarians both report lack of confidence in rabbit handling and physical examination. Three main handling methods are of concern according to literature: lifting by the ears or by the scruff, especially without supported hindquarters, and 'overturning' (restraint in dorsal recumbency with the head below the heart), which can induce tonic immobility. This observational study sought to describe handling techniques used by British Rabbit Council judges during assessment at rabbit shows, and assess associations with rabbit behaviour that could indicate welfare implications of these techniques. We hypothesised that greater durations of overturning would be associated with increased stress-related behaviours in rabbits during and after handling. In total, 65 rabbits and 17 judges were systematically observed across three shows, with ten handling methods documented. Rabbit behaviours were recorded using ethograms during and after judging. Observations post-handling were conducted blind to handling method, but blinding was impossible during handling. Participating judges were aware of the study aims, but not the hypothesis, and had consented to being observed during the normal judging processes of the exhibition. Only rabbits of consenting owners were observed. Generalised estimating equations were used to test statistical associations between handling technique and rabbit behaviour. Rabbits were lifted for a median of 5s (IQR: 2 – 11s), with 92% of rabbits 'laterally lifted', 49% 'lifted to the handler's body', and 32.3% lifted via the ear base with supported hindquarters. No rabbits were scruffed or lifted solely by the ears. For ventrum assessment (median duraon = 27s (IQR: 15– 36s)), 77% were 'tipped' with the head remaining upright, 61% were overturned, and 34% experienced both. During ventrum assessment, 36% struggled and this significantly increased with overturning duration ($p<0.001$) but not with tipping duration. This implies that overturning caused struggling, although reverse causation may be possible. Post-handling 'lying alert' increased significantly with tipping duration ($p=0.038$) only, but – as no other behaviours significantly decreased accordingly – it is unclear whether this behaviour replaced more relaxed or more vigilant behaviour and thus what the welfare implications are. The findings tentatively suggest that overturning is more aversive to rabbits than tipping, so tipping is recommended instead of overturning when ventrum assessment is required. In future, similar study protocols could be applied to assess handling effects within veterinary clinics, to investigate if results are applicable outside exhibition rabbit populations.

B34 TALK · THU 25 JUNE, 14:00–14:20 · CHANCELLOR'S (TRACK B)

Challenge accepted! Conducting impactful animal welfare research without using animals

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Animal welfare scientists often face personal ethical dilemmas surrounding the use of animals in experiments that may bring harm to the animals involved. For example, research on refinements may require maintaining control groups in conditions that are known to be detrimental to welfare. The principle of Replacement within the 3Rs promotes the replacement of sentient animals with non-animal methods, but this presents a challenge when studying animal welfare, behavior, or whole-animal biology is the purpose of the research. Replacement can be implemented as a spectrum ranging from "soft" to "hard" alternatives to effectively reduce animal use in scenarios where whole animal outcomes are necessary. Here, we will present recent data from our research group as a series of case studies on reducing and replacing animals used in mouse welfare research, including: using surplus (rather than purpose-bred) animals; testing alternative interventions in existing animals with welfare issues that would otherwise be treated following current best practices; observing animals that are kept for another purpose; and avoiding direct use of animals by working with medical records or other existing data. In our observational epidemiological work, we have identified several factors contributing to the prevalence of aggression and barbering in laboratory mice. Our data-mining work has leveraged animal husbandry records to show the negative impacts of corncob bedding on reproductive outcomes in a mouse breeding colony. Using systematic review and meta-analyses, we have answered questions about the welfare benefits of refined handling methods, as well as the reproductive consequences of various mouse breeding schemes. Although these approaches are sometimes limited in the specific questions they can answer (e.g., in epidemiology we can only test the effects of things that vary), they provide opportunities to ask more questions using much larger and more diverse animal populations than those of traditional controlled experiments. Assuming animals will continue to be used across various sectors (e.g., preclinical research, agriculture), we demonstrate the potential to conduct creative and meaningful animal welfare research by leveraging existing animal populations. The use of existing or surplus animals, epidemiology, data-mining, or meta-analysis can meaningfully answer questions about welfare without using additional animals, ultimately furthering the principles of Replacement and Reduction within animal welfare science.

Investigating ending the life of decapod crustaceans: Assessing efficacy of different methods and impact on muscle physiology in Norway lobster and signal crayfish.

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Decapod crustaceans have been recognised as sentient in some countries, therefore, identifying humane methods to end the life of these animals is critical for safeguarding animal welfare. Very little is known regarding the impact of different killing methods on decapods. Therefore, four methods were compared to determine firstly, which is the most rapid, and thus most humane and secondly to explore any effects on stress physiology. Two commercially relevant species, the freshwater signal crayfish, Pacifastacus leniusculus and the marine Norway lobster, Nephrops norvegicus, were compared. Firstly, heart rate was validated as a proxy for death by measuring the cessation of brain activity and heart rate. Heart rate and behavioural responses were then monitored during rapid chilling (ice slurry); overdose in anaesthetic; freezing and electric shock in water. Heart rate was monitored for 3 hours after application of the killing method to determine how long each method took and whether death occurred with no recovery. After this period, claw muscle and haemolymph were sampled to determine metabolic indicators linked to physiological stress. For Norway lobsters, electric shock (~1min) was the fastest method followed by freezing (~50 min). However, muscle and haemolymph lactate values were higher 3 hours after the electric shock indicating possible stress. The only effective method for signal crayfish was freezing (< 35 min), since ice slurry and electric shock were inconsistent with only a few animals succumbing. Freezing resulted in elevated stress indicators thus this may not be humane. Overdose in clove oil was effective for Norway lobster (~45min) but may only be suitable for laboratory use and was completely ineffective for the signal crayfish. In conclusion, freezing was the only effective method for both species, but it took a relatively long time for death to occur. In water electric shock was the most rapid method for Norway lobster, but further studies are needed to identify if this method causes a stress response and/or whether taste is affected. These species-specific differences highlight the need for future research to explore humane killing in a wider range of decapod crustaceans. Considering the commercial importance of these animals, the findings are essential for developing ethical practices and informing legislation.
Keywords: Animal welfare, Decapoda, crustacean, heart rate, euthanasia, glucose, lactate.

A welfare risk assessment of small-scale aquaculture clusters in southern Nigeria

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Fish welfare is increasingly recognized as a central component of responsible aquaculture; however, evidence from small-scale farming systems in sub-Saharan Africa remains limited. In such systems, welfare compromise is often driven by chronic environmental instability and limited monitoring capacity rather than acute husbandry failures. This study presents a quantitative, risk-based assessment of fish welfare practices and welfare risk factors in clustered fish farms in southern Nigeria. Between March and April 2025, structured questionnaires were administered to 188 aquaculture farms located within major farm clusters and surrounding independent operations in southern Nigeria. Data were collected on farm characteristics, farmer awareness of fish welfare, feeding and stocking practices, water-quality management, mortality patterns, and climate-related stressors. A composite Welfare Practice Index (WPI) was developed to reflect exposure to conditions known to influence fish welfare, including environmental control, monitoring frequency, and management responsiveness. Farms were categorized into low-, medium-, or high-risk welfare groups, and chi-square analyses were used to identify determinants of welfare compliance. Overall exposure to welfare risk was high. More than half of farms (55.9%) were classified as high-risk (low welfare), 34.9% as moderate-risk, and only 9.2% as low-risk (high welfare). Key risk factors included poor water-quality management (60%), elevated mortality (56%), and indicators consistent with chronic environmental stress, including slow growth (91%). Water management was predominantly reactive: 68% of farms reported changing water only when visibly deteriorated, and fewer than 5% conducted routine water-quality testing. Flooding was the most frequently reported climate-related stressors, contributing to stock loss and acute disruption of rearing conditions. Training and the use of digital or hybrid record-keeping systems were strongly associated with reduced welfare risk ($p < 0.001$), whereas mortality was driven primarily by environmental and infrastructural stressors rather than feeding practices alone. These findings suggest that welfare compromise in small-scale aquaculture systems is largely chronic in nature, arising from prolonged exposure to sub-optimal and unstable environmental conditions. This study provides a diagnostic welfare baseline for small-scale aquaculture clusters in southern Nigeria and demonstrates how risk-based assessments can identify priority areas for welfare intervention. Establishing such baselines is essential for developing targeted, evidence-based strategies that reduce the frequency and duration of welfare compromise in farmed fish under resource-limited production systems.

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Quantifying the effects of water quality on fish welfare and productivity in aquaculture: A meta-regression analysis

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Background Despite strong evidence that fish experience pain and stress, aquatic animal welfare remains under-examined. In aquaculture, water quality is a primary welfare determinant: suboptimal dissolved oxygen or elevated ammonia induces stress, suppresses growth, and increases mortality. Although these effects are well documented, their magnitude and consistency across species and production systems remain poorly quantified, limiting the development of welfare-based standards and the economic evaluation of welfare improvements. Objective This study quantifies the effects of key water-quality parameters—dissolved oxygen, total ammonia, and temperature—on two welfare-relevant productivity outcomes in finfish aquaculture: specific growth rate (SGR) and feed conversion ratio (FCR). Methods We synthesize 132 standardized treatment–control comparisons from 42 peer- reviewed studies covering 19 species, 22 production-system configurations, and 15 producing countries (1993–2026). Effect sizes are coded as log response ratios on each outcome separately. We estimate three-level random-effects meta-regressions (observations nested within papers) with cluster-robust standard errors at the paper level. Because primary studies differentially report stressor variables, we estimate three specifications—joint, ammonia-focused, and oxygen-focused—replicated across both dependent variables. The study uses exclusively secondary data; no additional ethical approval was required. Expected Results Preliminary estimates indicate that a 1 mg/L increase in dissolved oxygen raises SGR by approximately 6% in the oxygen-focused specification and by approximately 10% in the joint specification. A 1 mg/L increase in total ammonia depresses SGR by approximately 3% in the ammonia-focused specification and by 4.5% in the joint specification, with the ammonia focused estimate being the most precisely identified. The ammonia signal extends to feed efficiency, with FCR worsening by approximately 2.3% per 1 mg/L in the ammonia-focused specification. Dissolved oxygen effects on FCR are directionally consistent but statistically weaker. Salmonid species show larger implied effects than warm-water species, reflecting both biological response and price differentials. Implications Translated into shadow prices, the marginal welfare benefit of one additional mg/L of dissolved oxygen is on the order of US$220–1,015 per tonne harvested. Findings support species-specific welfare standards and suggest welfare-consistent water-quality management may be economically attractive for producers.

Quantifying the welfare impact of preslaughter operations in Atlantic salmon

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Globally, 78–171 billion farmed fishes are slaughtered annually. Welfare assessment and regulation have focused almost exclusively on the final slaughter phase — the interval from stunning to loss of consciousness, lasting seconds to minutes — while overlooking the welfare impact of the extended chain of pre-slaughter handling operations. In Atlantic salmon aquaculture, pre-slaughter handling involves feed withdrawal, crowding, pumping, live transport, and holding operations spanning hours to weeks, and exposing fish to multiple and simultaneous welfare challenges. Despite their extended duration and the severity of the stressors involved, the welfare impact of these operations has never been quantified. Additionally, pre-slaughter handling involves fundamental welfare trade-offs, whereby improvements in one welfare dimension can worsen others. Evaluating these trade-offs requires a common metric to quantify and compare harms across qualitatively different experiences. Without it, it is not possible to determine whether procedural modifications improve or redistribute harm, or where interventions would be most effective. We applied the Welfare Footprint Framework (WFF) to quantify cumulative welfare impacts across all pre-slaughter phases in Atlantic salmon. The WFF translates diverse welfare outcomes into a common currency - time spent in negative states of varying intensities - by integrating the intensity, duration, and prevalence of each experience encountered. Drawing on UK/Scotland production practices, we assessed best-case, worst-case, and typical scenarios defined by regulatory limits and industry consultation. For each phase, we identified six categories of affective experiences: pain and distress from crushing injuries, integumentary injuries, hunger, fear and panic, respiratory and metabolic distress, and developed biologically grounded temporal segmentation frameworks to trace how each experience evolves over time. Duration estimates were calibrated to the 8–16°C temperature range using Q_{10} temperature-rate corrections. The intensity of the experiences was examined through comprehensive reviews of the existing literature, including behavioral responses, neurophysiological markers, and evolutionary considerations. To estimate population-level prevalence of each experience, we combined regulatory data, industry reports, modeling of crowding dynamics, and physiological inference. This framework enables identification of which operations impose the greatest welfare costs, reveals critical research gaps, and establishes priority targets for welfare improvement. By expressing impacts per individual and per kilogram of production, it allows meaningful comparison between production systems and enables cost-effectiveness analysis of interventions. This work constitutes the first systematic quantification of cumulative welfare burdens across the entire pre-slaughter chain in any aquaculture species.

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