

UFAW International Conference 2022: Advancing Animal Welfare Science



28 - 29 June 2022



Edinburgh, UK



www.ufaw.org.uk/edinburgh22



UFAW2022



Scientific Programme

Welcome to the UFAW International Conference 2022

We would like to welcome you to Edinburgh for UFAW's first in-person conference since the start of the COVID-19 pandemic. We are delighted to be able to welcome so many old friends and colleagues, and to meet new ones after two years where we couldn't meet face to face.

Our experience of running online events during the pandemic led us to recognise the advantages of a virtual approach, including being able to reach a much larger and more global audience. We are therefore pleased to be able to stream the talks live online for those who are unable to be with us in-person. Posters can also be accessed online; a link can be found at the bottom of each page of the list of posters.

The scientific programme features presentations and posters covering a wide range of animal welfare issues and species. The conference will also include a workshop and a debate forum that will run concurrently on the afternoon of Wednesday 29th June. The workshop and debate forum are only open to those delegates attending the meeting in-person

We would like to thank all those who are contributing to the meeting, as speakers, poster presenters and chairs, as well as the delegates. We hope that you all enjoy the conference. Thank you also to our dedicated UFAW office staff (Sam Griffin, Jane Moorman and Tina Langford) who have ensured that the registration process runs smoothly.

We would also like to thank our publishing partner Wiley-Blackwell for their support. As part of your registration for this meeting, Wiley-Blackwell are offering a discount of 20% on all the books in the UFAW/Wiley-Blackwell animal welfare book series (use the code VET20 when you order from www.wiley.com).

Finally, please do let us know what you think of the meeting. Please fill in the post-conference online survey, and if you have any specific comments, please email events@ufaw.org.uk.

Huw Golledge, Stephen Wickens, Birte Nielsen, Liz Carter and Luisa Dormer
UFAW Organising Committee

The Universities Federation for Animal Welfare (UFAW)

The Universities Federation for Animal Welfare (UFAW) is an international scientific and educational animal welfare charity. UFAW's vision is a world where the welfare of every animal affected by humans is maximised through a scientific understanding of their needs and how to meet them. UFAW promotes an evidence-based approach to animal welfare by funding scientific research, supporting the careers of animal welfare scientists and by disseminating animal welfare science knowledge both to experts and the wider public.

UFAW's work relies on the support of members, subscribers, and donors. To learn more about our work, to become a member of UFAW, or to donate, please visit www.ufaw.org.uk/. Thank you for supporting Science in the Service of Animal Welfare.

UFAW: Science in the Service of Animal Welfare

Most of us care deeply about animal welfare and want to do the right thing for animals, be it those we eat, those we experiment upon, or our much-loved pets. But simply caring about animals isn't enough; we also need to know what makes animals' lives better or worse to guarantee their welfare. Our mission is to discover what matters to animals, develop scientific solutions to animal-welfare problems and disseminate evidence-based animal welfare information

At UFAW we strive to answer such fundamental scientific questions about animal welfare by:

- Funding innovative research projects, prioritising those areas and species where the greatest benefit to animal welfare can be made.
- Supporting the development of animal welfare science in countries and regions where it is less developed by supporting and helping to develop local expertise.
- Collaborating with other individuals and organisations who share our commitment to evidence-based animal welfare, wherever working together can create a greater impact than we would alone.
- Sharing accessible, evidence-based animal welfare information with experts and the wider public.

For more information, visit: www.ufaw.org.uk

Please join UFAW

UFAW is a membership society for all those who are interested in Animal Welfare Science. One of the best ways to support our work and stay up to date with our activities is to become a member of UFAW.

Membership currently costs just £30, or £10 for students.

ufaw.org.uk/membership

Conference location: Edinburgh

The conference is being held in the capital city of Scotland, Edinburgh - a UNESCO world heritage site. Located on the East coast of Scotland, Edinburgh is sometimes called the Athens of the North because of its many neo-classical buildings and reputation for learning.

The historic centre of Edinburgh is divided in two. To the south, the view is dominated by Edinburgh Castle, built high on Castle Rock, and the long sweep of the Old Town, with its medieval street layout, descending towards Holyrood Palace. To the north lie Princes Street and the New Town, with its 18th century planned streets of honey-coloured buildings.

The city is the seat of the Scottish Government and hosts a series of festivals that run between the end of July and early September each year. The best known of these events are the Edinburgh Fringe Festival, the Edinburgh International Festival and the Edinburgh Military Tattoo.

Edinburgh has 3 universities, Heriot-Watt University, Napier University and the University of Edinburgh (the oldest, founded in 1583) which runs the long-established MSc in Applied Animal Behaviour and Welfare.

As would be expected from a capital city, with a long history and that is a popular tourist destination, there is lots to see and do.

Please visit these links for more information about Edinburgh and ideas of things to do:

- [Attending A Conference - Meeting Edinburgh](#)
- [The Official Guide to Edinburgh - Forever Edinburgh](#)
- [Forever Edinburgh](#)
- [Edinburgh City Pass 2020 | The Official Guide to Edinburgh](#)
- [Top Attractions in Edinburgh, Scotland - This is Edinburgh](#)
- [Curious Edinburgh | Mobile walking tours on Edinburgh's scientific and community heritage](#)

Accommodation

Edinburgh has a large range of different accommodation, to suit all budgets. Some of the closest accommodation to the conference venue – the RCPE - are the [Travelodge Edinburgh Central](#) and [YOTEL Edinburgh](#), both also on Queen Street, and the [Premier Inn Edinburgh](#). For those on a limited budget, there are a number of hostels, many close to the main train station in Edinburgh, Waverley Station e.g. [St Christopher's Inn](#). Click on this [link](#) to explore other accommodation options or simply search the web using the term 'accommodation near EH2 1JQ'.



Conference venue:

Royal College of Physicians of Edinburgh

9 Queen Street, Edinburgh, EH2 1JQ

The Royal College of Physicians of Edinburgh (RCPE) is in the New Town part of the city. The Queen Street building was completed in 1846. The temple-like grandeur of the entrance hall is complemented by a state-of-the-art lecture theatre that seats up to 300 and an international conference centre. The conference will also make use of the spectacular Great Hall and New Library, which is where lunch will be served and the posters displayed.



The Great Hall and New Library will also be the location for the drinks reception for delegates on the evening of 28th June.

A video of the RCPE and its rooms can be seen [here](#).

The Royal College of Physicians of Edinburgh is one of three organisations that sets the training standards for physicians in the United Kingdom and was established by Royal Charter in 1681. More information on the history of the Royal College of Physicians of Edinburgh can be found [here](#).



Registration:

Registration will take place in the lobby of the RCPE from 8.30am on Tuesday 28th June.

On registering delegates will receive a timetable, a list of poster presentations and a badge, which allows access to the meeting and to lunch and refreshments. The conference abstract booklet will only be available online so if you wish a hard copy then you will need to print it out in advance. Please ensure you wear your lanyard and badge at all times.

Please note that only delegates that are registered can attend the scientific programme and that registration is for an individual, not an institution, and is not transferable, unless this has been agreed in advance with UFAW. Failure to agree such may result in individuals being denied entry to the meeting.

Talks will take place in the Conference Centre lecture theatre, next to the lobby, with the poster session, lunch and refreshments being held in the Great Hall and Library at the times indicated in the timetable.

Delegates with any general questions or queries should address these to the staff at the registration desk, in the lobby, in the first instance. Cloakroom facilities are available on request.

The conference programme is a very busy one and delegates are requested to take their seats in plenty of time before the start of each session. These will start promptly at the time indicated in the programme.

Catering:

Tea, coffee and lunch will be served in the Great Hall and Library, at the times indicated in the timetable.

Badges:

Delegates with a special role to play in the conference have been allocated a coloured badge, as follows:

Blue	Organiser and/or helper
Yellow	Speaker
Pink	Poster presenter

Internet access:

To access free Wi-Fi during the meeting connect to the following:

Network name: RCPE-WiFi

Password: chiron1681

Photography and video:

We will be taking photographs and recording videos throughout the conference. If you do not wish to be filmed or photographed, please let a member of staff know at registration.

Delegates are kindly requested to not take multiple photographs or record talks during the conference, as this is distracting for others.

Social media:

The hashtag for the conference is **#UFAW2022**

Safety:

In the event of a fire or other emergency, please leave via the nearest emergency exit. Delegates should assemble at No 14 Queen Street, to the left of the RCPE. A check that everyone attending the conference is present will then be made. Do not return to the building unless authorised to do so.

Drinks reception:

A drinks reception will be held in the Great Hall on the evening of the 28th June from 17.50.



Scientific Programme: Talks

Timetable and Speaker Abstracts



Timetable of event

Tuesday 28th June

All timings are GMT+1 / UTC+1/ BST

08.30 - 09.10 Registration and poster set-up

09.10 - 09.20 **Welcome and Introduction:** Huw Golledge (*UFAW*)

09.20 - 11.00 **Session One** Chair: Katherine Cronin (*Lincoln Park Zoo, USA*)

09.20 - 10.00 **Keynote Speaker: How to improve the quality of animal welfare science**
Hanno Würbel (*University of Bern, Switzerland*)

10.00 - 10.20 **Determining the line of acceptable welfare**
Heather Browning (*London School of Economics and Political Science, UK*)

10.20 - 10.40 **Assessing animal welfare impacts in wild Norway rat (*Rattus norvegicus*) management**
Sandra E Baker (*University of Oxford, UK*)

10.40 - 11.00 **Fertility control to mitigate human-wildlife conflicts and promote coexistence**
Giovanna Massei and Stephanie Boyles Griffin (*University of York, UK; Botsiber Institute for Wildlife Fertility Control and The Humane Society of the United States, USA*)

11.00 - 11.30 **Break**

11.30 - 12.50 **Session Two** Chair: Huw Golledge (*UFAW, UK*)

11.30 - 12.10 **Keynote Speaker: Meeting the demands of a growing human population, while also achieving good welfare**
Bas Rodenburg (*Utrecht University, The Netherlands*)

12.10 - 12.30 **Short Talks:**
Gradual decompression shows promise as a humane alternative to carbon dioxide
Jasmine M Clarkson, Jessica E Martin, Julian Sparrey, Francesco Marchesi, Matthew C Leach and Dorothy EF McKeegan (*University of Glasgow, The University of Edinburgh, Livetec Systems Ltd and Newcastle University, UK*)

A survey of farmers' views on changing management practices for goat kids reared away from their dams
Holly M Vickery, Rachael A Neal and Rebecca K Meagher (*University of Reading, UK; University of Dalhousie, Canada*)

Beyond the lab: Animal welfare and the 3Rs in wildlife research
Miriam Zemanova (*University of Fribourg, Switzerland*)

12.10 - 12.30 **Training of animals as an applied tool of stress reduction in pigs and therefore implemented refinement**
Mechthild Wiegard, Delia Fiderer and Christa Thoene-Reineke (*Freie Universität Berlin, Germany*)

12.30 - 12.50 **Update on the UFAW Journal *Animal Welfare***
Huw Golledge (*UFAW, UK*)

12.50 - 14.20 **Lunch:** Poster session from 13.20

Tuesday 28th June

14.20 - 15.40	Session Three	Chair: Rowena Packer (<i>RVC, UK</i>)
14.20 - 15.00	Keynote Speaker: How evidence is used to develop policy: Examples from the Scottish Animal Welfare Commission	Cathy M Dwyer (<i>University of Edinburgh, UK & Chair, Scottish Animal Welfare Commission</i>)
15.00 - 15.20	How can we improve laboratory rat welfare? A systematic review of refinements to laboratory rat housing and husbandry	Vikki Neville, James Lind, Elsa Mendl, Nathalie Cozma, Elizabeth S. Paul and Michael Mendl (<i>University of Bristol, UK</i>)
15.20 - 15.40	Short Talks:	
	Pebble to the metal: a boulder approach to enrichment for <i>Danio rerio</i>	Kyna A Byrd, Jacob H Theil, Jerome T Geronimo, Emily I Hui, David K Chu and Joseph P Garner (<i>Stanford University and University of California, Davis, USA</i>)
	Experience of dog ownership not matching expectation is associated with increased perception of undesired behaviours as 'problematic' in a UK survey	Ben Cooper, Rachel A Casey, Katharine Anderson, Jane K Murray, Kirsten McMillan, Melissa Upjohn and Robert M Christley (<i>Dogs Trust, UK</i>)
	The effects of different environmental enrichment strategies on the sleep quality of laboratory ferrets	Alice MM Dancer, Jennifer K Bizley, Maria Díez-León and Charlotte C Burn (<i>Royal Veterinary College and University College London, UK</i>)
	Improved welfare and reproductive performance of pregnant sows housed in enriched pens	Martyna E Lagoda, Keelin O'Driscoll, Joanna Marchewka and Laura A Boyle (<i>Teagasc, Agriculture and Food Development Authority, Ireland; Institute of Genetics and Animal Biotechnology, Poland</i>)
15.40 - 16.20	Break	
16.20 - 17.50	Session Four	Chair: Huw Golledge (<i>UFAW, UK</i>)
16.20 - 16.30	UFAW Awards Presentations: UFAW Medal for Outstanding Contribution to Animal Welfare Science & UFAW Young Animal Welfare Scientist of the Year	
16.30 - 17.10	Handling Change – Some lessons learned	Jane Hurst (<i>University of Liverpool, UK</i>)
17.10 - 17.30	Dogs in demand: how a puppy boom is causing a welfare bust	Rowena MA Packer, Claire L Brand, Zoe Belshaw, Camilla L Pegram, Kim B Stevens and Dan G O'Neill (<i>Royal Veterinary College and EviVet Evidence-based Veterinary Consultancy, UK</i>)
17.30 - 17.50	Use of environmental enrichment for reptiles in zoos across Europe	Alicia Bartolomé, Pau Carazo and Enrique Font (<i>University of Valencia, Spain</i>)
17.50 - 20.00	End: Drinks reception	

Wednesday 29th June

08.50 - 09.00	Introduction to meeting: Birte Nielsen (UFAW, UK)
09.00 - 10.40	Session Five Chair: Birte Nielsen (UFAW, UK)
09.00 - 09.40	Keynote Speaker: Use and misuse of measures of welfare: What can body weight tell us about an animal's welfare? Melissa Bateson (Newcastle University, UK)
09.40 - 10.00	Brain health: A new frontier for animal behaviour and welfare Alistair B Lawrence, Gerry Thompson, Neil A Mabbott, Barry W McColl and Sarah M Brown (Scotland's Rural College (SRUC), University of Edinburgh and Centre for Discovery Brain Sciences, UK)
10.00 - 10.20	Does complexity of aviary design affect hippocampal plasticity in laying hens Matthew J Craven, Jonathan H Guy, Timothy Boswell and Tom V Smulders (Newcastle University, UK)
10.20 - 10.40	Feathers, feet, and fractures: Understanding connections between injuries to improve poultry welfare Nienke van Staaveren (University of Guelph, Canada)
10.40 - 11.20	Break
11.20 - 13.00	Session Six Chair: Jonathan Amory (Writtle University College, UK)
11.20 - 11.40	Challenges of animal welfare assessment for controlled atmosphere killing methods Jessica E Martin (University of Edinburgh, UK)
11.40 - 12.00	Metabolomics as a promising new approach in animal welfare science: characterising the metabolomic fingerprint of exposure to acute stress in a pig saliva model Liat Morgan, Rune Birkler, Shira Shacham-Ni, Yonghui Dong, Lior Carmi, Tal Wachsmann, Boris Yakobson, Hagit Cohen, Joseph Zohar, Ehud Gazit and Melissa Bateson (Tel Aviv University, Chaim Sheba Medical Center, Kimron Veterinary Institute and Ben-Gurion University of the Negev, Israel; Newcastle University UK)
12.00 - 12.20	Animal welfare risk assessment of dairy cattle transported to slaughterhouses Remco S Schrijver, Johan H Bongers, Winanda W Ursinus and Dick THM Sijm (Office for Risk Assessment & Research (BuRO) of the Netherlands Food and Product Safety Authority (NVWA), The Netherlands)
12.20 - 12.40	Developing a visual attention bias test in horses Sarah Kappel, Marco A Ramirez Montes De Oca, Sarah Collins, Katherine Herborn, Mike Mendl and Carole Fureix (University of Plymouth and University of Bristol, UK)
12.40 - 13.00	Short Talks: Providing a "priority" lane increases visits to the milking robot in dairy cows managed in an automatic milking system Francesca Johansen, Gareth Arnott and Stephanie Buijs (Queen's University Belfast, Agri-Food and Biosciences Institute and AgriSearch, UK) Tickle my brains: playful interactions affect cerebral neurotransmitter receptors Vincent Bombail, Felix Effah, Lea Kreichati, Goharika Paladugu, Gabriel Auraujo Costa, Alistair Lawrence and Alexis Bailey (Université Paris Saclay, France; Scotland's Rural College (SRUC) and Saint George's University of London, UK) Brave breeds and brains under the spotlight: how to genetics and lighted incubation impact young laying hens stress responsivity? Maëva WE Manet, Saskia Kliphuis, Arjen van Putten, Rebecca E Nordquist, Vivian C Goerlich, Lucas Noldus, Frank AM Tuytens and T Bas Rodenburg (Utrecht University, Noldus Information Technology Wageningen and Wageningen University & Research, The Netherlands; Flanders Research Institute for Agriculture and Ghent University, Belgium) Making the most of opportunities - the effect of early environmental choice on later success in laying hens Lena Skånberg, Regine V Holt, Ruth C Newberry, Inma Estevez, Nicolas Nazar and Linda J Keeling (Swedish University of Agricultural Sciences, Sweden; Norwegian University of Life Sciences, Norway; Department of Animal Health and IKERBASQUE, Spain; Universidad Nacional de Córdoba, Argentina)
13.00 - 14.20	Lunch: poster session from 13.40

Wednesday 29th June

14.20 - 15.30 Session Seven		
	Debate Forum: Meeting rooms 1&2	Workshop: Conference centre
	Animal welfare labelling of products Chair: Birte Nielsen (UFAW, UK)	Measuring behaviour better Melissa Bateson (Newcastle University, UK)
14.20 - 14.30	Introduction to debate forum Birte Nielsen (UFAW, UK)	Workshop on experimental design in animal behaviour and welfare studies - limitations, problems and how to tackle (some of them)
14.30 - 14.45	Method-of-Production labels: a welcome trend for farm animal welfare? Frank AM Tuytens, Antoni Dalmau, Mara Miele, Isabelle Veissier, Bryan Jones and Harry J Blokhuis (Flemish Research Institute for Agriculture, Fisheries and Food (ILVO), Belgium; IRTA, Spain; Cardiff University and Blairhill, UK; Université Clermont Auvergne, France; Swedish University of Agricultural Sciences, Sweden)	
14.45 - 15.00	Pros and cons of animal-based measures in animal welfare labelling Siobhan Mullan (University College Dublin, Ireland)	
15.00 - 15.10	The role of the consumer in animal welfare labelling Alistair Lawrence (SRUC, Scotland's Rural College, UK)	
15.10 - 15.30	Questions for speakers and preparation for debate	
15.30 - 16.10	Break	
16.10 - 17.10 Session Eight		
16.10 - 17.10	Debate Forum (continued)	Workshop (continued)
17.10 - 17.30	Poster prizes and closing of conference	
17.30	End	

HOW TO IMPROVE THE QUALITY OF ANIMAL WELFARE SCIENCE**Hanno Würbel**

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Animal research is regulated under the premise that any harm imposed on animals must be indispensable. This is also the legal basis of the 3Rs principle (Replace, Reduce, Refine), which serves to minimize harm to animals in research. However, the 3Rs are just one of several ethical principles to be taken into account in the ethical evaluation of animal research. Unless study findings are scientifically valid and reproducible, animals, labour and other resources may be wasted on inconclusive research. With respect to animal welfare science, inconclusive research may also attenuate advances in animal welfare science, delay progress in improving animal welfare, compromise the credibility of animal welfare research, and harm animals for no good reason.

Sources of poor scientific validity in animal welfare science comprise aspects of construct validity, internal validity, and external validity. For example, construct validity can be impaired by the use of poorly validated measures of welfare, as well as the misuse of otherwise valid measures (see keynote presentation "Use and misuse of measures of welfare" by Melissa Bateson). Internal validity of study findings may be impaired by poor study design (e.g. lack of adequate controls), violations of good research practice (e.g. no blinding, no randomization), small sample sizes (low statistical power), analytical flexibility (including p-hacking and HARKing), and selective reporting of results. Finally, external validity may be compromised by unjustified generalization of findings based on narrow study populations and artificially standardized study conditions. These problems are exacerbated by the fact that animal welfare science is highly diverse in terms of animal species, study context, and methods, and conducted by a small scientific community. Thus, independent replications of findings are rare, which compromises evidence synthesis through systematic reviews and meta-analyses.

Based on the three fundamental aspects of the scientific validity of animal research – construct validity, internal validity and external validity – and in analogy to the 3Rs principle, I have proposed the 3Vs principle for assessing the scientific quality of animal research. The 3Vs principle offers a flexible framework that may be adjusted in content and level of granularity depending on the specific needs of funders, regulators, and editors when assessing the quality of animal research. I will discuss this framework in relation to animal welfare science, with the aim of providing some guidance on the design, conduct and reporting of animal research in view of scientifically valid and ethically responsible animal welfare science.

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DETERMINING THE LINE OF ACCEPTABLE WELFARE**Heather Browning**

London School of Economics and Political Science, UK
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While the aim of most animal welfare science is to assess animal welfare, it is often far less clear what types of recommendation to make based on these assessments. In particular there is a difference between work simply aimed at the comparative goal of improving welfare (i.e. increasing the level of welfare from its previous baseline) and that aimed at the absolute goal of achieving good welfare. The latter involves a normative element, in setting a judgement line regarding what counts as acceptable welfare. In this paper I explore what this means both conceptually and empirically, as well as two of the possible ways of setting this cutoff line – at the ‘zero point’ where negative turns to positive welfare (often taken as the turning point for a life worth living), and as a fixed line set by reference to some target population (e.g. wild members of the species or the welfare levels achieved through current institutional best practice). I conclude by noting that while there may be no single privileged way of setting this cutoff line, it is important to be clear on which line we are choosing in different contexts, and our reasons for doing so.

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ASSESSING ANIMAL WELFARE IMPACTS IN WILD NORWAY RAT (*RATTUS NORVEGICUS*) MANAGEMENT

Sandra E Baker

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Norway rats (*Rattus norvegicus*) are considered one of the most significant vertebrate pests globally, because of their impacts on human and animal health. There are legal and moral obligations to minimise the impacts of wildlife management on animal welfare, yet there are few data on the relative welfare impacts of rat trapping and baiting methods used in the UK with which to inform management decisions. Two stakeholder workshops were facilitated to assess the relative welfare impacts of six lethal rat management methods using a welfare assessment model. Fifteen stakeholders including experts in wildlife management, rodent management, rodent biology, animal welfare science, and veterinary science and medicine, participated. The greatest welfare impacts were associated with three baiting methods, anticoagulants, cholecalciferol and non-toxic cellulose baits (severe to extreme impact for days), and with capture on a glue trap (extreme for hours) with concussive killing (mild to moderate for seconds to minutes); these methods should be considered last resorts from a welfare perspective. Lower impacts were associated with cage trapping (moderate to severe for hours) with concussive killing (moderate for minutes). The impact of snap trapping was highly variable (no impact to extreme for seconds to minutes). Snap traps should be regulated and tested to identify those that cause rapid unconsciousness; such traps might represent the most welfare-friendly option assessed for killing rats. Our results can be used to integrate consideration of rat welfare alongside other factors, including cost, efficacy, safety, non-target animal welfare and public acceptability when selecting management methods. We also highlight ways of reducing welfare impacts and areas where more data are needed.

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FERTILITY CONTROL TO MITIGATE HUMAN-WILDLIFE CONFLICTS AND PROMOTE COEXISTENCE**Giovanna Massei¹ and Stephanie Boyles Griffin^{2,3}**¹Botstiber Institute for Wildlife Fertility Control Europe, Department of Environment and Geography, University of York, UK²Botstiber Institute for Wildlife Fertility Control, Media, PA, USA³The Humane Society of the United States, Gaithersburg MD, USA*gmassei@botstiber.org*

Trends in human and wildlife population growth and in landscape development indicate that human-wildlife conflicts will continue to escalate worldwide. This is particularly important for countries where both the density of the human population and that of some wildlife and feral livestock species are high and where the debate about how to mitigate these conflicts is often polarised. Lethal control, traditionally used to manage wildlife, can be ineffective in the long term, unfeasible, illegal or unacceptable for its environmental and animal welfare impact. For example, species like commensal rodents are still predominantly managed with anticoagulant rodenticides, which are regarded as markedly inhumane and also hazardous to non-target species via primary and secondary poisoning as these toxicants are transferred along the food chain. Animal welfare is now a key component of the debate concerning methods to mitigate human-wildlife conflicts and to promote coexistence. In this context, non-lethal options, such as fertility control, are increasingly advocated to manage overabundant wildlife. Oral contraceptives have been developed for birds and small rodents, and species-specific devices are now available to deliver baits containing contraceptives to several wildlife species. The first part of this presentation will illustrate case studies of recent advances in research and development on fertility control as a tool to manage wildlife and feral animals. The second part of the talk will highlight advantages and limitations of fertility control, compared to other methods of wildlife management, in terms of economic and animal welfare cost, feasibility, public perception and acceptance. These comparisons will be used to draw conclusions about the future of humane, effective, and publicly acceptable methods to manage billions of overabundant animals worldwide.

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MEETING THE DEMANDS OF A GROWING HUMAN POPULATION, WHILE ALSO ACHIEVING GOOD WELFARE**T Bas Rodenburg^{1,2}**¹Animals in Science and Society, Department of Population Health Sciences, Faculty of Veterinary Medicine, Utrecht University, Utrecht, Netherlands²Adaptation Physiology Group, Wageningen University & Research, Wageningen, Netherlands
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The human population worldwide continues to grow, resulting in an increased demand for both plant-based and animal-based food. This paper focuses on how we can meet the demands of a growing human population, while also achieving good animal welfare and, more broadly, good sustainability. Major issues like climate change, force us to think about the most sustainable food system, in which plant-based food sources obtain a more central position. Plant-based food sources that can directly be used for human food production, such as grain or soy, should be used for that purpose primarily. In such a food system, animals play a more modest role as recyclers of waste products from the human food chain and as grazers on marginal land. This would in turn result in a comparatively smaller livestock industry, where more focus is placed on quality than on quantity. To stimulate this transition, the livestock industry should be reshaped based on the OneWelfare criteria: the new industry should be good for animal welfare, for human well-being (including farmer income) and should be sustainable. To convince farmers to move in this direction, initiatives to improve animal welfare should be stimulated – even if only a relatively small step is made at the time. In The Netherlands, the government has recently taken over recommendations from a report from the Council for Animal Affairs on animal husbandry focused around good animal welfare. In this report, the Five Domains approach from David Mellor is taken as the basis and the focus is on redesigning animal husbandry systems by focusing on the perspective of the animal. Systems that provide more opportunities for animals to meet their behavioural needs and adapt to their environment also provide opportunities for better animal welfare, including animal health and resilience. In the current Dutch project ‘SmartResilience’, we see that pigs born in group-farrowing system, that are also kept in an enriched environment later in life are better able to cope with challenges than pigs born in a farrowing crate and kept in a conventional environment. This results both in better welfare and in better growth performance. In conclusion, by shifting to a more plant-based diet and redesigning animal production, it should be possible to meet the demands of a growing human population while also achieving good animal welfare. However, active involvement from all actors in the food chain, including consumers, is needed to make such a transition possible.

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GRADUAL DECOMPRESSION SHOWS PROMISE AS A HUMANE ALTERNATIVE TO CARBON DIOXIDE**Jasmine M Clarkson¹, Jessica E Martin², Julian Sparrey³, Francesco Marchesi⁴,
Matthew C Leach⁵ and Dorothy EF McKeegan¹**

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Mice are the most widely used laboratory species, with millions used annually worldwide. The vast majority of these are killed either during or after the scientific work and, according to current legislation, must be killed humanely. Exposure to a rising concentration of carbon dioxide (CO₂) remains the most common method of killing laboratory rodents, despite significant welfare concerns surrounding its use, including its ability to induce anxiety, dyspnoea, and pain at high concentrations. Therefore, there is an urgent need to find a humane, practical, and high-throughput alternative.

We are systematically investigating whether hypobaric hypoxia (via gradual decompression, a process equivalent to ascending to high altitude) could be a novel and humane approach to the killing of laboratory mice due to its insidious onset in humans. Hypobaric hypoxia occurs at low atmospheric pressures due to a proportional decrease in the partial pressure of oxygen, and exposure to these environments leads to progressive loss of motor and cognitive function and ultimately unconsciousness and death.

The goal of this trial was to determine the behavioural consequences of hypobaric hypoxia in conscious mice using a decompression profile designed to avoid the risk of barotrauma based on previous work. We investigated the effects of a terminal treatment: gradual decompression, CO₂ and a SHAM treatment (no killing method applied) and employed the use of pharmacological interventions to infer the likely welfare consequences in a 3x3 factorial design. Within each treatment, mice were administered analgesia (Buprenorphine, 0.05mg/kg), anxiolytic (Diazepam; 2.5mg/kg) or saline at equivalent volumes.

We found significantly elongated latencies to hypoxia and death in mice undergoing decompression compared to CO₂, however mice exposed to decompression exhibited a more 'normal' behavioural repertoire in line with SHAM mice. Decompression was associated with greater levels of ear scratching compared to SHAM and CO₂ mice, although only 33% of mice performed this behaviour. Ear scratching was unaffected by analgesia and anxiolytic intervention and therefore unlikely to reflect anxiety and/or pain. Exposure to CO₂ was associated with significantly more gasping which was mediated by analgesia and anxiolytic treatments and therefore likely to be associated with dyspnoea and air hunger. We also found more active escape attempts in mice undergoing CO₂ (n=3; all saline treated mice), compared to decompression (n=1).

We discuss our findings in relation to the likely welfare impacts of gradual decompression and conclude that it may have potential to provide a high welfare method of killing laboratory mice.

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A SURVEY OF FARMERS' VIEWS ON CHANGING MANAGEMENT PRACTICES FOR GOAT KIDS REARED AWAY FROM THEIR DAMS

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Within livestock production systems, animal welfare is largely dependent on human decisions, and therefore understanding farmers attitudes towards management practices has great potential to inform and influence future welfare research. This survey aimed to investigate farmers' attitudes towards changing goat kid rearing practices. It used Likert scales to examine willingness to change and the importance of different factors for decision-making, alongside open text responses that could be qualitatively analysed. 242 farmers (USA 72; UK 71; Australia 33; Canada 23; New Zealand 20; EU 14; Other 9) rearing goat kids away from their dams responded. All respondents rated from one (highly unwilling) to seven (highly willing), how willing they would be to supply three enrichment types. Willingness to provide enrichments differed ($\chi^2(2) = 190.114$, $p < 0.001$), with farmers most willing to provide climbing or loose items over swinging items. Safety concerns were a common reason behind an unwillingness to provide enrichment (101 responses / 76.5%). Farmers currently abruptly weaning (an area of welfare concern) were asked how willing they would be to use gradual weaning methods. Those currently abruptly weaning from ad libitum milk systems ($n=47$) showed no difference in willingness to change to different gradual weaning methods; median (IQR) willingness to change to removing teats was 2 (1 – 4), reducing milk temperature 3 (1 – 5) and diluting milk 2 (1 – 5), with feasibility the most common concern. Those currently abruptly weaning from bottle feeding ($n=18$) also showed no difference in willingness to change to gradual weaning methods. Median (IQR) score for willingness to change to reducing bottle feeds was 4 (1 – 7), reducing milk quantity 3 (1 – 6.25), and diluting milk 1 (1 – 5), respectively, and health related concerns were the most common reason behind being unwilling to change. All 242 respondents were asked to rate how important different factors are when deciding to implement a new management practice. There was a significant difference in importance between factors ($\chi^2(2) = 34.779$, $p < 0.001$). Median (IQR) importance of the factors was: labour/time 5 (4 – 7), cost 5 (4 – 7), evidence beneficial to welfare 6 (5 – 7), evidence beneficial to health 6 (5 – 7), and evidence beneficial to growth 6 (4 – 7). Examining goat farmers' attitudes towards changing management practices has been previously unexplored, and these findings could help ensure that future research is appropriately targeted to address farmer concerns and have the best opportunity of improving on-farm animal welfare.

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BEYOND THE LAB: ANIMAL WELFARE AND THE 3RS IN WILDLIFE RESEARCH**Miriam A Zemanova^{1,2,3}**¹ Environmental Sciences and Humanities Institute, University of Fribourg, Switzerland² Animalfree Research, Bern, Switzerland³ Oxford Centre for Animal Ethics, UK*miriam.andela.zemanova@gmail.com*

Wildlife research remains crucial for increasing our knowledge and improving species management and conservation amid the current biodiversity crisis. However, obtaining information on population status often involves the invasive or lethal sampling of a certain number of individual animals. Marking and sampling practices include taking blood and tissue samples, toe-clipping of amphibians and rodents, or using implants and radio-transmitters – techniques that can negatively affect the animal. Wildlife research may then result in a fundamental conflict between individual animal welfare and the welfare of the population or ecosystem. This conflict could be significantly reduced if non-invasive and non-lethal research practices were more broadly applied. The implementation of non-invasive methods could be guided by the so-called 3Rs principles for animal research (Replace, Reduce, Refine), which were proposed by Russell and Burch more than 60 years ago and have become a part of many animal protection legislations worldwide. However, the process of incorporating the 3Rs principles into wildlife research has been unfortunately rather slow and their importance overlooked. I will provide an overview of the most common research practices and discuss the potential animal welfare issues associated with them. I will then outline guidelines on available non-invasive research alternatives, which can contribute to both improved data collection and minimized impact on animal welfare.

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TRAINING OF ANIMALS AS AN APPLIED TOOL OF STRESS REDUCTION IN PIGS AND THEREFORE IMPLEMENTED REFINEMENT

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Taking samples is often quite stressful for animals used in experimental procedures even when the intervention itself is of minor impairment for the animals since it is commonly done under firm fixation of the animals. This is especially true for blood sampling from the neck veins in pigs as the animals have to be fixated with a steel sling around the upper jaw.

The study was conducted to quantify stress levels during blood sampling in pigs fixated with the sling and to investigate whether training can contribute to stress reduction and therefore be a means of Refinement.

First blood was drawn from twelve female Ellegard Minipigs using the common technique with fixation, which not only serves to prevent the animals from defensive movements or escaping, but also puts the animal's neck in a favourable position for sampling. Over a period of 3 weeks, the animals underwent clicker training to stretch their heads into a plastic tube and to tolerate blood sampling without fixation. A training plan was prepared in advance with action sequences divided into small actions. Finally, the training success was checked and blood was taken once again using the trained method. For the determination of stress levels, cortisol concentrations in saliva and serum were examined by ELISA. In addition, the heart rate of the animals was measured before and during blood collection using sensors attached to chest straps.

The saliva cortisol level of the trained and unfixed animals was significantly lower during and shortly after blood sampling than in the untrained fixed animals. Baseline heart rate was higher in the trained animals before sampling than in the untrained animals. In contrast to the untrained animals, both heart rate and salivary cortisol levels did not increase significantly in the trained animals due to the needle insertion and thus remained significantly lower as in the untrained animals. Serum cortisol did not differ on a group level, but very well in the intraindividual comparison of particularly agitated individual animals.

The stress caused by the common method of blood collection in pigs is essentially caused by the simultaneous fixation in an upper jaw sling. This amount of stress can significantly be reduced with the help of training, i.e. habituation and positive reinforcement. Therefore, training can be seen as an applied means of implemented refinement.

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HOW EVIDENCE IS USED TO DEVELOP POLICY: EXAMPLES FROM THE SCOTTISH ANIMAL WELFARE COMMISSION

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As animal welfare scientists, the development of the evidence base - the research which supports changes in animal husbandry and endeavours to understand what that means for animals - is a key part of our job. The evidence can be conflicting or partial in some cases, but where a strong balance of evidence exists, it may seem inevitable that policy should change and legislation should be introduced to prevent or encourage various practices. Painful management practices, for example, seem to be a good case for this – there is considerable research evidence from multiple approaches that castration, tail-docking, and disbudding cause very significant behavioural, physiological, neurological, and physical changes that suggest this to be very painful and aversive for animals. Yet, many of these practices are still permitted in many countries, without the use of anaesthetics or analgesics. If this quite clear-cut and scientifically uncontested evidence does not appear to influence policy making how much harder might it be where there is little evidence or where there are conflicting views? For scientists, a hierarchy of evidence exists with blinded, well-controlled studies and systematic reviews considered the highest level of evidence, and anecdote and opinion the lowest. However, studies of policy making suggest that this is not always considered of primary importance elsewhere: lobbyists may ignore the hierarchy of evidence, the needs of different actors may need to be balanced, and policy making attempts to draw on the opinions of all stakeholders and co-produce policy outcomes. Animal welfare issues and concerns generate very emotive responses, often on both sides of an argument, and scientific evidence may not keep pace with developments or can appear dry and unappealing in the face of emotional narratives.

To assist in animal welfare policy making by the Scottish Government, the Scottish Animal Welfare Commission (SAWC) was set up in 2020, following a long-term relationship between policy makers in Scottish Government and animal welfare scientists engaged in evidence gathering. SAWC's role is to provide independent evidence and advice to the Scottish Government on animal welfare by gathering evidence and providing a reasoned view of the animal welfare impacts of particular practices or policies. In this presentation I will give some examples of SAWC's work, including how we have dealt with issues where the scientific evidence base is lacking, and how different types of evidence are used.

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HOW CAN WE IMPROVE LABORATORY RAT WELFARE? A SYSTEMATIC REVIEW OF REFINEMENTS TO LABORATORY RAT HOUSING AND HUSBANDRY

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Refining the housing and husbandry of laboratory rats is an important goal. The implementation of any refinement should have a strong evidence base; it is not economical to expend time and money on refinements that have no benefits to rats, and we need to be certain that any changes we make are not detrimental to welfare. However, one swallow does not make a summer, which is why data synthesis is so important before drawing conclusions. We conducted a systematic review of studies investigating potential refinements of housing and husbandry to assess what refinements have, and haven't, been studied, and to assess whether there is evidence to support these refinements in terms of their impact on welfare. This systematic review involved qualitative analysis of 1016 articles; from which 55 results were extracted from preference studies and 3309 results extracted from studies not involving preference testing.

There are several considerations when interpreting the results of studies. The first is the poor reporting of methodology – it is possible that many studies were subject to biases. Secondly, many of the refinements (particularly those relating to housing: cage contents, cage type) co-occurred meaning that, in these studies, it was difficult to tease apart which refinements are most beneficial for rat welfare. The final and most important consideration is that there were a large number of moderating factors, such as age, sex, strain, and photoperiod, and the clearest result of this study is that a one-size-fits-all approach to refinements is not appropriate; different refinements will impact different rats in different ways. It is for this reason, that we recommend that rats are provided with a heterogeneous habitat; they should be provided with a range of areas that vary in size and complexity, a range of substrates, and a range of ways to obtain food.

Bearing these issues in mind, the present review still identified some changes that can be made to improve laboratory rat housing and husbandry. Specifically, there is overall support for the use of cage contents (particularly shelters and running wheels), improved cage types (e.g. bigger with multiple compartments), playpens, a greater number of cagemates, improved handling (which largely involved handling habituation), and foraging opportunities as means to improve welfare. The review also highlights areas where further research is likely to be valuable, including refinements to rat transportation, handling, and the use of training to increase co-operation between rats and laboratory personnel.

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PEBBLE TO THE METAL: A BOULDER APPROACH TO ENRICHMENT FOR *DANIO RERIO***Kyna A Byrd¹, Jacob H Theil², Jerome T Geronimo¹, Emily I Hui¹, David K Chu¹ and Joseph P Garner^{1,3}**¹ Department of Comparative Medicine, Stanford University, California, USA² Campus Veterinary Services, University of California, Davis, California, USA³ Department of Psychiatry and Behavioral Sciences, Stanford University, California, USA*kyna@stanford.edu*

Zebrafish are an established and widely used animal model, yet there is limited understanding of their welfare needs. Despite an increasing number of studies on zebrafish enrichment, it remains unpopular among zebrafish researchers to use in tank environmental enrichment. This is largely due to three perceived concerns when it comes to introducing enrichment into the tank (hygiene, health, and husbandry), although actual evidence for these is sparse. In order to side-step this debate, we tested the potential benefits of enrichments presented outside the tank. Thus, we investigated the preferences and stress physiology of zebrafish with pictures of pebbles placed underneath the tank. Zebrafish in the wild live in slow, murky freshwater environments and camouflage themselves against the bottom and other zebrafish. We hypothesized that zebrafish would show a preference for enriched environments and have lower stress levels than barren housed fish. We conducted two experiments. In the first experiment, we housed zebrafish in a standard rack system and recorded their preference for visual access to a picture of pebbles, with two positive controls: visual access to conspecifics; and group versus single housing. Using a crossover repeated-measures factorial design, we tested if the preference for visual access to pebbles was as strong as zebrafish's well-established preference for social contact. In the second experiment, using a 2x2 factorial design, zebrafish were housed in either barren or pebble-picture enriched tanks for one week, either singly or group housed as a positive control. At the end of the week, both chronic (tank water cortisol level) and acute (whole body cortisol) stress levels of zebrafish were measured. Overall, zebrafish significantly preferred the enriched side of the tank. They did not differ in preference between visual contact with conspecifics and gravel. The strength of preference was significantly influenced by the location of the enrichment and the number of fish in the tank, such that group housed fish only preferred enrichment if it was at the back of the tank, whereas singly housed fish showed no difference of preference depending on where the enrichment was placed. Cortisol levels in fish housed with pebble pictures were significantly reduced, as was cortisol levels in group housed fish. The use of a pebble picture under the tank was as beneficial as being group-housed, and it compensated for single housing. To our knowledge, this is the first study to demonstrate positive benefits of outside-the-tank enrichment for zebrafish in real-world tank conditions.

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EXPERIENCE OF DOG OWNERSHIP NOT MATCHING EXPECTATION IS ASSOCIATED WITH INCREASED PERCEPTION OF UNDESIRE BEHAVIOURS AS 'PROBLEMATIC' IN A UK SURVEY**Ben Cooper, Rachel A Casey, Katharine Anderson, Jane K Murray, Kirsten McMillan, Melissa Upjohn and Robert M Christley**

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Undesired behaviour is the most common reason for dogs <3 years of age to be euthanised in UK vet practices. Further, an estimated 40,000 dogs are relinquished to UK rescue organisations annually because of problem behaviours. Mismatched expectations about dog ownership and real-life experience are potentially important in the development and tolerance of undesired behaviours in dogs. We surveyed 369,389 owners of 440,759 dogs. Owners were asked to rate the frequency of 10 behaviours often considered undesirable on a 5-point Likert scale. Where behaviours were reported a series of follow-up questions included whether behaviours were perceived as problematic. The most common behaviours reported to occur regularly / very regularly were barking at visitors or people outside the house (62.2%) and not remaining calm during fireworks (45.8%). Overall, 21.8% of behaviours were considered a problem to the respondent or family: most common were not walking calmly on the lead (31%) and not staying calm around other dogs (29.9%). A relatively small proportion of owners considered barking at visitors or people outside the house (12.7%) or not remaining calm during fireworks (14.8%) to be a problem.

Respondents were asked to report how a series of 13 aspects of dog ownership varied from expected (less, as, or more than expected). Items were: costs of dog, feeding, vet visits and sundries; time needed for exercise and training; patience to deal with behaviour; damage to garden or home; amount of noise and activity; number of vet visits, and impact on social life. Expectations about dog ownership were compared with owner and dog demographics, frequency of undesired behaviours and whether owners perceived behaviours as 'problematic'. 'More than expected' responses were summated to give an overall 'surprised' score. The mean number of 'surprises' decreased with increasing owner age, number of dogs owned and increasing dog age. The mean number of 'surprises' was lower where owners acquired dogs from rehoming centres, and higher where owners acquired dogs from general or pet selling websites, and as a higher price was paid for their dog. Significant but weak correlations were found between mean 'surprises' and behaviour frequencies. However, logistic regression models suggested that respondents reporting more 'surprises' were more likely to indicate those behaviours which did occur as problematic. These findings suggest that mismatched expectations about ownership may be associated with reduced tolerance of undesired behaviour and could be important in understanding risks for relinquishment and early euthanasia.

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THE EFFECTS OF DIFFERENT ENVIRONMENTAL ENRICHMENT STRATEGIES ON THE SLEEP QUALITY OF LABORATORY FERRETS**Alice MM Dancer¹, Jennifer K Bizley², Maria Díez-León¹ and Charlotte C Burn¹**¹Royal Veterinary College, North Mymms, UK²University College London, Ear Institute, London, UK*adancer@rvc.ac.uk*

Providing laboratory animals with environmental enrichment is crucial for improving animal welfare. In humans, poor sleep quality is associated with poor health and welfare, and this is likely to be similar in other mammals. Consequently, while little studied, sleep quality can be a useful, non-invasive indicator of animal welfare. The benefits of different strategies for providing enrichment, such as novelty versus complexity, are also little studied. Moreover, the effects of habituation to novel enrichment on animal welfare generally, and sleep quality specifically, have not been explored. Here, we assessed the effects of four novel enrichments - soft bed, cardboard box, paper bag, dig-box - and complexity on sleep quality, across three conditions: Day 1 of each novel enrichment being introduced; Day 3 with the enrichment, habituating the ferrets to its presence; and a complex cage environment combining all four enrichments. Observations were made 3h after enrichment provision, when ferrets typically slept. Sleep quality assessment included sleep duration and rate of posture changes during sleep (high rates suggestive of fitful sleep). We found a significant interactive effect of condition with enrichment on time spent asleep (LMM: $F(3)=3.73$, $p=0.018$), with ferrets sleeping more in the habituated soft bed than the novel paper bag (Tukey's post-hoc pairwise comparisons: $\beta=-9.40$, $SE=2.42$, $t=-3.89$, $p=0.009$) or dig-box ($\beta=-9.79$, $SE=2.79$, $t=-3.50$, $p=0.025$). Time asleep was also significantly affected by condition across EE types (LMM: $F(2)=5.98$, $p=0.020$), with significantly more sleep in the complex than the novel condition ($\beta=-1.58$, $SE=0.54$, $z=-2.93$, $p=0.010$), and in the habituated than the novel conditions ($\beta=-0.91$, $SE=0.33$, $z=-2.73$, $p=0.012$). Rate of postural changes during sleep was affected by enrichment (LMM: $F(3)=3.06$, $p=0.04$), showing significantly more posture changes with the dig-box than the paper bag ($\beta=-0.16$, $SE=0.05$, $z=-2.91$, $p=0.02$). Enrichment also significantly affected latency to sleep (LMM: $F(4)=2.97$, $p=0.03$), with longer latencies with the cardboard box than the soft bed or complex environment ($\beta=-1.18$, $SE=0.39$, $z=-3.03$, $p=0.02$; $\beta=-1.24$, $SE=0.40$, $z=-3.03$, $p=0.02$). Our results demonstrate that novelty reduced sleep duration, but seemingly not sleep quality, and that providing a small, enclosed sleeping space (e.g. soft bed or paper bag) may improve sleep quality, regardless of the level of familiarity or complexity of the environment. It is important to recognise that other factors influence sleep, such as insufficient stimulation resulting in boredom. Therefore, alongside provision of suitable restful enrichment we recommend further investigation into longer-term effects of enrichment novelty and complexity on sleep quality.

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IMPROVED WELFARE AND REPRODUCTIVE PERFORMANCE OF PREGNANT SOWS HOUSED IN ENRICHED PENS

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Generally, conventional gestation housing systems for sows do not cater for their need for comfort while resting or to perform investigatory behaviour. This can lead to abnormal behaviour and chronic stress which can potentially impair reproductive performance. This study compared sow performance and welfare in conventional (CON) versus enriched (EN) pens, in a group housing system with full length individual feeding/lying stalls. Sows (n=120, 3 replicates) were mixed into stable groups of 20 unfamiliar animals on d30 post-service (EN n=60; CON n=60). CON pens had fully slatted, concrete floors, 2 blocks of wood and 2 chains suspended within the group area as enrichment. EN pens had rubber mats (EasyFix, Ireland) and a length of manila rope in each feeding stall, and straw provided in three racks, one in the middle and at each end of the pen. Sows were locomotion scored using a visual analogue scale on d30, d57, and d108 of pregnancy. Right and left eye tear staining was scored on d103 of pregnancy (0=no staining; 5=stain extends below mouth line). Reproductive performance measures included the number of piglets born alive, born dead, mummified, and total born. Generalized linear mixed models were used (SASv9.4; PROC MIXED, GLIMMIX) to investigate the effect of pen type on each measure. EN sows had lower locomotion scores on d57 (EN: 14.4 ± 1.86; CON: 20.0 ± 1.86; P = 0.034) and tended to have lower locomotion scores on d108 (P = 0.085) compared to CON sows. They also had a lower right eye tear stain score [EN: 1(1-2); CON: 2(1-3); P = 0.003] and tended to have a lower left eye tear stain score (P = 0.060) than CON sows. Finally, they had fewer piglets born dead (EN: 1.1 ± 0.14; CON: 1.6 ± 0.16; P = 0.021) and mummified (EN: 0.1 ± 0.08; CON: 0.4 ± 0.24; P = 0.001) than CON sows. Providing pregnant sows with comfortable resting surfaces and destructible enrichment to satisfy their behaviour needs seems to reduce chronic stress levels, as indicated by lower tear stain scores in sows from EN pens. Lower locomotion scores of EN sows suggest a protective effect of the rubber mats on sow leg health. Combined, these effects translated into improved reproductive performance of EN sows. Our preliminary results show enriched sow housing to have a positive effect on sow welfare and reproductive performance in contrast to conventional pens.

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**UFAW MEDAL FOR ‘OUTSTANDING CONTRIBUTION TO ANIMAL WELFARE SCIENCE’
AND UFAW EARLY CAREER RESEARCHER OF THE YEAR**

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

This year the winner of the UFAW Medal is **Professor Jane Hurst** ([University of Liverpool, UK](#)).

Previous winners have been:

- [2021 Professor Joy Mench \(University of California, Davis, USA\)](#)
- [2020 Professor Daniel Weary \(University of British Columbia, Canada\)](#)
- [2019 Professor Paul Hemsworth \(University of Melbourne, Australia\)](#)
- [2018 Professor Paul Flecknell \(Newcastle University, UK\)](#)
- [2017 Professor Sandra Edwards \(Newcastle University, UK\) and Professor Jeff Rushen \(University of British Columbia, Canada\)](#)
- [2016 Professor Donald Broom \(University of Cambridge, UK\) and Professor Christopher Wathes \(The Royal Veterinary College, UK\)](#)
- [2015 Professor David Mellor \(Massey University, New Zealand\) and Professor Georgia Mason \(University of Guelph, Canada\)](#)
- [2014 Professor Mike Mendl \(University of Bristol, UK\) and Professor David Fraser \(University of British Columbia, Canada\)](#)
- [2013 Professor John Webster \(University of Bristol, UK\) and Professor Peter Sandøe \(University of Copenhagen, Denmark\)](#)
- [2012 Professor Christine Nicol \(University of Bristol, UK\) and Professor Marian Stamp Dawkins \(University of Oxford, UK\)](#)
- [2011 Professor Ian Duncan \(University of Guelph, Canada\)](#)

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

This year there are two winners of the UFAW Early Career Researcher of the Year Award - **Dr Jessica Martin** ([University of Edinburgh, UK](#)) and **Dr Nienke van Staaveren** ([University of Guelph, Canada](#)).

Previous winners have been:

- [Dr Jamie Ahloy Dallaire \(Université Laval, Canada\) and Jen-Yun Chou \(University of Pennsylvania, USA\)](#)
- [2020 Dr Irene Camerlink \(Polish Academy of Sciences, Poland\)](#)
- [2019 Dr Marisa Eramus \(Michigan State University, USA\)](#)
- [2018 Dr Rebecca Meagher \(University of Reading, UK\)](#)
- [2017 Dr Pol Llonch \(Universitat Autònoma de Barcelona, Spain\)](#)
- [2016 Dr Rowena Packer \(The Royal Veterinary College, UK\)](#)
- [2015 Dr Jasmeet Kaler \(University of Nottingham, UK\)](#)
- [2014 Dr Lisbet Pluym \(Ghent University, Belgium\)](#)
- [2013 Dr Nuno Franco \(Institute of Molecular and Cell Biology, Porto, Portugal\)](#)
- [2012 Dr Charlotte Burn \(The Royal Veterinary College, UK\)](#)
- [2011 Dr Lucy Asher \(University of Nottingham, UK\), Dr Emma Baxter \(Scottish Agricultural College, UK\) and Dr Lisa Collins \(Queen’s University Belfast, UK\)](#)

HANDLING CHANGE – SOME LESSONS LEARNED**Jane L Hurst**

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Since childhood, I have been fascinated by rodents and have been very fortunate to have a long career investigating their behaviour and ecology. Throughout, I have been keen to investigate whether we can also apply a better understanding of these species to improve their welfare in laboratories and to develop less harmful approaches for rodent pest control. It has been very gratifying to see the change to less stressful handling methods for laboratory mice and other rodents resulting from our research, a change that is now becoming widespread around the world. But the time and effort required to achieve this has been far greater than I ever imagined, while my earlier studies exploring other factors influencing laboratory rodent welfare have had much less impact. I will review some examples, including our rodent handling work, to give some insight into the many barriers that need to be tackled along the road to changed practice, and some lessons I have learned along the way. If time permits, I will also give a brief overview of some current challenging research in which we aim to reduce the substantial harms caused by widespread rodent control methods.

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DOGS IN DEMAND: HOW A PUPPY BOOM IS CAUSING A WELFARE BUST**Rowena MA Packer¹, Claire L Brand¹, Zoe Belshaw², Camilla L Pegram³, Kim B Stevens³ and Dan G O'Neill³**

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Demand for puppies in the UK reached unprecedented heights during the COVID-19 pandemic. One in three UK households now owns a dog, with many puppy purchases during the pandemic driven by a desire to improve mental health during this challenging period. With evidence that dog ownership had a buffering effect upon human mental health during the pandemic, the value of dogs to society may also be peaking; however, amongst this period of high-demand, did the commoditisation of puppy-induced happiness put canine welfare in the crossfire? This presentation will explore the complex, growing welfare concerns arising from the surge in puppy purchasing during the pandemic, and its welfare legacy for UK dogs. Data from our recent 'Pandemic Puppies' study of puppies purchased under 16 weeks in the UK, either (i) after the first COVID-lockdown: 23rd March-31st December 2020 (n=4369) or (ii) during the same calendar-period in 2019 (n=1148) offers novel insights into the rapidly evolving UK puppy-buying culture. Although the majority of owners reported that they sought-out a 'trustworthy' breeder (78.9%) who they felt cared for their dogs (84.6%), many owners appeared willing to make compromises, and in some cases, take part in illegal sales, in their desperation to purchase a puppy. Despite the introduction of 'Lucy's Law' in April 2020, prohibiting the sale of puppies away from their place of birth or their mother, 24.9% of puppies bought in 2020 were sold without their mother present, up from 14.3% in 2019, and 29.8% puppies were collected from outside their breeder's property in 2020, up from 5.5% in 2019. Pandemic restrictions resulted in novel ways for sellers to feed demand, including pre-purchase viewings via live video-calls rather than inside breeders' properties (the latter down from 80.6% to 59.6%) and puppies being delivered directly to their new owner (5.5%, up from 1.0%). Such practices may be perceived as convenient by naïve buyers growing accustomed to online-shopping culture, but risk 'Petfishing', unintentional purchases from low-welfare breeders (e.g. unlicensed illegal breeders and illegal importers), attracted by soaring puppy-prices; indeed, one in three puppies bought during 2020 cost >£2000. If high demand for puppies is here to stay, how can it be met whilst still protecting canine welfare? This presentation will discuss future options, including licensed, formalised breeding as a home-business, and large-scale commercial breeding establishments with standards set using welfare science, as alternatives to the current undercover but ubiquitous illegal puppy trade.

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USE OF ENVIRONMENTAL ENRICHMENT FOR REPTILES IN ZOOS ACROSS EUROPE**Alicia Bartolomé, Pau Carazo and Enrique Font**

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Environmental enrichment has been established as an essential tool for the appropriate maintenance of captive animals and enhancement of their welfare. There is an increasing interest in zoo-based enrichment research, although interest in reptile enrichment has lagged behind that for other taxa. Different reasons have been suggested for this neglect, such as the misconception that reptiles are highly tolerant to impoverished captivity conditions. This, along with an obvious disconnect between scientific literature and environmental enrichment practice, hinders our understanding of the value of enrichment for reptiles in zoos. We used a survey to evaluate the current use of environmental enrichment for reptiles in European zoos. 121 zoos (32% response rate) took part in the survey. This was followed by a second, more detailed survey in which we questioned participants about their specific enrichment techniques. We found significant differences between both use of different enrichment types within each reptile group and between reptile groups for each enrichment type. Tortoises and monitor lizards are the most enriched taxa while venomous snakes are the least. The most commonly used enrichments are structural/habitat design and dietary. By contrast, training/behavioural conditioning is rare. A great array of different specific enrichment techniques was reported, with three being represented across all taxa: increasing structural/thermal complexity (e.g. climbing structures, different substrates, thermal gradient), varying feeding presentation/patterns, and introducing enrichment objects (mainly natural objects such as leaves and tree bark). Structural/thermal complexity is the most commonly used form of enrichment except in turtles, tortoises and crocodylians. In turtles and tortoises, cohabitation is the predominant enrichment, while associative learning is mainly restricted to crocodylians and monitor lizards. Chemical enrichment is used almost exclusively with venomous snakes. Finally, food item diversity is among the most frequently used forms of enrichment in every taxa but snakes. Other surrounding questions are also addressed in this study, such as enrichment goals, assessment methods, sources of information for enrichment ideas and whether enrichment for reptiles is considered essential and/or implemented routinely. These results suggest that, although its use is widespread across European zoos, our understanding of enrichment for reptiles is in need of a re-evaluation, as many of the enrichment techniques reported wade the sometimes blurry line between basic husbandry and enrichment.

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USE AND MISUSE OF MEASURES OF WELFARE: WHAT CAN BODY WEIGHT TELL US ABOUT AN ANIMAL'S WELFARE?

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Measurements of body weight and weight loss are used to assess welfare and define humane endpoints. Weight is an objective measure that can be obtained cheaply and accurately, but how does it relate to welfare? A good welfare indicator should be both sensitive and specific. Sensitivity describes the probability that an abnormal weight measurement allows us to diagnose a welfare problem correctly, whereas specificity describes the probability that a normal weight measurement allows us to assume good welfare correctly. To establish sensitivity and specificity of weight measures, we need to decide what constitutes normal weight and how we define welfare. In many species, body weight spans a huge range. Furthermore, many species are healthier under regimens of caloric restriction that individuals would never choose. Thus, weight presents problems for concepts of welfare based on good health and fulfilment of behavioural needs.

Setting these fundamental issues aside, surely rapid or sustained changes in weight are cause for concern? Weight loss can be indicative of starvation due to insufficient food being available to the animal or to underlying pathology. However, changes in weight can also be due to strategic changes in energy intake or allocation that have evolved to optimise fat stores and maximise fitness in the natural environment. For example, a rise in weight might indicate increased anxiety about food insecurity (indicative of negative welfare) and a drop in weight might indicate the removal of a socially dominant bully from a group (indicative of positive welfare).

To conclude, body weight alone has poor sensitivity and specificity as a welfare measure. Rapid changes in weight will often indicate that welfare-relevant changes have occurred, but loss of weight does not necessarily indicate reduced welfare, or gain of weight improved welfare. Weight should be used in conjunction with other indicators of pain or distress.

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BRAIN HEALTH: A NEW FRONTIER FOR ANIMAL BEHAVIOUR AND WELFARE**Alistair B Lawrence^{1,2}, Gerry Thompson³, Neil A Mabbott², Barry W McColl^{3,4} and Sarah M Brown²**¹ Scotland's Rural College (SRUC), West Mains Road, Edinburgh, UK² The Roslin Institute, Royal (Dick) School of Veterinary Studies, University of Edinburgh, Easter Bush, Midlothian, UK³ Centre for Discovery Brain Sciences, Chancellor's Building, Edinburgh, UK⁴ UK Dementia Research Institute, The University of Edinburgh, Edinburgh Medical School, The Chancellor's Building, Edinburgh, UK*Alistair.lawrence@sruc.ac.uk*

The study of the mechanisms that maintain brain homeostasis and contribute to brain health is an area of rapidly expanding knowledge in translational science. We argue here that there is considerable value in applying understanding of brain homeostasis and health to animal welfare. This paper will introduce some of the physical constituents of brain health, with exemplars to demonstrate the relevance of brain health to animal welfare.

Physical constituents of brain health (examples): There has been recent interest in the relationship between hippocampal neurogenesis and animal welfare. However, other non-neuronal cells, tissues and fluids all have potential influences on animal welfare. *Glial cells (astrocytes, oligodendrocytes and microglia)* have inter-related functions crucial to the maintenance of brain homeostasis. All glial cell types are involved in psychological functions including learning, emotions and mood. Under challenge, there is evidence that glial cells can contribute negatively to brain homeostasis, for example contributing to the development of chronic anxiety and depression. The brains' microvascular system permeates into brain tissue providing the metabolic needs of neurons and other cells; the *blood-brain-barrier (BBB)* forms a barrier around these capillaries limiting the passage of molecules into the brain. There is evidence that challenges (including psychosocial stress) can increase permeability of the BBB permitting passage of inflammatory molecules into the brain affecting neural functioning and leading to onset of anxiety and depressive like symptoms.

Relevance of brain health to animal welfare: *Sickness behaviour* is a well-described example of how disease processes lead to perturbation of brain homeostasis, with direct effects on psychological functions and animal welfare. *Repeated social defeat (RSD)* studies in mice have revealed bi-directional brain-body interactions in the establishment of the emotional and cognitive consequences of chronic social stress; for example, RSD may result in inflammatory immune cells entering the brain through breakdown of the BBB enhancing pro-inflammatory brain mechanisms that contribute to chronic anxiety. There is also a substantial literature on the positive effects of *environmental enrichment (EE)* on brain health (including on glial cell function and BBB integrity). Evidence suggests that many of the beneficial effects of EE are *activity-dependent* involving exercise and learning with significant implications for developing EE interventions to improve animal welfare.

In conclusion, applying the concept of brain health to animal welfare opens up an expanding knowledge base and range of techniques to understand how brain homeostasis is maintained and perturbed in small and large animals, with significant potential for yielding interventions to improve animal welfare.

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DOES COMPLEXITY OF AVIARY DESIGN AFFECT HIPPOCAMPAL PLASTICITY IN LAYING HENS?**Matthew J Craven^{1,2}, Jonathan H Guy^{1,2}, Timothy Boswell^{1,2} and Tom V Smulders^{2,3}**¹ School of Natural and Environmental Sciences, Newcastle University, Newcastle Upon Tyne, UK² Centre for Behaviour and Evolution, Newcastle University, Newcastle Upon Tyne, UK³ Biosciences Institute, Newcastle University, Newcastle Upon Tyne, UK*m.j.craven1@ncl.ac.uk*

In recent years, the egg industry has shifted towards cage-free housing systems. While this is generally believed to improve the welfare of laying hens and is popular with consumers, there are many different kinds of cage-free systems in use, each presenting different challenges to hens. This study compares two different free-range housing designs: flat deck (a large flat floor with one raised area containing perches) and multi-tier (with 5 tiers that birds are free to move between). We hypothesised that birds housed in the lower complexity flat deck system would experience higher levels of chronic stress than those housed in the more complex multi-tier aviaries, in which they had greater opportunity to explore and therefore higher cognitive stimulation.

Pullets (n=12) were sampled from a rearing site with a flat deck design at 14 weeks of age. These were culled, then one hemisphere from the brain of each bird was collected and fixed. When the remaining birds reached 16 weeks of age, some were moved into flat deck adult housing, and some were moved into multi-tier housing. These two aviaries were geographically close to one another and were both managed by The Lakes Free Range Egg Company. The birds were allowed to settle in their new aviaries for 8 weeks, then 12 average birds were randomly selected from each group. The selected birds were culled at 24 weeks of age, and again, one hemisphere of each brain was collected and fixed. Brains from all 3 groups (pullets, flat deck, multi-tier) were cut to 50µm coronal sections which were immunohistochemically stained to visualize doublecortin (DCX), a marker of neural plasticity. We counted stained cells in the caudal and rostral hippocampal formation (HF) in order to quantify DCX⁺ cell density, which has previously been found to be decreased in the avian caudal HF in response to a variety of chronic stressors. We expected that DCX⁺ cell density in the rostral HF, which has a role in spatial memory, would be significantly higher in the multi-tier group because of greater cognitive stimulation.

We compared DCX⁺ cell density between birds from the rearing site and each type of adult housing. There were no significant differences in DCX⁺ cell density among the housing groups. The difference in complexity between the multi-tier and flat deck aviaries was therefore not great enough to have a detectable effect on hippocampal plasticity and any welfare differences would be minimal.

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FEATHERS, FEET, AND FRACTURES: UNDERSTANDING CONNECTIONS BETWEEN INJURIES TO IMPROVE POULTRY WELFARE**Nienke van Staaveren**

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Efforts to improve animal welfare are multi-faceted due to the interconnectedness of behaviour and health, the influence of environmental conditions, and the variability in how individual animals may experience welfare. In poultry production, the occurrence of injuries can negatively affect animal welfare. Injuries refer to disturbances of the structure or function of any part of an animal. Prevention or treatment of injuries are important provisions to minimize pain, promote physical functioning, and ensure good animal health and welfare. Injuries can be caused by animal behaviour, physiology, housing and/or management. Poultry are prone to different types of injuries to the feathers, skin, muscle, or bones. Challenges with, for example, injurious pecking, footpad dermatitis, or keel bone damage remain a major concern in commercial poultry production and have implications for different biological processes including thermoregulation, flight, locomotion, or communication in poultry. While there is some evidence that injuries can heal when causative factors are removed, this is not always possible in practice and could cause potentially painful injuries to persist if not otherwise treated. In addition to the injuries themselves being important welfare issues, they also can provide access points for secondary infections. Furthermore, several of these injuries are suggested to be associated with one another. Co-occurrence of injuries can be due to shared risk factors in the housing and management of the flock or characteristics that make individual birds more likely to become victims, and injuries potentially exacerbating one another. Information on co-occurrence of injuries is relatively scarce but could shed light on biological connections and could influence human decision-making in the treatment or management of animals under their care, thereby impacting the overall welfare of poultry. Herein, we will discuss the co-occurrence of injuries in poultry with a particular focus on injurious pecking, footpad dermatitis, and keel bone damage as well the implications these injuries may have on bird behaviour, physiology and welfare.

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CHALLENGES OF ANIMAL WELFARE ASSESSMENT FOR CONTROLLED ATMOSPHERE KILLING METHODS

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When assessing the animal welfare impacts of a killing method, two fundamental questions must be answered: (1) how long does it take for the animal to lose consciousness; and (2) what affective states are likely to be experienced until this point? These questions are particularly relevant for killing methods which involve a gradual transition to unconsciousness such as exposure to modified environments, where the animal has the potential to experience negative affective states such as pain and anxiety during induction (as opposed to rapid-acting methods such as electronarcosis). Time to loss of consciousness (LOC) is often measured indirectly by loss of posture and interpretation of spontaneous behaviour has been the basis of assessment of the animal welfare impacts of various killing and slaughter methods. Such behavioural indicators are non-invasive, accessible, and practical in challenging environments such as slaughter plants. They are also largely transferrable for immediate application by a range of users (e.g., veterinarians and technicians). However, their limitations relate primarily to difficulty of interpretation relating to the lack of understanding of underlying motivational drive and assumptions about the conscious state of the animal. The use of electroencephalography (EEG) provides a more direct measure of vigilance state, and has evolved from purely visual interpretation of EEG trace to complex spectral analysis providing objective parameters to describe and characterise brain state during the killing process. While this approach has aided identification of time to LOC, EEG outputs must still be interpreted, and care is required as different agents influence electrical brain activity in different ways. Nevertheless, when used in unison with spontaneous behaviour, EEG measures can validate behavioural indicators of LOC, as well as providing insight into the sliding scale of cognitive impairment prior to LOC, improving our ability to interpret the spontaneous behaviours observed. Additionally, a detailed, mechanistic approach to ethogram construction (avoiding consequential descriptions) may be useful, promoting objectivity and avoiding confounds arising from an observer's interpretation of motivational drive (e.g. an escape attempt versus a vigorous righting reflex). The use of pharmacological interventions adds further clarity, by identifying behaviours which may be suppressed by the use of analgesic or anxiolytic agents, inferring the experience of pain and anxiety. Their value is highly dependent on rigorous validation of the agents in the study species, as well as considering their wider physiological and behavioural effects. Finally, recent attempts to answer question two (above) have involved the implementation of innovative and theoretically sophisticated behavioural paradigms. These challenging approaches aim to directly assess the subjective mental experiences of animals during killing, using as operant exit and conditioned aversion paradigms. They require animal training and may be affected by cognitive impairment, but hold promise to provide uniquely animal-centric data. Together, the approaches described here represent continuous efforts to improve our capacity to more fully and objectively understand the end of life experiences of animals, a crucial endeavour to protect welfare in a wide range of animal use contexts.

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**METABOLOMICS AS A PROMISING NEW APPROACH IN ANIMAL WELFARE SCIENCE:
CHARACTERISING THE METABOLOMIC FINGERPRINT OF EXPOSURE TO ACUTE STRESS IN A
PIG SALIVA MODEL**

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Exposure to intensely stressful life events can have both acute and chronic consequences for animal welfare. To understand the damaging effects of stress on welfare, and to develop interventions to alleviate these, we urgently need improved, objective methods to measure the impacts of stress exposure. Single biomarkers, including stress hormone levels (cortisol/corticosterone) and telomere length, have shown some promise in this regard, but are insufficiently specific or sensitive for assessing individual welfare. Moreover, welfare is a complex construct, involving both physical health and psychological well-being, that is unlikely to be captured with any single biomarker. We hypothesise that one solution to this problem is to use a triangulation approach, whereby multiple biomarkers, each with its own strengths and weakness for welfare assessment, are measured simultaneously to yield a specific fingerprint of the impact of stress. Untargeted metabolomics uses Ultra-High-Performance-Liquid-Chromatography coupled with High-Resolution-Mass-Spectrometry (UHPLC-HRMS) to measure thousands of metabolites (small molecules) in each individual simultaneously. While metabolomics is a rapidly developing field in human biology, it has not yet been extensively used in animal welfare research. Potential advantages of the approach include the ability to analyse non-invasively obtained samples, such as saliva, urine and hair, and the increased likelihood, compared with other omics approaches, that findings based on small molecules will translate successfully across species. Our objective was to develop optimized methods for sample extraction, UHPLC-HRMS data acquisition and analysis and use these to identify the metabolomic fingerprint of exposure to an established acute stressor in pigs. Pooled saliva samples from a population of 200 pigs were obtained non-invasively using cotton ropes provided for enrichment. Samples were collected at two time points: (1) in the familiar environment, as a baseline (n=31); and (2) 24 hours after transport, regrouping and a night at the slaughterhouse (n=32). Metabolites were extracted by UHPLC-HRMS using four parallel extraction and acquisition procedures for broader coverage. Several thousand metabolites were detected in four analyses (9327, 9188, 2518 and 1165 metabolites). For more than 30% of these, the relative concentration was significantly down- or upregulated, indicating a 2.0-333.3 fold-change between the time points before and after stress (Adj P<0.05). Physiological changes were identified in amino acids, B-vitamins, phospholipids, hormones, and metabolites related to beta-oxidation. The results reveal the metabolic pathways altered by stress and uncover novel biomarkers for further exploration. Overall, our results highlight the potential of metabolomics as a promising method in animal welfare research.

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ANIMAL WELFARE RISK ASSESSMENT OF DAIRY CATTLE TRANSPORTED TO SLAUGHTERHOUSES

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Transport may lead to severe animal welfare consequences and cull dairy cattle are particularly at risk due to often existing health disorders prior to transport, especially lameness and low body condition score (BCS). Even though the Transport Regulation (Council Regulation (EC) No 1/2005) specifically describes a few categories of animals that are unfit for travel, the Regulation does allow transport of “slightly ill or injured animals if the transport does not cause additional suffering” but without further specification. Enforcement is hampered by the open norms of the Regulation.

We studied the legal base of the animal welfare regulations for transport of cattle, the enrolling responsibilities for animal welfare for the competent authority and for sector representatives, the actual implementation of official controls under field situations, numbers of animals and routes of transport. Study methods consisted of a literature review and documentation collection, field data collection and analysis, and interviews. The risk assessment (RA) was performed following the principles of the risk assessment methodology from EFSA and consisted of hazard identification, hazard characterization, exposure assessment and risk characterization.

We conclude that between 25-70% of the Dutch dairy cows on transport are free of abnormalities; between 30-75% of the animals show abnormalities; and between 0.05-5% of the animals are unfit for transport. The main welfare consequences were characterized as bruises and injuries, slipping and falling, lameness, general malaise, exhaustion, being overrun, terminal suffering or death. The figure below summarizes the welfare consequences for transport, expressed as the welfare impact (=severity x duration of welfare consequence) versus estimated numbers of animals that were affected from the total of 359.181 adult Dutch dairy cattle that were transported to slaughterhouses in 2020. In conclusion, a significant number of adult dairy cattle are exposed to transport of long duration which may lead to medium to high impact animal welfare consequences. Additionally, a significant number of adult dairy cattle that are slightly ill or injured are exposed to transport conditions for which they are unfit, opposing the Regulation. In order to reduce animal welfare risks we recommend how transport restrictions can be imposed on duration and length for adult dairy cattle and how loading and unloading at stops or assembly centres should be avoided for cattle at risk. We propose elements for an assessment protocol to assess fitness for travel of adult dairy cattle in the field and relate assessment outcomes to particular transport routes.

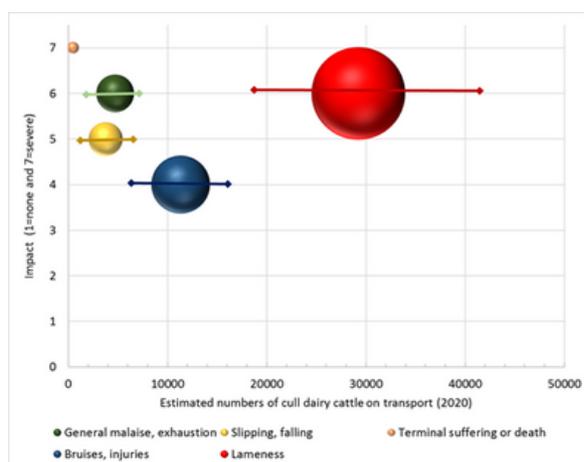


Figure. Relative risk of main welfare consequences of cull dairy cattle during transport, expressed as welfare impact (combination of severity and duration) and population at risk (as mean with ranges out of total population in 2020 of 359.181 cull dairy cattle in The Netherlands)

The size of the spheres illustrates the number of animals

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DEVELOPING A VISUAL ATTENTION BIAS TEST IN HORSES**Sarah Kappel¹, Marco A Ramirez Montes De Oca², Sarah Collins¹, Katherine Herborn¹, Mike Mendl²
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Negative affect can modulate how animals attend to competing emotional stimuli, e.g. images of threatening vs. non-threatening faces of conspecifics, similar to the heightened attention to threat observed in anxious humans. We aimed to develop a visual attention bias (AB) test in horses by measuring their visual attention to images of conspecifics showing facial expressions associated with negative (social threat), comparatively more neutral (at rest) and positive (food anticipation) situations. As in humans, we expected horses with lower welfare (i.e. negative affect) to have an attention bias towards the negative stimuli.

Forty-four horses from three riding schools (39% female, 13.84±5.92 years) were individually presented with two images simultaneously on two separate screens. Horses were presented with positive/neutral, positive/negative, and negative/neutral images pseudo-randomly chosen from images of four unfamiliar conspecifics. Combinations were shown twice to each horse, and which screen each image was presented on was counterbalanced across the two presentations. Attention duration was measured based on head turn behaviour towards the stimuli recorded until the horse turned its head away (total duration, and proportion of time looking at stimulus). Trials in which horses showed no viewing preference by keeping their heads straight for the minimum trial duration (20s) were excluded from the final data analysis. We assessed welfare via a range of direct (health, behaviour) and indirect (social, housing, feeding management) indices derived from published protocols. Total attention duration difference was analysed with Wilcoxon tests (due to non-normality). Effects of stimulus type (i.e. negative/positive/neutral), side (left/right), facility, and welfare score on attention were determined with generalised linear mixed models.

Contrarily to the predictions, all images were attended for a similar amount of time (median (seconds), Q1-Q3: negative/neutral: negative=9.6, 0.0–22.6, neutral=7.9, 3.1–17.2, $V=471$, $p=0.4$; negative/positive: negative=8.9, 4.3–23.3, positive=13.7, 2.5–20.8, $V=410$, $p=0.8$; positive/neutral: positive=10.3, 4.8–21.3, neutral: 10.6, 1.4–17.0, $V=435$, $p=0.5$). Lower welfare levels predicted shorter attention to the negative stimulus ($X^2_{1} = 4.56$, $p=0.03$), possibly reflecting threat avoidance similar to findings in macaques. The three riding schools significantly differed in how long horses attended to both stimuli combined ($X^2 = 50.03$, $p<0.001$) suggesting that variations in test conditions might influence attentional processing of visual cues, an important consideration for conducting cognitive tests at different facilities. We discuss the further methodological investigation required before using AB as an indicator of affective valence in horses (e.g. suitability of emotional cues, including sensory processing; effect of conspecific familiarity; individual difference in experience and social motivation).

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**PROVIDING A “PRIORITY LANE” INCREASES VISITS TO THE MILKING ROBOT IN DAIRY COWS
MANAGED IN AN AUTOMATIC MILKING SYSTEM****Francesca Johansen^{1,2,3}, Gareth Arnott¹ and Stephanie Buijs²**¹Queen’s University Belfast, Belfast, UK²Agri-Food and Biosciences Institute, Hillsborough, UK³AgriSearch, Hillsborough, UK*Fjohansen01@qub.ac.uk*

Cows within automatic milking systems (AMS) are not herded to a parlour for milking, but instead voluntarily visit a milking robot. As such, voluntary behaviour is essential to the optimal functioning of these systems. The autonomy provided to the cows by permitting voluntary visits is thought to provide a welfare benefit. However, not all cows visit the robot frequently enough to keep productivity high. Especially lame cows or cows with low social ranking are at risk of a low visit frequency, as these have a reduced ability to compete for access to the robot (which can only milk one cow at a time). This means that such cows must adhere to the milking schedules of more dominant animals, thereby reducing autonomy. Strategies which increase ease of access to the robot for these “high-risk” groups of cows (lame, low-ranking) may mitigate these issues.

We evaluated the effects of a ‘priority lane’ on visit frequency of lame and/or low-ranking cows managed in an AMS. The hypothesis stated that cows with access to the priority lane would visit the robot more frequently. Data were obtained during a 5.5-week period from 24 early lactation cows recently transferred to an AMS. These 24 cows were either lame (i.e., mobility score ≥ 2) or low-ranking (i.e., lowest third of herd). The cows were matched into pairs of equal social dominance ranking and mobility score. Within each pair, one animal was allocated to the PRIORITY group (could access priority lane), and one was allocated to the CONTROL group (no priority access). 18 additional cows were included in the herd to provide competition for robot access. In line with our hypothesis, PRIORITY cows had a higher visit frequency than CONTROL cows (7.81 ± 2.47 SD vs. 5.657 ± 1.74 SD visits daily, $p=0.03$). However, visit frequency was high in both groups, likely due to the relatively low number of animals sharing the robot. As AMS are programmed not to milk cows that return too soon after their previous milking, this resulted in a higher number of PRIORITY cows making non-milking visits than CONTROL cows ($p=0.03$). The number of milking visits did not significantly differ between the groups ($p=0.08$). In conclusion, priority access increased visit frequency in “high-risk” cows, which may affect the number of daily milkings favourably under conditions of greater competition.

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TICKLE MY BRAINS: PLAYFUL INTERACTIONS AFFECT CEREBRAL NEUROTRANSMITTER RECEPTORS**Vincent Bombail^{1,2}, Felix Effah³, Lea Kreichati¹, Goharika Paladugu³, Gabriel Auraujo Costa³, Alistair Lawrence² and Alexis Bailey³**¹INRAE, Université Paris Saclay, France²Animal Behaviour and Welfare Group, Scotland's Rural College, Edinburgh, UK³Pharmacology Section, Saint George's University of London, UK
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Rat tickling, or playful handling, is a heterospecific interaction where a human hand playfully interacts with a rat. This activity simulates juvenile rat “rough and tumble” play and has been shown to improve animal-human interactions. Rat tickling can be used to investigate the impact of positive emotional states in affective neuroscience and has also been proposed as an enrichment for laboratory rats. Both potential uses of tickling are intricately linked; characterising the physiological correlates of having positive experiences should inform experimenters on the potential impact of tickling as an enrichment.

In this study we aimed to investigate the impact of tickling on behavioural markers and brain neurotransmitter receptor levels. We performed a tickling protocol that involved tickling and pauses, and we did not carry out pinning of rats, as we have previously hypothesised this may be perceived as aversive by some individuals. Rats (8 controls, 8 tickled) were treated for 8 days, a time scale consistent with the appearance of brain receptor effects in response to other pleasant stimuli, such as psychotropic drugs. We recorded UltraSonic Vocalisations (USV, markers of positive affect) and behaviour, during anticipation of tickling and tickling pauses. We assessed the number of behavioural transitions, indicative of arousal during anticipation of a rewarding experience. At the end of the experiment, brains were dissected and frozen. We performed radioactive ligand binding on brain sections, to investigate the abundance of brain receptors for oxytocin, dopamine (D2 receptor) and opioids (mu opioid receptor).

USV production was higher in the tickling group, indicating increased rat enjoyment, during tickling pauses but not during anticipation phases. Behavioural transitions were increased in the tickling group for both the anticipatory and tickling pause phases. This suggests a decorrelation between the behavioural marker of arousal and the expression of positive affect through USV. Analysis of the 14 known USV types revealed that, if the production of most USV types increased over time, the greatest increase was for ‘multistep’ USVs. Quantitative receptor autoradiography in 18 brain regions revealed no impact of tickling on oxytocin and D2 receptor. Mu opioid binding was higher in the *nucleus accumbens*, a region associated with reward processing. This data confirms earlier pharmacological reports by others, on the role of opiates in the ontogeny of play behaviour. Characterising the physiological impact of tickling should inform us on the physiology of positive affect and contribute towards improving uptake of the practice.

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BRAVE BREEDS AND BRAINS UNDER THE SPOTLIGHT: HOW DO GENETICS AND LIGHTED INCUBATION IMPACT YOUNG LAYING HENS STRESS RESPONSIVITY?

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A promising intervention to improve chicken welfare is the presence of light during incubation. More specifically, a cycle alternating green light and darkness phases decreased fearfulness in broilers. The impact on laying hens, however, is not known. We thus investigated the effects of lighted incubation on stress sensitivity in two common layer hybrids: ISA Brown and Dekalb White. The latter is known to be flightier than the former.

Half of the eggs of each hybrid were incubated in standard dark conditions and the other half in a green light:dark cycle of 12:12 throughout the incubation, resulting in a 2*2 design. Because the developmental stage has a major impact on the ability to cope with stressors at adulthood, our observations focused on the rearing phase. To measure fearfulness, the group behaviour response to a novel object was monitored during live observations. To measure long-term HPA-axis activity, individual corticosterone levels in feathers at 17 weeks old were determined with an ELISA technique.

We expected the light-incubated chicks to show lower fearfulness and HPA-axis activity than dark-incubated chicks. In addition, we expected brown chicks to show lower fear responses than white chicks. Finally, stronger effects of the incubation treatment were expected in white chicks – given their higher stress sensitivity and a better light transmission through white eggshells compared to brown.

There was no significant difference in fearfulness during the novel object test between the incubation treatments or the hybrids (N=120, parametric survival regression model, $p \geq 0.4$). Further investigation through video recordings is required to reach a sufficient statistical power and draw reliable conclusions.

The preliminary analysis of corticosterone did not show any significant effect of the hybrid or the incubation treatment (generalised linear model, $N = 20$, $p \geq 0.18$). However, a descriptive analysis shows lighted incubation may have decreased corticosterone levels in the primary feathers n°2 of both the hybrids, which would confirm our hypothesis of lighted incubation to lower HPA activity. Processing of additional feathers is, however, required to draw any conclusion.

Our research shows no effect of lighted incubation on laying hen fearfulness and HPA-axis activity. Hybrid differences were not found here neither, though they were found in behaviour tests not included in this report. Later in the project, a video tracking technology coupled with ArUco markers for identification will enable us to extract individual data from the novel object test, and assess the link between behaviour and physiology.

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MAKING THE MOST OF OPPORTUNITIES – THE EFFECT OF EARLY ENVIRONMENTAL CHOICE ON LATER SUCCESS IN LAYING HENS**Lena Skånberg¹, Regine V Holt², Ruth C Newberry², Inma Estevez^{3,4}, Nicolas Nazar⁵ and Linda J Keeling¹**

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Early experiences may impact an individual's potential to make the most of future opportunities by influencing exploration, spatial skills and learning abilities. These traits are needed by laying hens when transferred to adult laying facilities, especially those with complex aviary housing systems. The aim of this study was to identify specific rearing conditions that could promote these traits. During Early-rearing (Day 1-Week 4), 364 one-day-old laying hen chicks were housed in one of 16 pens corresponding to two pen environments: "Multi-Choice" (four litter and perch types) or "Single-Choice" (one litter and perch type). During Mid-rearing (Week 5-15), half of the groups changed to the opposite environment, resulting in four treatment combinations. At Week 16, all groups were moved to standard pens in the laying house. To explore the effects of these four treatments, two types of behavioural tests were performed, both involving an initially novel situation and repeated opportunities to find mealworms as rewards. Opportunity test 1 (Week 9-10) was carried out in a novel hole board arena with one mealworm in each of 9 cups and birds were tested alone and in groups of three. Opportunity test 2 (Week 14 and 17) was carried out in the home pen and involved a human positioned close to a novel bowl containing hidden mealworms. The birds' behaviour and use of novel resources during the first hour when moved to the laying pens and weight gain (Week 16-27) were also recorded. Birds with "Multi-Choice" during Mid-rearing ate proportionally more worms in both opportunity tests ($P < 0.001$; $P = 0.005$, GLM) and gained more weight during the laying phase ($P < 0.01$, LMM) compared to birds with "Single-Choice". Irrespective of Mid-rearing environment, birds with "Multi-Choice" during Early-rearing used the perches sooner ($P = 0.03$, LM) after being transferred to the laying house whereas birds who only experienced "Single-Choice" during rearing were slower to move and explore the laying pen than all other treatments ($P < 0.05$, GLM). In conclusion, providing variation within resource types is a straightforward way to increase environmental complexity and this early exposure boosted birds' abilities to gain rewards and use novel resources. Furthermore, the provision of this variation during the first four weeks of life seems to have a long-term effect on ability to exploit three-dimensional space.

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Scientific Programme:

- Workshop: Measuring Behaviour Better
- Debate Forum: Animal Welfare Labelling of Food Products



WORKSHOP: MEASURING BEHAVIOUR BETTER**Melissa Bateson**

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'Measuring Behaviour Better' is a workshop to help animal welfare scientists improve their skills at recognising poor science and ultimately do better science themselves. In this workshop, you will:

- Learn to spot confounds and biases arising from poor study design;
- Learn to spot common errors in data analysis and interpretation;
- Learn to report a study more transparently;
- Practice designing an improved version of a study within stated constraints.

The first half of the workshop is focussed around critiquing a fictional paper especially written to illustrate a number of errors and omissions common in animal welfare research studies (as well as other areas of behavioural and biomedical research on animals). You will use the ARRIVE guidelines (Animal Research: Reporting of In Vivo Experiments) author checklist to help you identify these mistakes. Your understanding of the topics covered will be tested via multiple-choice questions embedded in the workshop (answered anonymously) and there will be opportunities to ask questions.

In the second half of the workshop, you will collaborate to design an improved version of the experiment described in the paper. You will be divided into small groups for this task, and each group will have to work under a different set of constraints chosen to simulate realistic scenarios faced by researchers (e.g. limited time, limited space, limited staff time, limited animals, etc). A subset of groups will be chosen to present their improved designs to the workshop. Together we will discuss the pros and cons of alternative approaches to the experimental design.

The skills developed in this workshop are central for anyone involved in designing and conducting studies on live animals. They are also important for anyone involved in reviewing the work of others, including supervisors, referees and journal editors. The overall aim of this workshop is to improve the quality of data collected and ultimately make animal welfare science more reproducible.

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Measuring Behaviour

An Introductory Guide

4th edition

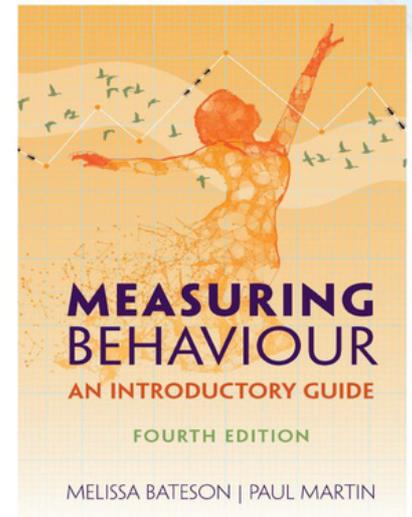
Melissa Bateson

Newcastle University

and **Paul Martin**

Measuring Behaviour is the established go-to text for anyone interested in scientific methods for studying the behaviour of animals or humans. It is widely used by students, teachers and researchers in a variety of fields, including biology, psychology, the social sciences and medicine. This new fourth edition has been completely rewritten and reorganised to reflect major developments in how behavioural studies are conducted. It includes new sections on the replication crisis, covering Open Science initiatives such as preregistration, as well as fully up-to-date information on the use of remote sensors, big data and artificial intelligence in capturing and analysing behaviour. The sections on the analysis and interpretation of data have been rewritten to align with current practices, with advice on avoiding common pitfalls. Although fully revised and revamped, this new edition retains the simplicity, clarity and conciseness that have made *Measuring Behaviour* a classic since the first edition appeared more than 30 years ago.

Acknowledgements; 1. Introduction; 2. Science and Truth; 3. Choosing a Research Question; 4. Designing a Behavioural Study; 5. Ethics and the Law; 6. Defining Behavioural Metrics; 7. Recording Methods; 8. Recording Technology; 9. Individuals and Groups; 10. Measurement Quality; 11. Data Analysis; 12. Interpreting and Communicating Findings; References; Index.



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METHOD-OF-PRODUCTION LABELS: A WELCOME TREND FOR FARM ANIMAL WELFARE?**Frank AM Tuyttens¹, Antoni Dalmau², Mara Miele³, Isabelle Veissier⁴, Bryan Jones⁵
and Harry J Blokhuis⁶**

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Melle, Belgium

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Uppsala, Sweden

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There is a surge of initiatives to provide animal-sourced food with method-of-production (MoP) labels. MoP-labels aim to facilitate the uptake of production standards that are, or are perceived to be, more sustainable and animal-friendly. These standards may include e.g. a maximum stocking density, a ban on mutilations, or access to an outdoor area, and often increase production costs. The reasoning is that farmers will be compensated for these higher costs by the willingness of an increasing proportion of consumers to seek out and pay premium prices for MoP-labelled food. The aim of this contribution is to reflect on whether this increasing interest in MoP labels is a welcome approach for improving animal welfare in livestock farming. For many animal welfare scientists it may feel as back to square one as most MoP-provisions include so-called resource-based instead of animal-based measures of animal welfare. Since the Welfare Quality project (2004-2009) in particular, scientific consensus had been growing that animal welfare is most directly assessed by using animal-based indicators, whereas resource-based indicators imply an increased likelihood of better/worse welfare. Resource-based provisions, however, are generally more feasible to audit cost-efficiently and give farmers more security about whether or not they comply with MoP-standards. Moreover, many consumers have limited knowledge about the actual welfare problems in animal agriculture and commonly associate certain provisions (e.g. straw for pigs, pasture for cattle) with superior welfare. By focussing on such resource-based provisions, MoP-labels thus readily accord with consumer perception. However, erroneous perceptions about the link between certain provisions and true animal welfare state might be reinforced if these provisions are included in the MoP-label. MoP-provisions detailing how the animals are to be housed and managed do not guarantee a certain level of animal welfare. Indeed, true animal welfare status is the outcome of complex interactions between stockperson(s), housing environment and the animals. If this match is bad, the actual animal welfare status might be poor despite compliance with all MoP-provisions. If such cases will be revealed to the public, the consumers' confidence in such MoP-labels will wane swiftly. Another concern, is that within MoP-labels competition to produce at the lowest cost will continue without financial incentives to further improve animal welfare. The full potential of each production system will thus not be realised if such MoP-labels are not complemented with animal-based measures or other incentives for farmers to keep on striving to improve animal welfare.

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PROS AND CONS OF ANIMAL-BASED MEASURES IN ANIMAL WELFARE LABELLING**Siobhan Mullan**University College Dublin, Ireland
siobhan.mullan@ucd.ie

Promoting transparency for consumers has risen up the societal and political agenda in recent years, and many countries, including the UK, are actively considering ways to achieve this through voluntary or mandatory welfare labelling. Whilst animal-based measures (welfare outcomes) are considered to give a more direct insight into animal experiences, input-based assessments have so far been the basis for most existing labelling terms such as 'Free range' eggs, 'Outdoor bred' pork, or 'Pasture fed' beef. Importantly, for eggs in the UK at least, method of production labelling was the catalyst for a shift in consumer purchasing behaviour towards a system (free range) whose principles they supported.

Incorporating animal-based measures into animal welfare labelling comes with some significant challenges currently. Firstly, there is the decision about which measures to include- is a single 'iceberg' measure sufficient or are a suite of measures required to provide a more holistic evaluation of welfare? Secondly, farm level assessments are often time-consuming, resource intensive and come with some practical challenges. Thirdly, communicating nuanced composite welfare assessments to consumers is not straightforward, and has so far been boiled down to a small number of categories.

Nevertheless, there are opportunities to further embrace welfare outcome assessments as part of labelling requirements. Strengthening the existing procedures currently employed by farm assurance schemes for monitoring welfare outcomes could be a useful mechanism to feed into a welfare label. Automated assessments may provide answers to some of the feasibility challenges. Starting with a method of production labelling system based on 'realistic welfare potential' in the first instance seems the most feasible way forward at present. Increasingly augmenting such a system with welfare outcome safeguards should be the ultimate aim.

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THE ROLE OF THE CONSUMER IN ANIMAL WELFARE LABELLING**Alistair B Lawrence^{1,2}**¹ Scotland's Rural College (SRUC), West Mains Road, Edinburgh, UK² The Roslin Institute, Royal (Dick) School of Veterinary Studies, University of Edinburgh, Easter Bush, Midlothian, UK*Alistair.lawrence@sruc.ac.uk*

The initial period of the modern animal welfare debate was characterized by the use of legislation to prevent animal cruelty and to implement minimum legal standards for example in relation to housing conditions. The early 2000s saw governments shift away from a legislation only approach towards what could be referred to as a policy of 'shared responsibilities', including a recognised role for consumers and importance of the choices they make in their food purchases. At the same time various approaches to farm assurance were being developed. Whilst the primary aim of farm assurance was to increase consumer confidence in food safety, it opened up possibilities for informing consumers about a range of food qualities and attributes including those related to ethical and sustainable food production (see other talks in this workshop).

The aim of this short presentation is to acknowledge the important role that consumer choices can play in improving animal welfare, but at the same time to be aware of potential limitations to demand-side solutions in resolving intransigent farm animal welfare issues.

There are cases where it could be argued that the market has worked to reduce market failure and lead to improved animal welfare, e.g., the substantial increase in non-caged egg production. It is also possible to argue that in other situations improved labelling or information transfer to consumers could help close the attitude-consumer behaviour gap. It is further possible that more radical changes such as introduction of trading schemes for 'animal welfare units' could help further in reducing farm animal welfare market failures.

However, there may be limits to consumer-driven approaches to improving farm animal welfare; a recent study concluded that consumer demand alone could not be expected to secure improved pig welfare suggesting the need for the use of other market-driven approaches. It may also be an appropriate point to return to considering the role of governments in farm animal welfare improvements. For example, a recently published food strategy addressing major issues facing the food system proposes an interventionist strategy involving government and business as: 'Transforming the food system will require change at all levels: structural, cultural, local and individual.' In conclusion we perhaps should be cautious in putting too much emphasis on individuals' behavioural change if our aim is to make significant improvements to farm animal welfare.

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Yumi Yamanashi, Yuko Ikkatai, Rie Akami, Nahoko Tokuyama, Moe Honjo and Duncan Wilson (*Kyoto City Zoo, Kyoto University, Kanazawa University, Japan Monkey Centre and Nagasaki University, Japan*)

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EVIDENCE FOR MULTIPLE TEMPERAMENT TRAITS IN SHEEP**Leigh Atkinson^{1,2}, Rebecca E Doyle^{1,2}, Andrew Woodward² and Ellen C Jongman^{1,2}**¹ Animal Welfare Science Centre, The University of Melbourne, Parkville, Victoria, Australia² Faculty of Veterinary and Agricultural Sciences, The University of Melbourne, Werribee, Victoria, Australia*atl@student.unimelb.edu.au*

Temperament refers to the early appearing and stable behavioural traits that are genetic in nature, and in agricultural species is often used to describe the expression of behavioural reactivity, fearfulness or emotionality. High behavioural reactivity is indicative of high levels of fear which can negatively impact welfare by altering the experience of pain and causing chronic stress, affecting growth and immunity. In a commercial setting high behavioural reactivity can also result in poor maternal behaviours, injurious behaviour and handling difficulties, which may inadvertently prompt negative handling from the stockperson. In an effort to improve animal welfare, increase productivity and increase the safety of the stockperson, the goal of temperament testing in sheep is to remove highly reactive individuals from the breeding nuclei. While multiple temperament traits have been identified in other species only the single trait of ‘nervous-calm’ has been classified in sheep, which is defined as “fearfulness and reactivity in response to humans and novel environments”. However, there is evidence to suggest that the traditional tests used to measure ‘nervous’ and ‘calm’ are capturing level of activity and not fearfulness, which has negative welfare implications. We hypothesised that more than one temperament trait exists in sheep and that the measures used in traditional sheep temperament tests are indicative of different traits. To investigate this we measured 16 behavioural responses to three fear-based tests in 89 lambs, on two separate occasions, three months apart. Our results agree with previous studies that the traditional measures of temperament show high repeatability over time. However, a principal component analysis identified four possible temperament traits: ‘exploration-avoidance’, ‘sociability’, ‘boldness-shyness’ and ‘general activity’, with traditional measures sitting across the four traits. A cluster analysis identified four different groups of lambs based on similar expressions of each trait which suggest the trait ‘boldness-shyness’ appears to capture reactivity towards humans most accurately. This implies that traditional assessments of temperament in sheep are unsuitable in identifying behavioural reactivity towards humans. Further investigation is required to understand how each trait relates to fear in different situations.

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PRELIMINARY INVESTIGATION ON THE EFFECT OF HOUSING SYSTEM AND STOCKING DENSITY ON BEHAVIORAL RESPONSE OF FARMED RABBIT (*ORYCTOLAGUS CUNICULUS*) IN HUMID TROPICS**Mathew O Ayoola, Mobolaji O Alabi and Oguntunji Abel O**

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The welfare and productivity of farmed rabbits *Oryctolagus cuniculus* must consider the housing pattern and stocking density. Rabbits are social animals and living in social isolation can display physiological symptoms of stress, stereotype, and frightened behavioral pattern towards man. The welfare of farmed rabbits is dependent on the housing condition. There is a dearth of information on likely effect of housing system and stocking density on some behaviors of rabbit in humid tropics, hence this experiment. Thirty-six (36) weaned New Zealand breed of rabbits (90 days old) were randomly divided into three housing treatments, H₁ (pen with straw litter), H₂ (hutch cage), H₃ (pen with soil), two stocking densities high (20 rabbits/m²) and low (10 rabbits/m²) in a 3 x 2 factorial experiment. The experiment lasted for 4 weeks. The average temperature and humidity index (THI) within the building was in the range of 29 – 32°C, and rabbits were fed ad libitum with concentrate, forage, and water. Behavior evaluations were monitored in punctual record at every 2mins, between 8 – 10 am and 3 – 6 pm daily with a computer vision-based motoring system. An ethogram was made with the observed behaviours; exploratory (smell the surrounding environment), resting, intake (feeding or drinking), social (interaction with other animals/response to man's presence), aggressive, and stereotypes (biting or licking cage bars, burrowing). The result revealed significant ($p < 0.05$) interaction between housing systems and stocking densities. Rabbits in H₂ at high stocking density are more aggression, while those in H₃ at high stocking density exhibited more stereotypical behavior as compared to others. Rabbits in pens (H₁ and H₂) at low stocking density are not significantly different ($p > 0.05$) for social interaction, exploratory, and resting but differ ($p < 0.05$) as compared to other groups. Intake and time were not affected by treatment groups. It can be concluded that the housing system and stocking density are important factors in rabbit welfare. Pen housing systems and low density are more preferred by farmed rabbits based on observed behavioral responses.

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EFFECTS OF WEANING REGIMES ON GROWTH PERFORMANCE AND STRESS RESPONSE IN WEANLING PIGS**Temitope O Bankole¹, Olufemi A Adebisi¹, Emmanuel O Ewuola¹, Ayoola A Oluyemi¹ and Olusoji J Abiola²**¹ Department of Animal Science, University of Ibadan, Ibadan, Oyo state, Nigeria² Department of Veterinary Medicine, University of Ibadan, Ibadan, Oyo state, Nigeria
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Weaning is one of the most stressful events in pigs as this affects their health, growth performance and welfare especially during the first week post-weaning. Early weaning subjects weanling pigs to severe weaning stress while late weaning reduces the stress. Therefore, this study assessed the effects of different weaning regimes on weanling pigs' growth and stress response. Eighteen sows and 72 piglets randomly allotted to 3 treatments and 6 replicates were used for this study which lasted fourteen weeks. The piglets were weaned at four weeks (T-4wk), six weeks (T-6wk), and eight weeks (T-8wk). Growth performance [feed intake, weight gain, and feed conversion ratio (FCR)] was measured for 6 weeks, while the stress indices [corticosterone, white blood cell (WBC) and leucocyte differentials (lymphocytes, neutrophils, monocytes and eosinophils)] were measured for fourteen days post-weaning. Data were analysed using descriptive statistics and ANOVA at $\alpha 0.05$. Feed conversion ratio of weanling pigs in T-4wk (2.42 ± 0.09) was significantly ($p < 0.05$) higher than T-6wk (2.23 ± 0.15) and T-8wk (2.22 ± 0.10). The average weight gain and average feed intake in pigs on T-8wk (5.76 ± 0.29 kg; 12.81 ± 0.61 kg) and T-6wk (5.69 ± 0.36 kg; 12.70 ± 0.39 kg) were significantly ($p < 0.05$) higher than T-4wk (4.53 ± 0.18 kg; 10.94 ± 0.48 kg). Corticosterone concentration in the weanling pigs ranged from 55.83 ng/ml (T-4wk) to 48.31 ng/ml (T-8wk) on day 4, 45.58 ng/ml (T-6wk) to 45.42 ng/ml (T-4wk and T-8wk) on day 11, and 46.52 ng/ml (T-4wk) to 45.25 ng/ml (T-6wk) on day 14. The white blood cell (WBC) count of the weanling pigs in T-4wk ($8.83 \pm 0.07 \times 10^3 \mu\text{l}$) was significantly ($p < 0.05$) higher than T-6wk ($8.53 \pm 0.12 \times 10^3 \mu\text{l}$) and T-8wk ($8.62 \pm 0.14 \times 10^3 \mu\text{l}$) on day 1. However, the values obtained for days 7, 11 and 14 followed the same trend except for day 4 where T-6wk ($9.80 \pm 0.23 \times 10^3 \mu\text{l}$) was significantly higher than T-8wk ($9.10 \pm 0.08 \times 10^3 \mu\text{l}$). The monocyte count of the weanling pigs in T-8wk ($3.92 \pm 0.14\%$) was significantly ($p < 0.05$) higher than T-6wk ($3.17 \pm 0.15\%$) and T-4wk ($3.50 \pm 0.24\%$) on day 11 while on day 14, T-8wk ($3.58 \pm 0.26\%$) was significantly ($p < 0.05$) higher than T-6wk ($2.58 \pm 0.16\%$). The eosinophil count of T-4wk ($4.75 \pm 0.04\%$) was significantly ($p < 0.05$) higher than T-6wk ($3.75 \pm 0.13\%$) and T-8wk ($3.88 \pm 0.10\%$) on day 1. It can be concluded from this study that weaning piglets at 6 weeks gave the optimum result and improved their performance and welfare post-weaning.

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EFFECT OF POSITIVE HUMAN INTERACTION ON ATTENTION BIAS AND AFFECTIVE STATES OF COMMERCIAL BREEDING DOGS**Uri Baqueiro-Espinosa, Tsz H Lo, Victoria McEvoy, Rachel Hunter and Gareth Arnott**

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Long-term confinement can have detrimental effects on the welfare of dogs, leading to chronic stress and the development of behavioural problems such as aggression and fearfulness towards novel situations. Previous research in humans and animals shows that negative affective states, including anxiety and depression, increase the subject's attention towards a threatening stimulus. However, enrichment in the form of positive human interaction has been shown to reduce behavioural fear responses in shelter dogs and appears to increase positive expectancy towards ambiguous stimuli in kennelled dogs. In this study, thirty-one breeding dams from various breeds and crossbreeds were assigned to either a control (N = 16) or a treatment group (N = 15). Treatment consisted of 15-minute enrichment sessions, three days a week, where an experimenter offered treats to the dogs and encouraged them to play with different toys. Dogs in the control group were maintained at baseline management conditions where the only human interactions they had were those related to daily feeding and cleaning of their pens. After the 4-week treatment, dogs were tested in a 180 seconds attention bias test. Dogs were exposed for 10 seconds to a sudden-threatening negative stimulus (an umbrella being opened and closed in a continuous manner) at the start of the test and to a positive stimulus (bowl with food) throughout the duration of the test. Duration and frequency of the attention towards both the negative and positive stimuli were compared between the two groups. Statistical analyses using pairwise comparisons showed that control dogs had a higher frequency of looking towards the location of the threatening stimulus ($P < 0.01$). Moreover, enriched dogs spent significantly more time interacting with the food bowl (sniffing and eating: $P < 0.01$) than control dogs. To our knowledge, this study is the first to assess dogs emotional state using an attention bias paradigm. Our results suggest that long-term positive human interaction can positively influence the affective state of adult female commercial breeding dams.

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RISK FACTORS FOR INTEGUMENTUM ALTERATIONS IN THE CARPAL REGION OF NORWEGIAN DAIRY COWS

Conor Barry and Camilla Kielland

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Alterations to the integument, as described in the Welfare Quality® Assessment Protocol for Dairy Cattle (WQ® protocol), are of concern for cow welfare. Previously, risk factors for integument alterations (IAs) have been identified but few have included integrative animal-based measures of resting comfort such as the duration of lying down movements. Less comfortable lying areas result in increased time needed to lie down. Prolonged lying down movement durations may be a risk factor for carpal IAs.

On an individual level, carpal IAs may be associated with lameness and body condition score (BCS). Both should also be considered when investigating risk factors for IAs.

The aim was to explore risk factors for IAs in the carpal region of Norwegian dairy cows.

A random sample of cubicle-housed Norwegian dairy herds were assessed using the WQ® protocol between April and November 2021. Herds visited by one assessor (n=97) were analysed.

The 'mean time to lie down' was calculated for each herd with a mean of 5.9s. According to WQ®, 17 herds (17.5%) were Cat. 1 (normal, <5.2s); 52 herds (53.6%) were Cat. 2 (moderate problem, 5.2-6.3s); and 28 herds (28.9%) were Cat. 3 (severe problem, >6.3s).

A total of 3480 cows present in these herds were clinically scored according to the WQ® protocol. IAs in the carpal region were absent in 67.6% of the study population and present in 32.4%. Of all cows assessed, 88.4% were not lame, 8.9% mildly lame, and 2.7% severely lame. Furthermore, 85.7% were classified as having normal BCS, 2.0% were scored as very lean and 12.4% as very fat.

Univariate logistical regression analysis, with herd as a random effect, showed that both mild and severe lameness increased the odds ratio (OR) for carpal IAs to 2.05 (P<0.001) and 3.28 (P<0.001), respectively, when compared to not lame cows.

Very lean cows had an increased OR for IAs in the carpal region of 1.78 (P=0.027) compared to cows with normal BCS.

Cows from herds with a 'mean time to lie down' in Cat. 2 and Cat. 3 had a higher risk of carpal IAs compared to those in Cat. 1 with respective ORs of 1.58 (P=0.018) and 1.57 (P=0.032).

Based on these univariate analyses, lame cows, very lean cows, and compromised resting comfort were significant risk factors for carpal IAs. Identification of risk factors using welfare assessment data can facilitate targeted interventions to improve dairy cow welfare on-farm.

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DOES CANINE OSTEOARTHRITIS AFFECT STEP COUNT?**Leanne Blake¹, Jack O'Sullivan^{1,2}, Cameron Smith^{1,3} and Lucy Asher¹**¹ School of Natural and Environmental Sciences, Newcastle University, Newcastle Upon Tyne, UK² University of Lincoln, Lincoln, UK³ University College London, London, UK*l.c.blake@newcastle.ac.uk*

Canine Osteoarthritis (OA) affects approximately 80% of dogs over the age of eight, however, diagnosis is often delayed until unrelated veterinary appointments. When considering the problem of late diagnosis, human medicine highlights the diagnostic potential of accelerometers. By applying accelerometers to canine studies, it may be possible to identify subtle gait abnormalities associated with the initial stages of OA, perhaps facilitating earlier diagnosis. To investigate potential associations between OA, and the gait parameter 'step count', an existing accelerometer dataset, recorded from sound and arthritic dogs across seven-day durations, was used. Following the principles of the six-minute walk test (a human gait assessment), the six-minutes of highest continuous activity was first identified per dog, per day. Next, a published pedometer algorithm was adjusted and translated to implementation in an open-source programme before application to the six-minute windows, generating initial step counts, before filtering against irregular steps and shuffles. Step count was then recorded in three categories: initial count, filtered count, and the difference between the two counts. Relationships between OA, age and the step count categories were first explored using linear mixed effects (LME) models. OA was included as the independent variable, entering each step count category (in turn) as a fixed effect, with dog ID as a random effect. Models then included age as the independent variable before final models included both age and OA. As multicollinearity was suspected, ridge regression models were required. For each step count category, the mean and standard deviation was extracted per dog, per day. Models included age and OA as independent variables, with the mean and standard deviation for each step count category entered as fixed effects. Next, data were subset to include only arthritic individuals, and LME models were used to explore associations between the Liverpool Osteoarthritis in Dogs (LOAD) score (an indicator of OA severity), and the step count categories. Categories were entered as fixed effects, while LOAD score was included as the independent variable, with dog ID as a random effect. A significance value of $p=0.05$ was selected for all models. Although the mean step count was greater for arthritic dogs across all categories, this was not statistically significant, $p>0.05$ across all models. While future research will validate the pedometer algorithm, this study suggests that many arthritic dogs maintain high activity levels, indicating that investigation of more subtle gait parameters is required if accelerometers are to be used for identifying OA.

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PANDEMIC PUPPIES: A CANINE WELFARE TIMEBOMB?

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Soon after the first UK nationwide COVID-19 'lockdown' on 23rd March 2020, media reports emerged of surging levels of puppy acquisition, the so-called 'Pandemic Puppy' phenomenon. A cross-sectional online survey of Pandemic Puppies purchased <16 weeks of age between 23rd March–31st December 2020 (n=4369) identified long-term implications for canine behaviour and welfare in this population. Compared with puppies bought during the same date-period in 2019, Pandemic Puppy owners were more likely to be first-time dog owners, and to have demonstrated reduced adherence to recommended puppy-buying practices, increasing the risk of being purchased from poor welfare sources. This was compounded by reduced opportunities for socialisation/habituation during periods of social restriction in 2020 (e.g. attending puppy classes), compared to puppies purchased pre-pandemic.

Here we report new findings from a longitudinal study designed to assess the evolving welfare status of the original Pandemic Puppy cohort as they reach adulthood. From January 2022 onwards, online surveys hosted via REDCap were sent to participants who provided informed consent to participate in further research and a valid email address (n=2341) as their dogs reach 21, 24 and 27 months old. Owners were asked to report on six key areas of concern for the welfare of this wider population: (i) health – health problems, preventative/routine health care provisions and veterinary access; (ii) behaviour – owner-reported problem behaviours, separation related behaviours, abnormal repetitive behaviours, training provisions, information sources and methods used; (iii) dog-owner relationship – owner expectations vs. realities of dog ownership, via completion of the Monash Dog Owner Relationship Scale (MDORS), and (iv) COVID-19 impact: perceived impact of the COVID-19 pandemic on the lifestyles of Pandemic Puppies and their owners, including routine changes; (v) homing status – current homing status, considered and actual reasons for relinquishment, (vi) mortality – death/euthanasia and circumstances leading to these outcomes.

At 21 months (n=542; response rate 54.6%), the three most common owner-reported problem behaviours were pulling on the lead (67.3%), jumping up at people (55.8%) and not returning when called (52.8%), reported at markedly rates higher than published studies of comparable populations. The impact of owner purchasing behaviours and demographics, and puppies' early-life experiences (<16 weeks) upon negative outcomes including poor health, behaviour and relinquishment will be evaluated using multivariable logistic regression models. This information will be vital in tailoring support from the animal welfare community to protect the future welfare of this unique cohort, as well as understanding the long-term consequences of puppy-purchasing behaviour.

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SALIVARY BIOMARKERS OF ACCLIMATIZATION IN DAIRY COWS WITH DIFFERENT MILK YIELD POTENTIAL

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Environmental heat stress affects the productive performance of animals, especially those of high genetic merit. The Mediterranean region is characterized by sudden and prolonged heat periods. Although animals can adapt to warm environmental conditions, in these conditions they are less likely to acclimate. Saliva testing is a non-invasive and inexpensive test that can be a source of biomarkers. Results from our team suggested that the salivary levels of Hsp70 could function as a putative biomarker of thermal stress. The main objective of this work was to study the acclimatization process in dairy cows with high milk yield potential (HP; > 8000 kg of milk at 305 days in lactation) and low milk yield potential (LP; ≤ 8000 kg of milk) and to relate physiological parameters with salivary protein profiles. 6 HP and 6 LP animals were followed during four days in two periods: Summer - high environmental temperatures (animals under heat stress) and Winter – low environmental temperature (animals in thermoneutrality). Environment temperature was evaluated using a black globe thermometer (BGT) placed outside (BGTsun) and inside the facility (BGTshade). Rectal temperatures (RT) and respiratory rate (RR) were measured. On each period samples of saliva were collected through cotton rolls (Salivettes®) and samples of blood from the coccygeal vein. BGT, RT and RR were significantly higher ($P < 0.05$) in Summer (BGTsun) $35.71 \pm 4.71^\circ\text{C}$; BGTshade $23.88 \pm 2.05^\circ\text{C}$; $38.80 \pm 0.10^\circ\text{C}$; 64.13 ± 3.69 mov.min.) comparatively to Winter (BGTsun) $14.21 \pm 2.61^\circ\text{C}$; BGTshade $6.15 \pm 1.01^\circ\text{C}$; 38.07 ± 0.02 ; 36.13 ± 2.21 mov.min.), but no differences were observed between HP and LP. Regarding triiodothyronine (T_3), in Summer, HP had significantly lower values than LP, which indicated a more intense acclimatization. Higher values of salivary pH were observed in Summer in both HP and LP group. No significant differences were observed among periods in salivary cortisol (SC), however there was a significant negative correlation between SC and RT ($r = -0.615$, $P = 0.03$). In Winter, HP had higher levels of SC than LP cows, which could be associated with metabolic heat production. Salivary albumin was higher in HP, during Summer. The results reinforce the concept that saliva can be useful in monitoring temperature adaptation in milk-producing animals.

Acknowledgments:

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THE IMPACT OF THE COVID-19 PANDEMIC ON CAT AND DOG RELINQUISHMENT AND ABANDONMENT

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During times of crisis such as natural disasters and economic crashes, there is an increase in companion animal relinquishment and abandonment. The Covid-19 pandemic brings with it a unique situation where many citizens have an abrupt loss of income while animal shelters and veterinarians are forced to provide restricted services. As a result, we are likely to see an increase in risk to animal welfare. The aim of this study was to examine reasons given by companion animal owners for abandonment, relinquishment and transfer (giving a pet away to a friend or family member) during the Covid-19 pandemic. A survey was distributed to 4000 participants via Prolific Academic[®]. Participants were asked whether they had given up or considered giving up a pet since the pandemic began. While 95.2% of cat and dog owners had not considered it, 4.8% of owners had either considered it (4.3%) or had already given up a companion animal (0.5%). A more detailed questionnaire was distributed to those that had considered or had given up a cat or dog. A total of 189 participants completed the second questionnaire. The most common reasons given for giving up or considering giving up a pet included financial constraints (20.3%), behavioural concerns (14.3%), Covid-19 – related health concerns (13.6%) and safety concerns (10%). Dogs were more likely than cats to be considered for relinquishment. Risk factors for relinquishment include being a new pet owner, renting rather than owning the home, and lack of access to resources such as training. This findings can help in identifying pet owners at risk of relinquishing their pets during the pandemic and beyond.

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PROXIMITY INTERACTIONS IN A PERMANENTLY HOUSED DAIRY HERD: NETWORK STRUCTURE, CONSISTENCY, AND INDIVIDUAL DIFFERENCES**Kareemah Chopra¹, Holly R Hodges², Zoe E Barker², Jorge A Vázquez Diosdado¹, Jonathan R Amory², Tom C. Cameron³, Darren P Croft⁴, Nick J Bell⁵ and Edward A Codling¹**¹ Department of Mathematical Sciences, University of Essex, Colchester, UK² Writtle University College, Chelmsford, UK³ School of Life Sciences, University of Essex, Colchester, UK⁴ Centre for Research in Animal Behaviour, College of Life and Environmental Sciences, University of Exeter, Exeter, UK⁵ Royal Veterinary College, Hatfield, UK*km19088@essex.ac.uk*

Understanding the herd structure of housed dairy cows has the potential to reveal preferential interactions, detect changes in behaviour indicative of illness, and optimize farm management regimes. This study investigated the structure and consistency of the proximity interaction network of a permanently housed commercial dairy herd throughout October 2014, using data collected from a wireless local positioning system. Herd-level networks were determined from sustained proximity interactions (pairs of cows continuously within three meters for 60 s or longer), and assessed for social differentiation, temporal stability, and the influence of individual-level characteristics such as lameness, parity, and days in milk. We determined the level of inter-individual variation in proximity interactions across the full barn housing, and for specific functional zones within it (feeding, non-feeding). The observed networks were highly connected and temporally varied, with significant preferential assortment, and inter-individual variation in daily interactions in the non-feeding zone. We found no clear social assortment by lameness, parity, or days in milk. Our study demonstrates the potential benefits of automated tracking technology to monitor the proximity interactions of individual animals within large, commercially relevant groups of livestock.

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TELL ME HOW YOU FEEL – USING A MODIFIED NOVEL ARENA TEST (MNAT) TO ASSESS SOW WELFARE IN THREE DIFFERENT POST-WEANING HOUSINGS**Jen-Yun Chou^{1,2,3} and Thomas D. Parsons¹**

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Sow confinement has been a globally debated issue. More countries/food companies have committed to phasing out gestation stalls for pregnant sows. However, after weaning when sows transition from lactation to a new pregnancy, confinement is still commonly used. It is a sensitive time for sows due to weight loss from nursing, hormonal changes, and oestrus expression. Research to date used lesion score and some behavioural indicators to assess sow welfare during this time but has yet explored sow's subjective experience and psychological wellbeing when being individually confined as opposed to group housing. This study attempted to answer these questions by using a modified novel arena test (MNAT). Fifty sows in their first parity were allocated to three housing treatments: individual stall ($n = 17$), individual pen ($n = 16$) and small group of six ($n = 17$). On the day of weaning, all sows went through the MNAT individually in a randomised order (T1). The MNAT consisted of two sessions, where sows were exposed to a novel arena with a novel object (bright blue brush) and another identical arena with a stall (the same as what was used in the housing treatment). After T1, sows were put into their respective housing treatments for 8 days. On d8 post-weaning, all sows were tested again in the same MNAT (T2). Behaviours were video-recorded for analysis, and salivary samples were also collected before, between and after the two sessions of the MNAT to determine the cortisol concentration. Preliminary results showed no difference in salivary cortisol between treatments in T1 or T2, and cortisol is always higher after each test session compared to before ($P < 0.001$). Housing treatment also had no effect on all behaviours recorded during the test sessions. In the presence of the stall, sows spent longer time exploring the arena ($P < 0.001$) and vocalised more ($P < 0.001$) but showed less movement ($P < 0.01$). They also spent longer time exploring and less time staying alert in T2 than T1 ($P < 0.001$). This suggested that sows responded differently to the MNAT depending on which session and test they were in, but the 8-day post-weaning housing treatment did not affect their response in the test. The next step is to analyse their general behaviour time budget and posture changes in their housing treatment and use other holistic approach to fully understand the impact of mid-term confinement on their welfare.

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AUTOMATIC DETECTION OF ENRICHMENTS USAGE IN RHESUS MONKEYS

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UNTWISTING QUESTIONS ABOUT NESTING MATERIALS AND LABORATORY MOUSE WELFARE**Kendall M Coden¹, Jerome T Geronimo¹, Michael F Gutierrez¹, Kyna A Byrd¹ and Joseph P Garner^{1,2}**¹ Department of Comparative Medicine, Stanford University, California, USA² Department of Psychiatry and Behavioral Sciences, Stanford University, California, USA
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From research previously funded by the Universities Federation for Animal welfare, we know that nesting material is vital for the wellbeing of laboratory mice. As a result, nesting material enrichment is rapidly being adopted for mice at research institutions in the USA. While this is a major victory for laboratory animal welfare, there are now a new set of concerns regarding nesting materials. These concerns include (1) compromised health checks of mice if nesting obscures the view of animal care staff; (2) compromised thermoregulation if mice are provided too little nesting material; and (3) inefficiency in use of technician time manually adding material to cages rather than directly caring for animals. In this study, we investigated the impact of three different nesting materials (manually added EnviroDri and automatically added Tight or Loose Alpha-Twist) on mouse ability to maintain thermal homeostasis and quality of nest construction. The ideal nesting material should be easily manipulated by the mice and be highly insulating. The more insulating a material, the flatter the nest required by mice to maintain temperature homeostasis and the easier it is to visualize mice during health checks. We hypothesized that mice would have difficulty interacting with both Alpha-Twist options leading to poor nest quality and poor thermoregulation. To test this, we exposed C57BL/6J mice, which are both the most common laboratory mouse within the USA and are notoriously bad at nest construction, to three different nesting materials in a factorial cross-over design in which each cage acted as its own control. Trained observers scored nest quality daily. To assess the impact of nesting material type on stress and thermoregulation, we recorded infrared video of mice during weekly cage changes and measured core and peripheral body temperatures. Peripheral body temperature increased with the number of mice in the cage, confirming that this is a sensitive measure of thermoregulation. Conversely, there was no difference in peripheral temperature between the three nesting materials. However, there were differences in nest quality. These data are consistent with previously published studies that mice alter nest structures to maintain thermal homeostasis. These data suggest that switching from the manually added EnviroDri to either of the automatically added Alpha-Twist options is possible without compromising the welfare of laboratory mice.

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THE GROWING TREND OF INTRAORGAN EUTHANASIA INJECTIONS IN COMPANION ANIMALS**Kathleen A Cooney^{1,2}**¹Companion Animal Euthanasia Training Academy, Loveland, Colorado, USA² College of Veterinary Medicine and Biomedical Sciences, Colorado State University, Fort Collins, Colorado, USA*kathleen@caetainternational.com*

Companion animal euthanasia has been evolving in recent times, with veterinary personnel shifting towards intraorgan pentobarbital injections as their preferred method over intravenous administration, especially those who specialize in end-of-life related veterinary work. A 2018 survey asked eighty-three veterinarians about their preferred method of euthanasia for dogs and cats, and why they preferred one technique over another. Although the group of respondents was small, they represented varied backgrounds in mobile and hospital settings and shared the desire to improve the euthanasia experience for their clients and patients. The findings revealed a shift away from intravenous administration, although this technique remained the first choice for most. Reasons to reach for intraorgan injections include decreased concerns over patient blood pressure and ability to avoid venipuncture. Intraorgan euthanasia injections require use of pre-euthanasia anesthetics leading to patient unconsciousness. Patient unconsciousness is believed to reduce pain, anxiety and fear during the euthanasia procedure in a variety of species, leading to improved welfare during death. Given the requirement for unconsciousness by use of pre-euthanasia anesthetics before intraorgan euthanasia injections, the trend is a positive step forward in companion animal welfare to reduce pain and distress and can be distributed throughout other animal industries. If intraorgan euthanasia routes are to gain momentum, there needs to be increased euthanasia technique training leading to improved confidence by the practitioner.

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LAME COW WELFARE: WHAT IS THE MOBILITY TEAM THINKING? OR WHO SEES PAIN HOW?**Emily F Craven¹, Jenny Stavisky², Natalie Robinson² and Rachel Dear²**¹Oakwood Veterinary Group, Harleston, Norfolk, UK²VetPartners, Spitfire House, York, UK*em_craven@hotmail.co.uk*

Dairy cow lameness is a common cause of impaired health and welfare on farm. Lameness results from a variety of painful conditions which affect mobility. Non-steroidal anti-inflammatories (NSAIDs) help to mitigate this pain. The aims of this study were to investigate how different mobility team members (veterinary surgeons (VS), veterinary technicians, foot trimmers and farmers) rated pain severity, and made decisions about NSAIDs across a range of common lameness presentations.

An online survey was distributed amongst contacts and shared on social media, and data were collected between January and September 2021. Respondents were asked to assign a score between 1 (no pain at all) to 10 (worst pain possible), and if they used NSAIDs/preferred NSAIDs for each condition. Factors affecting the decision to use NSAIDs were also scored from 1 (not very important) to 10 (very important). Following descriptive analysis, selected factors were compared using a 2-tailed Mann-Whitney U test, with significance $p < 0.05$.

Of the 211 useable responses, 81 (38.4%) were from VS, 81 (38.4%) farmers, 34 (15.1%) FT and 15 (7.1%) VT. Farmers consistently scored pain lower, typically by 1-2 points, than other groups. Farmers were also less likely to report giving NSAIDs than other groups for most conditions. Farmers scored "I think it works" (mean 8.7) and "comfort of cow" (mean 8.6) as the most important factors when choosing whether to use a NSAID, with route of injection (mean 2.6) and cost (4.0) scored lowest. Farmers were more likely than VS to prioritise "comfort of cow" when choosing whether to use NSAIDs ($p < 0.001$) and less likely to prioritise "cost of drugs" ($p < 0.001$). When vets were asked which factors they thought were important in farmers' choice of whether to use NSAIDs, they scored cost of drugs as significantly higher than farmers ($p < 0.001$).

The variation between professions in pain scores was substantial for many conditions, which may affect NSAID use. Farmers reported a high emphasis on cow comfort, and low emphasis on cost, which differed significantly from VS perceptions of what farmers thought. This study highlights the importance of communication within the mobility team to remove assumptions about treatment barriers and ensure that there is shared ownership and matched expectations in lameness recognition and management. Our results suggest that members of the mobility team think differently and that recognising and accounting for this may be a route to improving the welfare of lame dairy cows.

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GETTING CLOSE TO ANIMALS AT THE ZOO: IMPACTS ON ANIMAL WELFARE AND HUMAN PSYCHOLOGY**Katherine A Cronin¹, Stephen R Ross² and Maureen Leahy¹**¹ Animal Welfare Science Program, Lincoln Park Zoo, Chicago, USA² Lester Fisher Center for the Study and Conservation of Apes, Lincoln Park Zoo, Chicago, USA*kcronin@lpzoo.org*

Many zoos offer programs with educational or “ambassador” animals that allow visitors to have a closer experience with certain animals. Zoo programs like these present a unique opportunity for people to learn about animals and, hopefully, motivate pro-environmental behavior on their behalf. However, these programs have direct impacts on the welfare of the animals involved. Furthermore, several studies have shown that when people view animals in unnatural contexts or alongside people, they are more likely to think the animals are appealing pets and are less likely to think those species are in need of conservation support in the wild. Therefore, understanding the direct and indirect impacts of ambassador programs on animals requires research in animal welfare science and human psychology. Considering animal welfare first, we synthesize the existing literature and extract three general approaches that are likely to reduce the welfare risk, and potentially provide welfare benefit, for animals in educational programs: (1) animals remain in their primary habitat; (2) animals have the choice of whether or not to participate; (3) programs align with the animals’ natural history and daily husbandry routines. We then turn to the study of human psychology and consider how the visual images of animals common to zoo educational programs in various contexts impact people’s perceptions that the animals are appealing pets in an online study. In contrast to most previous research, we found no effect of visual context on pet interest. However, we did find that younger generations had a concerning level of interest in ownership of both of these species, especially compared with older generations. We consider the priorities for future research to inform zoo approaches to engaging people in a way that meets educational goals while supporting positive animal welfare and promoting responsible actions.

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PUPPY SEPARATION RELATED BEHAVIOUR: EFFECT OF PREVENTATIVE ADVICE ON PUPPY BEHAVIOUR WHEN LEFT ALONE**Fiona C Dale¹, Charlotte C Burn¹ and Rachel A Casey²**¹Royal Veterinary College, North Mymms, UK²Dogs Trust, London, UK*fidale@rvc.ac.uk*

Canine separation-related behaviours (SRBs) are common and can impact on canine welfare. Preventing SRB development could indicate improved canine welfare and reduce relinquishment or euthanasia risk. There have been numerous studies on potential SRB treatments, but few have focused on preventative advice provided before puppy acquisition. We aimed to ascertain the efficacy of such advice on puppy behaviour over their first six-months in a new home. New puppy owners (n=34) were randomly provided with advice sheets: Controls were given general responsible ownership advice, 'Calm' group owners were additionally given advice including calmly leaving and returning to the puppy, 'Habituation' group owners were advised to gradually increase the time and distance puppies could be left for, and 'Combination' group owners were given all advice elements. Owners filmed puppies left alone at four timepoints over a six-month period. A treatment-blind observer categorised puppy behaviours and used the data to score each video in terms of 'active anxious' behaviour (e.g. whining, barking), 'passive anxious' behaviour (e.g. panting, lip-licking), relaxing (e.g. lying) and 'active positive' behaviour (e.g. playing, eating). Multivariable mixed models were conducted to investigate the effect of treatment and time point on each behavioural score, as well as other relevant variables, e.g., whether the dog was left with another dog or with the TV/radio on and appropriate interactions. Active anxious scores were significantly higher within the first week in the new home than at all other time points over the six-month period and were lower if owners reported that they left their puppies calmly. Puppies had significantly higher passive anxious scores if left fully alone compared to if they had the company of other dogs. Mean relaxing score was significantly higher in 'Calm' group puppies compared to Controls and 'Combination' puppies, and female puppies had significantly higher mean relaxing scores than males. Active positive scores were significantly higher with increasing owner-reported compliance to 'Calm' advice, and when dogs had canine company those dogs in the 'Calm' treatment had significantly higher active positive scores than Control dogs. The results suggest the advice did not reduce SRBs overall; however, elements of the 'Calm' treatment appear to decrease active anxious and increase relaxing behaviours in dogs left alone without human company. Further work is encouraged to explore the effect of elements of preventative advice, and owner compliance to advice, on reducing signs of anxiety and increasing positive behaviours when dogs are separated from owners.

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AN INVESTIGATION INTO *SUS SCROFA DOMESTICUS* AND MILK REPLACER PRE-WEANING, FOCUSING ON SIZE AND SOCIAL BEHAVIOURS IN THE FARROWING CRATE

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Selective breeding of pigs focusing on increasing productivity has led to larger litter sizes than a sow can sustain throughout lactation. Milk replacer is often used in industry to supplement lactation and reduce pre-weaning deaths in farrowing crates. The association between milk replacer use, size, and competition at the teats is well studied, leaving a lack of information on the general milk replacer use patterns of piglets, the impact of size on milk replacer use, and behaviour at the milk cup. This study aimed to investigate the patterns of milk replacer use, and the impact of size on milk replacer use and social behaviour at the milk cup in 20-day old pigs in farrowing crates, pre-weaning.

16 litters of Large White cross Landrace piglets (n= 225) were housed in farrowing crates with access to milk replacer and clean water ad libitum. Creep feed was provided from day 10. An automatic piped system provided milk replacer to each milk cup. Observations were recorded on camera for 48 hours from day 20, after which piglets were weighed. Weights were categorised as HIGH or LOW based on relative weight in relation to median weight. If piglets were median weight, they were classed as HIGH. Observations of the frequency of milk replacer use, and behaviours displayed at the milk cup were compared against weight. Frequency of use over day versus night were also analysed separately. The data were analysed in Genstat(V21).

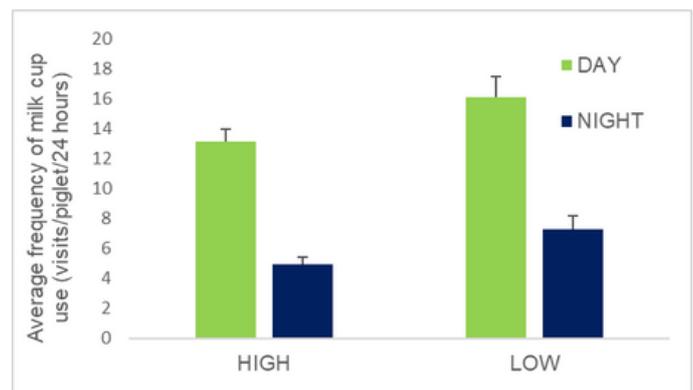
Table 1 shows the results of behaviours at the milk cup for between-litter weights. Figure 1 shows milk cup use increased in day compared to night, HIGH piglets less frequently than LOW.

The results demonstrate 20-day old piglets use the milk cup overnight less frequently than in the day, and when categorised as HIGH. The results also show LOW piglets wait and join at the milk cup significantly more than HIGH, suggesting that increasing the number of milk cups could increase opportunities for drinking, increasing the overall use of milk replacer.

Table 1: T-test results for the differences in behaviour frequencies at the milk cup at 20 days old comparing HIGH and LOW weight groupings of piglets (over 48 hours).

	HIGH	LOW	SED*	P value
Total frequency	36.2	46.8	5.2	0.044
Aggression frequency	12.1	9.6	2.2	0.251
Waiting frequency	1.7	4.8	0.8	<0.001
Joining frequency	0.4	2.3	0.4	<0.001

*SED= Standard Error of Difference



Day-Night P<0.001, HIGH-LOW P=0.044

Figure 1: Mean Frequency of Milk Cup use in 20-day old piglets compared between DAY and NIGHT and between piglets of HIGH and LOW weight groupings. (n=225).

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ASSOCIATIONS BETWEEN BEHAVIOUR MODIFICATION PROGRAM PROGRESSION, CAT STRESS SCORE, AND LATENCY TO EMERGE FROM HIDING IN SHELTER CATS (*FELIS CATUS*) FROM HOARDING ENVIRONMENTS

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Animal hoarding includes an accumulation of animals that has exceeded capacity for meeting animal care needs. Cats entering shelters from a "hoarding environment" (HE) are commonly highly fearful, have high disease prevalence, and their resource-intensive care presents a challenge for shelters. No known direct research has investigated HE cats' in-shelter behaviour or progression of behaviour modification (BMOD).

The present study has three aims 1) describe the condition and outcomes of shelter cats from HEs 2) report the progression of cats through a novel standardized BMOD program, and 3) assess associations between days since intake, BMOD progression, Cat Stress Score (CSS), and latency to emerge from hiding following shelter close (latency to emerge).

Cats were admitted from three HEs in staggered intakes between April-December 2021 (n=36). Cats deemed fearful by a veterinary behaviourist (n=31) entered a six-step BMOD program, culminating in seeking human attention without treats. Cats received 1-4 BMOD sessions daily, and a mean daily BMOD score was calculated. CSS was scored in-person daily at 10:00, 13:00, and 17:00, and a mean daily CSS score was calculated. A repeated measures correlation tested associations between days since intake, BMOD, CSS, and latency to emerge for individual cats, with a Bonferroni correction (statistically significant $p < 0.008$).

Most cats progressed to BMOD completion (n=27, 87%) in a mean $16.0 + 14.1$ days and were adopted. Others n=2 (0.06%) were transferred due to overcapacity (at BMOD stage 5), and n=2 (0.06%) were euthanized due to persistent fear. Results showed moderate-high negative correlations between CSS and BMOD [$r_{(31)} = -0.69$, 95% CI [-0.73, -0.64], $p < 0.001$], and CSS and days since intake [$r_{(36)} = -0.62$, 95% CI [-0.67, -0.56], $p < 0.001$]. A moderate positive correlation was observed between days since intake and BMOD [$r_{(31)} = 0.58$, 95% CI [0.51, 0.63], $p < 0.001$]. Low negative correlations were observed between days since intake and latency emerge [$r_{(36)} = -0.32$, 95% CI [-0.40, -0.23], $p < 0.001$] and latency to emerge and BMOD [$r_{(31)} = -0.30$, 95% CI [-0.38, -0.21], $p < 0.001$]. A low positive correlation was observed between CSS and latency to emerge [$r_{(36)} = 0.24$, 95% CI [0.14, 0.32], $p < 0.001$].

These results present evidence of the progression of cats from HEs through BMOD over days, resulting primarily in adoption. BMOD progression, decreasing CSS, and reducing latency to emerge in this population likely indicates acclimatization to the shelter over time.

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“END THE CAGE AGE”: IS IT POSSIBLE TO MANAGE GESTATING SOWS WITHOUT INDIVIDUAL STALLS?**Maria Costanza Galli¹, Claudio Mazzoni², Federica Mereghetti³, Elena Bordignon¹,
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The success of the European Citizens Initiative ‘End the Cage Age’ clearly threatens the use of gestation stalls for pregnant sows. Given the limited scientific knowledge on the impact of the timing of the creation of the group pen after insemination, it is necessary to evaluate the impact of this change both in the short-term (aggressiveness signs and cortisol variation) and long-term (sows body condition score, sows reproductive indicators and litter performance). In the study, we compared the effects of mixing sows early (3 days; PEN3D) and late (28 days; PEN28D) after insemination evaluating body injuries and cortisol on the day of mixing, 3 and 7 days after mixing, pregnancy maintenance and performance at the farrowing.

The sows included in the study (n=144) were of mixed parity (parities 2 to 7) and they were all weaned 4 week after farrowing and moved from farrowing to the breeding area, where they were placed into individual stalls. Once inseminated, all sows were assigned to one of the two following experimental treatments: PEN3D and PEN28D and they were maintained as a static group until 1 week before farrowing. The group size was 20, and they were housed on solid concrete floor, with a slope to convey manure in a drain, and with a floor space allowance of 2.25 m²/head. Two blocks of wood on chains and two chains were provided as enrichment. Feed was distributed manually, spreading it in a wide clean area of the pen floor, allowing sows to explore and root. Regarding short-term effects, no differences were recorded between treatments for salivary cortisol concentrations and the number of fresh injuries.

For the old scratches score, a significant effect of treatment was observed only at three days after mixing, where sows of the PEN28D had a highest anterior lesion score than sows of the PEN3D (P=0.005).

Considering the long-term effects of the treatments, no differences were observed for sow's backfat thickness, pregnancy rate, farrowing rate. Even the litter size was unaffected by the experimental treatment.

This study suggests that mixing sows into groups early after insemination rather than 28 d after might not affect both reproduction and measures of sow welfare, even on a commercial farm. However, with the increasing public opinion interest for a total ban of individual housing systems, research activities must be addressed to identify rearing techniques that can reduce risks to impaired sow welfare and productivity, starting from the phase of mixing sows right after piglets weaning.

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MEASURING AFFECTIVE STATE IN THE HORSE (*EQUUS CABALLUS*): THE EMOTIONAL RESPONSE TO A REWARD PREDICTION ERROR PARADIGM**Julia Gerke, Claire O'Brien, Ourania Kyrozi and Sebastian McBride**Institute of Biological, Environmental and Rural Science, Aberystwyth University, Aberystwyth, UK
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The term reward prediction error (RPE)² describes the changes in phasic striatal dopamine firing that occurs when there is a discrepancy between the predicted and the received reward outcome. It is the basis of adaptive action-outcome learning but it also elicits an immediate and strong emotional response in the animal that can vary dependent on the animal's current affective state. Measuring this immediate emotional response may therefore be a useful method to probe the background affective state of the animal. Here we used changes in facial expression to quantify the immediate emotional response in horses using a Facial Action Coding System (EquiFACS)³. Facial expressions in 10 horses were recorded in two contexts, the non-arrival of an expected reward (-ve RPE) and the arrival of an unexpected reward (+ve RPE)⁴. All horses were subjected to three-stages of training and testing using an automated operant system⁵: 1) an overtraining stage with reward 2) an extinction stage without reward (-ve RPE) and 3) a reinstatement stage with renewed reward (+ve RPE). During these stages, EquiFACS action units (AUs) and action descriptors (ADs, EADs), interactions with the operant system and spontaneous blink rate (SBR)⁶ were measured. Significant differences between -ve and +ve RPE were demonstrated for SBR, total AU count and trial latency. Significant differences were also recorded between -ve and +ve RPE for AU101 (Inner Brow Raiser; $p=0.021$), AU145 (Blink; $p=0.003$), AU18 (Lip Pucker; $p=0.005$), AU24 (Lip Presser; $p=0.018$), AU25 (Lips Part; $p=0.017$), AD19 (Tounge Show; $p=0.009$), AD38 (Nostril Dilator; $p=0.007$), AD81 (Chewing; $p=0.008$), EAD101 (Ears Forward; $p=0.007$), EAD103 (Ear Flattener; $p=0.003$) and EAD104 (Ear Rotator; $p=0.003$) with all of them being represented in a higher number in -ve RPE. These data show that the RPE paradigm induces discernable and measureable negative and positive emotional states that have the potential to identify different background affective states in the horse.

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FACIAL EXPRESSIONS OF ACUTE PAIN IN JAPANESE MACAQUES: DEVELOPMENT OF AN ASSESSMENT TOOL

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Changes in facial expression provide cues for assessing emotional states in mammals and may provide non-verbal signals of pain. While biomedical research has a continuing demand for primate models, the evaluation and treatment of pain are not only crucial for the generation of valid data but also from an ethical perspective. A validated scale for assessing pain in macaques has yet to be developed, further aggravating the difficulties inherent to discriminating the presence and intensity of pain in this genus. Developments in the past decade have brought forth a number of applicable techniques to detect facial expressions of pain. In the present study, we used geometric morphometrics to explore the facial shape variation in female Japanese macaques who underwent experimental laparotomy. Face image samples were collected from video footage of fourteen macaques in four conditions: before surgery and 1, 3, and 7 days after the procedure. Videos were taken just before scheduled analgesic administration. Image samples in the pre-surgical condition were considered pain-free, and facial expressions emerging after surgery were investigated as potential indicators of pain. Forty-four facial landmarks were selected based on the underlying facial musculature and their corresponding facial action units and then annotated on each image (324 pre-surgical images; 750 post-surgical images). Overall variability in the shape space was assessed using principal component analysis (PCA). Shape differences between conditions were explored with Canonical Variate Analysis (CVA). The results were compared at the level of the individual subject before being pooled. Group PCA indicated substantial overlap between the four conditions. The main contributor to face shape variation was inter-individual morphology. CVA showed substantial separation of conditions for both group and individuals' analyses. Facial changes suggested that tightly closed eyelid or eye squeeze and lip tension present one day after surgery were associated with pain, and varied in presence and intensity depending on the subject. The present study emphasizes the importance of individualized assessment and provides a better understanding of facial signals of pain in captive macaques, which will ultimately lead us to improve their overall care.

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FRIENDS? – EFFECTS OF GILTS’ SOCIAL EXPERIENCES AND GENETIC LINE WHEN MEETING AN UNFAMILIAR PIG AT 5 AND 20 WEEKS OF AGE**Linda Marie Hannius, Linda Keeling, Claes Anderson, Daiana de Oliveira, Stina Emriksson and Anna Wallenbeck**

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Our overall research aim was to develop management and breeding strategies for gilts in order to better prepare them for group housing as sows. In this first study, we assessed the immediate reaction to an unfamiliar pig in a novel environment in a Paired Interaction Test (PIT), to assess short-term effects of breed and social experience. In total, 95 gilts of two genetic lines of the Yorkshire breed, with a history of single housing (Dutch Yorkshire, DY, n=54) or group housing systems during gestation (Swedish Yorkshire, SY, n=41) were used. A 2x2x2 factorial design enabled comparisons between different social environments during two rearing phases, balanced over the two breeding lines. From 2 to 5 weeks of age, half of the litters had access to the piglets and sows in the neighbouring pen (access pen, n=49 gilts) whereas the others did not (control pen, n=46 gilts). From 10 weeks of age to farrowing, half of these groups were mixed with unfamiliar gilts (mixed groups, n=46 gilts) and the other half were not mixed (intact groups, n=49 gilts). To investigate the effect of previous social experience the gilts met an unfamiliar gilt of the same age for 3 minutes in a PIT, in a novel environment, at 5 and 20 weeks of age. Two monitoring technicians were available to intervene, however severe aggressive interactions were rare and only one test was terminated. The results indicate that extra social experience had no effect on the social or explorative behaviour in gilts during the PIT at 5 weeks of age, but that SY gilts explored pen fittings more frequently compared to DY gilts ($p < 0.05$). In the PIT performed at 20 weeks of age, there were only effects of minor relevance of extra social experience on social and exploratory behaviours. Regarding breed-lines, DY gilts explored pen fittings and floor more frequently, kept a larger distance to the other pig and performed play behaviours more frequently compared to SY gilts ($p < 0.05$). Taken together, the results indicate that genetic line had a greater effect than social experience on gilts reaction during a 3 minute PIT. In the next step we will investigate the long term effects of social experience and genetic line on social performance.

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DOES REGENERATIVE AGRICULTURE ADDRESS ANIMAL WELFARE, HUMAN WELL-BEING, AND ENVIRONMENT CONSERVATION (ONE WELFARE APPROACH)? – A REVIEW**Matías J Hargreaves-Méndez and María J Hötzel**

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The public is concerned about the impacts of animal production on the welfare of animals, the environment, and human well-being. The One Welfare framework addresses this problematic situation by considering human and animal welfare as interconnected within a physical and social environment. Regenerative agriculture (RA) is an alternative for more sustainable food production, born in response to public concerns with industrial agriculture. However, RA lacks a precise definition. Additionally, non-scientific sources claim that improved animal welfare and human well-being are a clear outcome of RA, but there is less scientific consensus about what RA is and whether it has such outcomes. Here we aimed to analyse whether peer-reviewed articles support that RA may provide a physical and social environment that improves animal welfare and human well-being. We searched peer-reviewed articles (1960-2021) in Scopus and Web of Science to find issues of the One Welfare categories animal welfare, human well-being, and environmental conservation, using PRISMA-P (Preferred Reporting Items for Systematic Reviews and Meta-analysis Protocols). We classified the animal welfare issues based on the Five Domains Model and the human well-being issues based on the Human Development Index and theoretical processes associated with subjective well-being. For environmental conservation, we selected studies that 1) included livestock and 2) mentioned a specific role of livestock in environmental conservation. From 427 results, we found 73 that included animal welfare (n=26), human well-being (n=40), or environmental conservation (n=66) issues. We then conducted a qualitative analysis of the contents using Atlas.Ti8 to examine the interconnections between the three One Welfare categories. We found 45 animal welfare issues (78% associated with positive mental states); 116 human well-being issues (84% 'likely' to improve human well-being); and 202 environmental conservation issues (29%: soil improvement; 10%: biodiversity; 10%: carbon sequestration). We also found scientific evidence that RA can provide a physical and social environment favourable to animal welfare and human well-being, given that the majority of the issues for the three One Welfare categories were associated with positive values after the qualitative analysis. However, it is necessary 1) to strengthen the empirical body of research to test the alleged benefits of regenerative agriculture on animal welfare, human well-being, and environmental conservation, and 2) to further an interdisciplinary dialogue about RA definitions, with a central role for animal welfare, human well-being, and environmental conservation.

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CHANGES IN PREVALENCE OF OWNER REPORTED SEPARATION RELATED BEHAVIOUR WITH TIME DOGS LEFT ALONE DURING COVID RESTRICTIONS**Naomi D Harvey, Robert M Christley, Rebecca Mead, Jane K Murray, Melissa Upjohn and Rachel A Casey**

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There are few studies investigating the association between changes in daily routine and the behaviour of owned dogs. One large change for many dogs in the United Kingdom (UK) was a significant reduction in time left alone during the coronavirus pandemic in 2020. We surveyed dog owners living in the UK in May-July 2020 during the first coronavirus 'lockdown'. Owners were asked questions regarding their dogs' routine and behaviour in a typical week in February (before the pandemic) and the previous 7 days at the time of survey completion. In October 2021, 18-months after restrictions began, the same owners were invited to complete a follow-up survey on their dogs' behaviour with a specific focus on separation-related behaviour (SRB). The follow-up survey was completed for 1,354 dogs (mean age 6.6 years, 49% female, 80% desexed). Although 97% of dog owners indicated awareness of an increased risk of separation-problems when leaving hours increased again, 43% reported that they did not take any steps to prepare their dog for this. Overall, 12% of dogs reportedly developed new SRBs at some point in the 18-month period when their owners started to leave them alone for longer periods or more often. In October 2021, dogs were being left alone less often and for shorter periods of time, compared to February 2020. Most dog owners (81%) expected their October 2021 leaving pattern to remain the same after the pandemic ends, suggesting this change may be permanent. In October 2021, 15% of dogs were reported to have shown a defined set of SRBs in the previous 7 days, which was reduced from 25% before the pandemic in February 2020. For the 15% of dogs that displayed at least 1 SRB in October 2021, 74% of owners indicated they believed their dog was "OK" or "happy/didn't mind" being left alone, whilst only 26% believed their dog was "a bit" or "extremely" upset/stressed. This suggests three quarters of dog owners may not recognise that SRBs indicate their dogs are in a negative emotional state when alone. The overall reduction in prevalence of SRBs seen across this 18-month period, alongside reduced time left alone, indicates improved welfare for UK pet dogs. However, lack of awareness of the link between SRBs and negative emotional states in dogs is concerning and may reduce the likelihood that owners of dogs with SRBs will seek help to support their dog with this issue.

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WELFARE CONSIDERATIONS FOR CHICKENS USED AS LABORATORY ANIMALS**Lindsay J Henderson, Kris Hogan, Amanda Novak, Adrian Sherman and Helen Sang**The Roslin Institute, The Royal (Dick) School of Veterinary Studies, The University of Edinburgh,
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The domestic chicken (*Gallus domesticus*) is an important model organism in a range of applied, basic and clinical sciences. Research using chickens has advanced our knowledge of the genetic, neural and physiological basis of complex traits, and progressed understanding of immunology, host-pathogen interactions, and vaccine production and development. Studies using the chicken embryo have also elucidated the key stages and control of vertebrate development. There is considerable research into how to improve the welfare of chickens under commercial conditions. However, in an agricultural setting, housing and husbandry practices are primarily designed to maximise yield in both laying hens and broiler birds raised for meat. Whereas, for chickens used in research, husbandry practices and housing conditions should adhere to the principles of the 3Rs and birds must be maintained in compliance with the appropriate legislation, which in the UK is the Animals (Scientific Procedures) Act 1986. Despite the importance of the chicken as a research animal, there are significant knowledge gaps in our understanding of how housing, husbandry and enrichment can impact the welfare of wild type and genetically altered chickens used for research, and the routes through which this could impact experimental outcomes. We argue that an improved knowledge base is required to improve the replicability and reproducibility of studies, potentially reducing the number of chickens used in research.

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BOWLS ARE BORING: INVESTIGATING THE USE OF ENRICHMENT FEEDING FOR PET DOGS AND THE ASSOCIATED PERCEIVED BENEFITS AND CHALLENGES**Madeline G Heys¹, Imogen Lloyd² and Carri Westgarth²**¹ School of Veterinary Science, University of Liverpool, Leahurst, UK² Institute of Infection, Veterinary and Ecological Sciences, University of Liverpool, Leahurst, UK
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Canine enrichment feeding (CEF) is recommended by some vets and behaviourists, yet research into its use is surprisingly absent. This study is the first to investigate demographics of owners and dogs that use CEF and the perceived benefits and barriers to its use. An online questionnaire was advertised on social media in July-August 2021 and received 1750 usable international responses. The survey collected information on owner and dog demographics, feeding methods and reasons, dog behaviour (Mini-C-BARQ) and BCS. Multivariable logistic regression was used to determine factors associated with not using CEF. Pearson's chi square tests were used to examine associations between CEF use and owner-reported satiety and begging. Univariable binary logistic regression was used to examine associations between CEF type and veterinarian-rated BCS. Kongs, chews and activity toys were the most commonly used. CEF was most often used for the purposes of providing a treat, delivering meals and to keep dogs busy. Owners that did not use CEF were more likely to be: male (OR=1.25, 95%CI=1.08-5.87, p=0.03); and over 50 years old compared to 18-30 (OR=2.91, 95%CI=1.17-3.44, p=0.01). Dogs that were not fed using enrichment were more likely to: be aged 7 or above compared to under 3 years (OR=2.87, 95%CI=1.60-5.16, p<0.001); be of working type compared to hound (OR=6.92, 95%CI=1.95-24.05, p=0.003); have exercise needs <30mins compared to between 30mins-1hour (OR=3.08, 95%CI=1.27-7.46, p=0.01). Dogs that were not fed using enrichment were less likely to show dog-directed fear (OR=0.72, 95%CI=0.58-0.89, p=0.002) or training difficulties (OR=0.56, 0.42-0.73, p<0.001). There were numerous perceived benefits to using CEF, including: provides mental stimulation; prevents boredom; reduces anxiety; and improves problem behaviours. Using certain types of enrichment (Kongs, snuffle mats, Lickimats, puzzle feeders, scatter feeding and scent games) were associated with reduced owner perceived hunger and begging. Dogs fed using a slow feeder were five times more likely to be an ideal body condition compared to those that never used a slow feeder (OR=5.25, 95%CI=1.649-16.717, p=0.005). Potential benefits of CEF include managing dog weight through reducing owner perceived hunger and begging which are linked to poorer compliance during food restriction diets. Findings also show that owners perceive CEF can improve behavioural problems. Further research using experimental designs would be beneficial to establish causal relationships between CEF and weight management and behaviour. Owners that are male, older, or own older dogs or with lower exercise needs may in particular benefit from encouragement to use CEF.

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THE EFFECT OF SLEEP QUANTITY AND QUALITY ON THE AFFECTIVE STATE OF THE HORSE

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Sleep is critical for physical and psychological well-being but very little is known about the consequences of sleep deprivation in domestic animal species. In humans, sleep deprivation greatly affects emotional state and mental wellbeing and a similar effect may also exist for animals. Previous work in horses has shown that poor routine husbandry practices, such as high light levels at night and low depths of bedding, can affect the type and quantity of sleep that horses experience. The aim of this study, therefore, was to assess if changes in normal sleep patterns in horses impacts on the animal's affective state. Ten horses were exposed to two conditions, a control condition (10cm straw and light off) and a treatment condition (5cm straw and lights on) in order to alter sleep quantity and quality. Each condition lasted for 10 days. Horses' sleep behaviour was recorded and REM and NREM sleep states were estimated using continuous focal behavioural sampling and a previously published sleep ethogram. Horses were tested using a cognitive judgement bias task after both conditions. Levels of optimism and pessimism were determined based on the latency of go/no-go decisions in both the control and treatment conditions. Here we present the findings of the study and discuss whether significant changes in sleep quantity and quality can result in differences in cognitive judgement bias in horses and thus their affective state.

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INVESTIGATING THE RELATIONSHIP BETWEEN RECUMBENCE AND THE FREQUENCY OF STEREOTYPICAL AND FEEDING BEHAVIOUR IN TWO CAPTIVE AFRICAN ELEPHANTS (*LOXODONTA AFRICANA*) AT NIGHT

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In recent years, the welfare status of elephants in captivity has been a hot topic of debate amongst North American and European zoos, namely due to their social complexity and need for space causing discrepancies between ex-situ and in-situ environments. To permit the continuation of keeping elephants in captivity evidence of welfare improvements is necessary, yet the lack of nocturnal behavioural research limits knowledge of overall behavioural repertoires and fails to provide a complete set of behavioural benchmarks to assess welfare, perhaps compromising the success of current welfare strategies. The aim of this study is to investigate whether the frequency of recumbence correlates with the frequency of stereotypical behaviour and standing sleep at night in two adult African elephants (*Loxodonta africana*). Observations were made using CCTV footage over 10 consecutive days from the 23rd of December 2021 and the 3rd of January 2022, between the hours of 17:00 to 8:00. The study subjects are 2 adult bull African elephants (*Loxodonta africana*) named Shaka and Janu housed at Noah's Ark Zoo Farm in Clevedon, United Kingdom. The results showed that the most common behaviours at night were feeding (Shaka: 52.17 ± 14.38 , Janu: 81.42 ± 16.22) and recumbence (Shaka: 49.5 ± 12.59 , Janu: 46.08 ± 9.15) in agreement with results from previous studies. No significant correlation was found between the frequency of recumbence and the frequency of standing sleep for either Shaka ($r = 0.23$, $n = 12$, $p = 0.463$) or Janu ($r = -0.17$, $n = 12$, $p = 0.595$). Similarly, no significant correlation was found between the frequency of recumbence and stereotypic behaviour for Shaka ($r = -0.13$, $n = 12$, $p = 0.679$). Despite this, both elephants displayed a similar overall trend in the times in which they entered and exited recumbent rest. These findings provide an initial insight into social importance of recumbence, which may help elephant keepers to examine social compatibility of unrelated elephants, thus reducing the welfare implications caused by inadequate social groups.

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WELFARE AND SCIENTIFIC LIMITATIONS OF THE FORCED SWIM TEST**Kimberley Jayne¹, Julia Baines¹ and Emily R Trunnell²**¹ People for the Ethical Treatment of Animals (PETA) UK² PETA US*KimberleyJ@peta.org.uk*

Depression and anxiety disorders are among the most common mental health conditions, affecting 3.6% and 4.4% of the global population, respectively. Many pharmaceutical companies have abandoned the development of new anti-depressants, partially attributing this to low quality of preclinical tests, including over-reliance on animal behavioural screens. The forced swim test has been one of the most widely used tests for screening antidepressant drugs. However, increasing evidence shows that the test is poor at predicting antidepressant efficacy, and could even hinder the development of effective new treatments. In this test, small animals (typically mice and rats) are placed into inescapable beakers filled with water, with no rest platform. Initially the animals try to escape by attempting to climb up the sides of the beaker or swim underwater in search of an exit, then they will swim until eventually they become immobile and float the water. Historically this behaviour has been interpreted as 'behavioural despair', however the test has been widely criticised for its validity, with floating considered to be a positive sign of learning, conserving energy and adapting to a new environment. By its nature, the test is stressful and has been highlighted by the National Centre for the Replacement Refinement & Reduction of Animals in Research for being "highly contentious" and "under considerable scrutiny" due to "its severity and effect on animal welfare". Regulators and other agencies have discouraged use of the forced swim test on both welfare and scientific grounds, yet it is frequently still used in both basic research and in testing. Here we review the evidence for ending use of the forced swim test in research and testing for depression therapeutics based on science and welfare grounds, identify other areas of its use where welfare is compromised, and provide suggestions for removing the test from project protocols that fit within UK/EU legislative frameworks.

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AVOIDING FRUSTRATION BY PROVIDING A CHEAP ALTERNATIVE – USING A NOVEL MAXIMUM PRICE PAID TEST TO QUANTIFY THE MATERNAL MOTIVATION IN DAIRY COWS (*BOS TAURUS TAURUS*)**Emma H Jensen¹, Melissa Bateson², Heather W Neave¹ and Margit B Jensen¹**¹ Department of Animal Science, Aarhus University, Tjele, Denmark² Centre for Behaviour & Evolution, Newcastle University, Newcastle upon Tyne, United Kingdom
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In most western conventional dairy production systems, the cow and calf are separated shortly after calving. This procedure ensures more saleable milk for the farmer and can reduce the separation stress experienced by cow and calf, as they are prevented from forming a strong bond. However, consumers are increasingly criticising this practice, and research has found that calves benefit from prolonged cow contact. Similar animal welfare benefits are associated with contact to the dam and contact to so-called nurse cows, who nurse one or more calves that are not their own. Little research has focussed on the possible benefits gained by the cow of rearing her own calf. Our study therefore aims to assess and quantify the cow's maternal motivation, as strongly motivated behaviours can be interpreted as behavioural needs, which have important impacts on the animal's welfare. We compare the maternal motivation across three housing conditions: cows and calves housed together full-time, cows and calves housed together during the day but separated during the night, and cows and calves separated 48 h postpartum (controls). To quantify motivation, we use a novel maximum price paid (MMP) test. Two motivations are assessed: the strength of the cow's maternal bond to her calf, and the cow's motivation to nurse her calf. Both tests use the same set-up; cows are asked to walk through pneumatic gates, on which the weight is progressively increased. If the work required to obtain calf contact exceeds the cow's motivation, she will not walk through the gate. MMP tests can potentially result in frustration for the animal at high prices, if there is no alternative. Our novel take on the method thus provides the cow with a cheap, but less attractive, alternative to the highly motivated resource. This introduces an element of choice, and thus is expected to avoid frustration, if the animal is not willing to pay the price of the attractive resource. To our knowledge, we are the first to use this novel take on the MMP test, as well as the first to assess the cow's motivation to nurse her calf. With this poster, we wish to present the method in more detail, as well as some preliminary results from our ongoing study. Furthermore, we want to discuss the applicability of the method in other studies.

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THE STRUCTURE AND TEMPORAL CHANGES IN BROKERAGE TYPOLOGIES APPLIED TO A DYNAMIC SOW HERD

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Brokerage typologies represent an aspect of sociality by describing the social structure, at a group and individual level, concerning the direction and flow of behaviours or information within, and between subgroups. While animal studies have identified keystone individuals, capable of imparting positive and negative effects on conspecifics, none have characterised social networks based upon brokerage roles. This study applied a brokerage model to a dynamic sow herd (average size = 78) to investigate the direction aggression flows within and between subgroups (based upon connectedness). In total, 42 hours of video observations were obtained over two production cycles. Each production cycle covered 21 days, and behavioural observations occurred on days 1, 2, 3, 7, 14, 20, 21. The social network metrics of degree centrality (number of interactions) and brokerage position (the extent to which individuals lie on the directed path between two previously unconnected individuals) were analysed to describe the directional flow of agonistic behaviours within the networks and investigate the relationship between sociality (based upon connectedness) and brokerage typology. Brokerage typologies are described as coordinators, gatekeepers, representatives, consultants, and liaisons. Aggressive behaviours included biting, thrusting, chasing and displacement. The results revealed all pigs have brokering capability regardless of social connectivity, with a relationship between the level at which a sow is interacting and the brokerage typology they typically engage. Coordinating and consulting behaviour was typically engaged in by the highest connected sows. Significant differences in initiated behaviour (outdegree centrality) and received behaviour (indegree centrality) were found between the specific brokering roles in both production cycles. Coordinators engaged in significantly more aggressive interactions than other brokerage types, showing higher mean indegree and outdegree centralities. Results also reveal consistency in group-level structure over time with consistency in coordinating and consulting behaviour. This preliminary study of brokerage typologies demonstrates the capacity to extend the traditional social network metrics currently applied in animal science research, providing an individual-level criterion to describe how behaviour flows through a network. It further allows for detailed comparisons of network structures within herds, providing a platform to support future research by extending subgroups to account for other variables, including welfare. Knowledge of brokerage typologies could serve to deepen our understanding of how subgroup formation and social roles impact aggression or the transference of detrimental behaviours through social learning.

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LIGHT AND LARVAE FOR LAYERS: EARLY-LIFE INTERVENTIONS TO PREVENT FEATHER PECKING IN LAYING HENS**Saskia Kliphuis¹, Maëva WE Manet¹, Vivian C Goerlich¹, Rebecca E Nordquist¹, Frank AM Tuytens^{2,3} and T Bas Rodenburg^{4,4}**

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Severe feather pecking, the pulling out of feathers of conspecifics, is a maladaptive behaviour shown by laying hens, and causes significant welfare issues in commercial laying hen farming. Possible underlying causes are fearfulness and lack of foraging opportunities. As early life is a crucial stage for behavioural development, adapting the incubation and rearing environment to the birds' behavioural needs may prevent the occurrence of feather pecking. In a 2*2 factorial design study, we investigated the effect of a green light-dark cycle throughout incubation, resembling more natural incubation circumstances, and of foraging enrichment with live larvae during rearing on fearfulness and feather pecking. Divided over two rounds of experiments, 1100 ISA Brown eggs were incubated either under 12:12h or 0:24h light-dark conditions. After hatch, 400 female chicks were housed in 44 pens (8 to 10 chicks per pen). During the entire rearing phase, half of the chicks received black soldier fly larvae in a food puzzle as enrichment. Treatments were not mixed within pens. To assess fear of humans, we carried out an approach test on pen level at 10 weeks of age. To assess feather pecking, we performed home pen observations at 5 weeks of age and scored feather damage at 16 weeks of age. As green light during incubation was shown to reduce fearfulness in broilers, and enrichment with larvae could fulfill the birds' behavioural need to forage, we hypothesized that chickens receiving both light and larvae would be the least fearful and show the least feather pecking compared to no light and no larvae. Our results showed more tail feather damage in the 'light-no larvae' group, compared to all other treatment groups. However, treatments did not affect the number of feather pecking bouts. In addition, the approach test showed no effect on fearfulness. In conclusion, little effect of light during incubation or larvae enrichment during rearing has been found so far, but analysis of additional tests is still ongoing. This experiment was part of the project PPILOW (Poultry and PIg in Low-input and Organic production systems' Welfare, www.ppilow.eu).

The PPILOW project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under grant agreement N°816172.

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TOWARDS THE STUDY OF BOREDOM IN PIGS – DEVELOPING A TASK TO ASSESS PIGS' TIME PERCEPTION

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Subjective experience of time is sensitive to internal and external environment – time flies when you are having fun and drags when you feel bored. Moreover, a feeling of time going by slower than usual is an important characteristic of boredom in humans. Farmed pigs commonly live in barren and monotonous environment, which is likely to induce chronic boredom and may thus distort the experienced time of pigs in a similar manner. Hence, the aim of this study was to develop a time perception task for pigs. For this, 28 pigs were trained to discriminate between a short (1 s) and a long (8 s) tone by choosing a correct goal-box on the right or left side of a test arena. 26 pigs reached the learning criterion ($\geq 80\%$ correct choices in short and long trials across two consecutive sessions; mean \pm sd: 20 \pm 8 sessions). These pigs were subsequently tested in six test sessions, where they were exposed to tones of intermediate durations (i.e. 2.75, 4.5 and 6.25 s) that were interspersed between the learnt short and long tones. Pigs had to decide if the unlearned intermediate tone felt rather like 'short' or 'long' by choosing the right or left goal-box. Prior to testing, pigs in the treatment group (N=17) experienced either enriched or unenriched waiting (4 min) or started the test session without prior waiting (control sessions). Pigs in the control group (N=9) always started test sessions without prior waiting. As predicted, pigs in the control sessions from the treatment group and pigs from the control group performed similarly in the task ($\chi^2_1=1.105$, $P=0.293$). Interestingly, pigs tended to show fewer long choices in test sessions after enriched, but also after unenriched waiting when compared to pigs' performance in the control sessions ($\chi^2_2=5.433$, $P=0.066$), indicating that time was going by faster following both waiting treatments. In conclusion, this study indicates that the experienced time of domestic pigs is sensitive to time distortion, making this task a promising design to assess chronic boredom of pigs in future projects.

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PIGLETS' REACTION TO HUMAN AFTER WEANING IS LINKED TO THE RESPONSE OF THEIR SOW TO THE SAME HUMAN DURING GESTATION**Mathilde Lanthony¹, Marek Špinká² and Céline Tallet¹**¹ PEGASE, INRAE, Institut Agro, 35590 Saint-Gilles, France² Department of Ethology and Companion Animal Science, Czech University of Life Sciences, Prague, Czech Republic
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A good human-animal relation is important for pig welfare. To evaluate the effect of sows' relation to human on their piglets', we measured the influence of sow's reaction to an unfamiliar human on their piglets' reaction to the same human after weaning. We studied 24 sows and 96 of their piglets of the same breed. The sows were group housed during the gestating period and belonged to three different groups of 18 (± 1) individuals. We observed their reaction to an unknown human approaching them in their pen, one by one, at 70 days of gestation. They were then classified in two categories whether they avoided human contact or not: shy (n=11) and docile (n=13). They were transferred to individual farrowing pens one week before farrowing. The piglets were weaned at 28 days and reared in groups of three from the same litter. Two male and two female piglets of each sow were chosen to be observed. At 32 or 33 days, each piglet was submitted to an individual human voluntary approach test (HVA) in a 2.7 m x 2.7 m room. After 5 minutes of isolation in this novel area, the same human as for the sows entered the room and sat still along a wall on a small stool. The behaviour of each piglet was recorded thanks to video analysis. A principal component analysis and a hierarchical clustering on principle components were performed to categorize the piglets according to their behaviours. Three categories were obtained that we named "shy" category (n=44), constituted of piglets staying away from human and freezing, "friendly" category (n=20), constituted of piglets coming and staying close to human, and "explorer" category (n=32), constituted of piglets not affected by the presence of the human and exploring the room. A Pearson's Chi-squared test was performed and showed a significant effect of the sow category on their piglets' reaction to human ($X=8.55$, $p=0.013$). It appears that shy sows mostly produce shy piglets and that docile sows produce any of the three kind of piglets described. A shy sow had 59% chance to have shy piglets and only 9% chance to have friendly piglets. Those findings suggest that sows could transmit their reaction to humans to their piglets and that this is persistent event after weaning. If the transmission is accomplished non-genetically, taming shy sows could thus be favourable both for sow and piglet welfare.

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USING HORSES' FACIAL EXPRESSIONS TO ASSESS PAIN LEVELS AUTOMATICALLY THROUGH DEEP LEARNING-BASED MODELING

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Protocols to assess pain in horses have been developed. However, they are dependent on a well-trained human observer, who most of the time, does not have enough time availability to evaluate the animals for long periods, as demanded by the protocols. In addition, even with adequate training, the presence of an unknown person during the assessment could result in behavioural changes such as a decrease in expression of pain related behaviours. The proposed study aims to explore the potential of using automated methods to assess pain levels in horses, continuously, and without the need to rely on human availability. We have developed a machine vision algorithm based on the Horse Grimace Scale and the use of machine learning methods. Video images were captured from 7 horses that underwent surgical castration. The images were captured on four distinct timepoints of the day, aiming to gather a variable repertoire of facial expressions and therefore distinct levels of pain. The animals received pain control protocol according to the University of São Paulo, School of Veterinary and Animal Science guidelines, which was reviewed and approved by the Ethics and Animal Use Committee (protocol 6603170419). The videos were processed through a software in order to automatically detect and extract frames of each horse at different moments, resulting in 185672 frames, that were then manually selected in order to get only the ones that allowed a good visualization of the animal's head, and therefore the evaluation of pain expressions. A labeling process was applied to build an image database of distinct levels of pain for each of the three facial parameters used: eyes, ears and mouth and nostrils. Afterwards, machine learning methods based on Convolutional Neural Network (CNN) were used to build an individual pain classifier for each facial parameter. These individual classifiers were then combined to build a final algorithm based on Artificial Neural Network (ANN), that presented an overall accuracy of 75.8% while classifying pain on three levels: not present, moderately present and obviously present. While classifying between two categories (pain not present and pain present) the overall accuracy reached 88.3%. Although there are improvements to be made in order to allow the use of the system on a routine basis, the model showed to be promising, which could lead to early diagnosis of pain and promote prompt treatment. The protocol is an educational tool for students and professionals and consequently, benefit animal welfare.

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THE IMPORTANCE OF COMPREHENSIVE SPECIES-SPECIFIC DATASETS IN ANIMAL WELFARE RESEARCH: AN EXAMPLE WITH DONKEYS**Holly A Little, Stuart L Norris, Linda Evans, Andrew Judge and Sarah Tulloch**

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Equids are found in diverse contexts globally as both companion and working animals and are vital for supporting the livelihoods of rural communities across low- and middle-income countries. Optimising equid welfare is therefore of paramount importance for both community livelihoods and wider animal welfare. Whilst there is a great deal of research focussed on horses, donkey-specific publications are comparatively limited and yet critical for informing welfare interventions. The Donkey Sanctuary is a data-driven organisation, directly responsible for ~6000 donkeys across both the UK and Ireland, for which a multitude of welfare and veterinary data are held within a centralised database, managed by an internal data team. With over four million data points, this donkey-specific data collection poses a unique opportunity for numerous donkey-focussed research projects with the potential to improve their welfare globally.

The Donkey Sanctuary's database, known internally as the Animal Management System (AMS), was specifically designed to record in-depth data on all aspects of donkey care, rescue and rehoming. As well as supporting organisational needs, such as the processing of admissions, rehoming and welfare issues of external animals, these data include: demographics, movements, behaviour, weight/BCS, environmental conditions, husbandry e.g. grooming activities and bonded relationships and clinical data, including medications, vaccinations, dental health, hoof health, blood and faecal tests, surgery and post mortems. Although the primary purpose of this data collation is herd management, the opportunity for research is evident. Alongside its use in internal decision-making, such as heightening flu vaccination in response to the equid flu outbreak and managing equid behavioural issues and training, AMS has been used for numerous studies aiming to improve the welfare of donkeys, including those in conjunction with universities and veterinary colleges at both the undergraduate and postgraduate level. These studies include understanding the effect of foot bathing on keratoma-like lesions and identifying donkey-specific risk factors for various diseases and health conditions such as laminitis, sarcoids and liver disease.

This presentation will discuss the role of AMS in these studies, presenting detailed case studies, in order to demonstrate the efficacy of animal rescue/management organisations collating and using comprehensive datasets for improving animal welfare. The illustration of this dataset will highlight the multitude of research opportunities that can be created with the ultimate goal of making evidence-based improvements to animal welfare across varied global contexts, ensuring that methodologies for optimising welfare are, wherever relevant, optimal at the species-level.

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THE PDSA ANIMAL WELLBEING (PAW) REPORT 2021: THE IMPACT OF COVID-19 ON UK PET WELLBEING**Rachel Malkani^{1,2}, Emma Tipton¹, Rebecca Ashman¹, Lynne James¹ and Sean Wensley¹**¹ Policy and Campaigns, Veterinary Services, PDSA, Telford, UK² University of Surrey, School of Veterinary Medicine, Guildford, Surrey, UK
*r.malkani@surrey.ac.uk***Introduction**

The PDSA Animal Wellbeing (PAW) Report provides nationally representative companion animal welfare surveillance that identifies trends and priorities and helps to drive and monitor change. The PAW Report was initiated by the PDSA (The People's Dispensary for Sick Animals), the national UK veterinary charity, in response to the introduction of the UK's Animal Welfare Acts. It set out to understand and monitor the wellbeing of the UK's pet dogs, cats, and rabbits and is framed around the Five Welfare Needs. The 2021 report focussed on pet acquisition and the animal welfare impacts of COVID-19.

Methods

The survey was conducted with YouGov between 04/05/2021 and 25/05/2021, using their nationally representative panel of over a million adults living in the UK. The sample totalled 4,579 cat, dog, and rabbit owners over the age of 18. The findings are also used to estimate the size of the owned pet cat, dog and rabbit populations in the UK.

Results

The estimated pet populations in 2021 were 9.6 million dogs (95% CI \pm 300,000), 10.7 million cats (95% CI \pm 300,000) and 900,000 rabbits (95% CI \pm 100,000).

These figures are not statistically significantly different from February or August 2020.

Significantly more owners who acquired their pet during the pandemic said that they got their pet from abroad (10%) compared to those who acquired their pet before the pandemic (3%).

In dogs obtained during the pandemic, 18% are showing signs of distress when left alone, 15% are showing signs of fear, and 11% are showing signs of aggression towards unfamiliar dogs.

In cats obtained during the pandemic, 16% of owners have seen an increase in nervous behaviour.

48% of rabbits live alone and 50% of rabbits have not received regular boosters.

Impact

The PAW Report provides the veterinary professions and others with robust data on the main welfare problems affecting the UK's pet dogs, cats, and rabbits. This evidence is used to inform welfare-promoting activities in both veterinary practice, animal welfare and policy.

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PRIMARY VALIDATION AND RELIABILITY TESTING OF THE ANIMAL WELFARE ASSESSMENT GRID FOR DOGS

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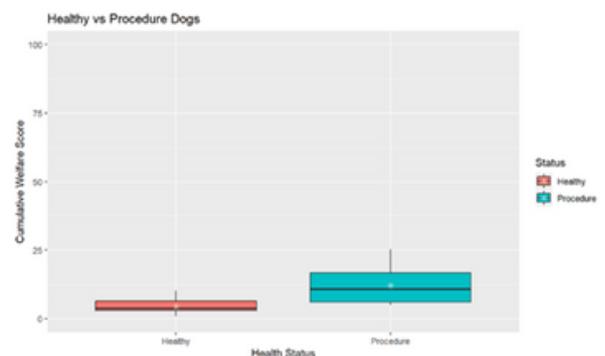
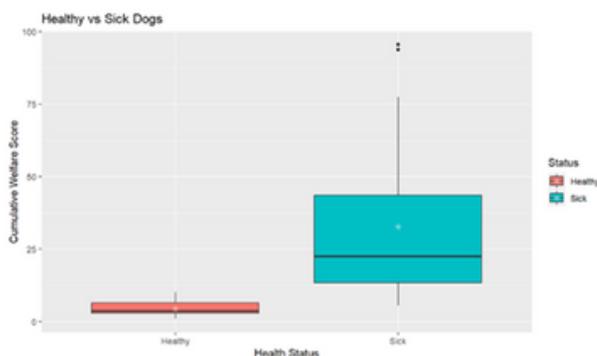
The Animal Welfare Assessment Grid (AWAG) for dogs is a user-friendly, online tool for veterinary and animal welfare professionals to use to quantify and objectively score the welfare of dogs. It assesses the five welfare needs across the parameters of: physical health, psychological wellbeing, environmental comfort, and veterinary and management procedural events, and draws attention to the temporal component of welfare. A range of factors are scored within each of these parameters.

Content validity was assessed by subject matter experts rating the validity of the factors for assessing dog welfare using the Content Validity Index (CVI). The I-CVI (The proportion of content experts giving item a relevance rating of 3 or 4) = 0.99 (acceptable score 0.83) and S-CVI/Ave (sum of proportion relevance rating)/(number of expert) = 0.94. Demonstrating excellent content validity.

Construct validity was evaluated by users of the tool scoring healthy dogs, sick dogs, and dogs undergoing neutering procedures. Mann Whitney tests were conducted in R Studio to ascertain if the tool can differentiate between healthy (n=38) and sick dogs (n=41) (W= 25, p-value = <0.001), and healthy and dogs undergoing neutering (n=8) (w = 36, p-value = <0.001). This shows the AWAG can discriminate between dogs of differing health status.

Test re-test reliability of the AWAG was tested by users conducting multiple assessments on individual dogs under non-changing conditions. Repeated measures ANOVA report no significant difference between tests for each dog (F=0.55, p=0.71). These demonstrate that there is little variation in the scores of dogs. Inter-user reliability was assessed by two users scoring an individual dog at the same time in veterinary referral practice. Repeated measures ANOVA shows no statistical difference between scores (F=0.39, p=0.55).

These initial tests demonstrate that the AWAG for dogs is a valid and reliable tool to assess the welfare of dogs. The tool is currently being used to score and monitor the welfare of dogs with chronic emotional and clinical conditions.



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MANYGOATS - A NETWORK TO PROMOTE OPEN AND REPRODUCIBLE RESEARCH ON GOAT BEHAVIOUR AND WELFARE

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* The project members of ManyGoats who contributed to this work are listed alphabetically.

Most studies on goat behaviour have been conducted on groups of animals characterised by specific individual factors and living conditions. Due to the contextual idiosyncrasies of individual testing sites, the results of individual studies could only be valid for the particular group of animals and thus may not always be reproducible. However, robust results are necessary to ensure that outcomes are broadly relevant; this is vital if such results are intended to contribute towards improving husbandry and management conditions, and thus ultimately bettering animal welfare. Multi-site approaches can offer a resource-efficient opportunity to tackle this problem and increase the external validity of scientific results. For this reason, we formed the ManyGoats network; our aim is to improve the generalisability of findings in goat behaviour and cognition research by implementing identical experimental protocols to simultaneously test animals across different facilities around the world. The network will also aim at improving training and knowledge transfer in goat behaviour research and will adhere to Open Science principles, making our work transparent, inclusive and readily accessible. To date, the ManyGoats network consists of more than 25 researchers across five continents, with expertise in goat behaviour, animal welfare, veterinary medicine, statistical modelling and animal ethics, but more researchers/labs are invited to join the network. In our first proof-of-concept study ('ManyGoats1'), we will focus on goats' behavioural response to humans and/or handling by humans, and whether the attentional state of the person handling the goats affects their behaviour. To increase heterogeneity in our sample and identify factors that contribute to behavioural variation, we will test a diverse range of subjects (i.e. both sexes, different ages, goats used for dairy, meat, fibre and companionship) in different living conditions (e.g. lab, farm, zoo settings). Currently, we are developing the ManyGoats1 test protocol and anticipate starting data collection in the second semester of 2022.

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EFFECT OF WEANING AGE ON VARIOUS MEASURES OF HEALTH IN RHESUS MACAQUES (*MACACA MULATTA*): A RETROSPECTIVE STUDY**David A Massey^{1,2}, Claire L Witham¹ and Melissa Bateson²**¹ Biosciences Institute, Newcastle University, Newcastle-Upon-Tyne, UK² Centre for Macaques, MRC Harwell Institute, Salisbury, UK*d.massey2@newcastle.ac.uk*

The permanent separation of captive rhesus macaques (*Macaca mulatta*) from their mother (herein, weaning) is a major stressor and weaning age has been identified as a promising candidate for refinement. There is robust evidence that very early weaning has long-lasting negative consequences on monkeys' behaviour (increased neophobia and stereotypies) and general health (reduced weight, increased susceptibility to gastrointestinal infections and disorders, increased prevalence of alopecia, and higher probability of being wounded). Whilst the link between early weaning and subsequent health and behaviour consequences is well established, no study has systematically tested the hypothesis that weaning later than the current UK guidelines (of no earlier than 10 to 14 months) will have further welfare benefits. To test this, we took advantage of historical records at the Medical Research Council's Centre for Macaques. During annual health screens, animal technicians and the Named Veterinary Surgeon take measures of coat condition, weight, and *Campylobacter* presence from rectal swabs. Additionally, data from injuries that require veterinary treatment are stored in individual health records. We took all measures of weight, *Campylobacter* incidence, and injuries from 2004-2021 and all measures of coat condition from 2009-2021 (as this was not recorded before 2009) to test the predictions that later weaning would correlate with decreased incidence of *Campylobacter* infection and injury, and increased weight and coat condition. The full dataset contained observations from 800 individuals (Female = 437). To test acute effects of weaning, we sampled records for monkeys that had two consecutive observations: one group either side of weaning; one group that remained in the natal group. To test chronic effects, we sampled the data for observations of individuals near their 3rd birthday (excluding those that were weaned within 6 months of the observation). We found an acute effect of weaning on coat condition and *Campylobacter* incidence: weaned individuals were more likely to have worse coat conditions than monkeys that remained in their natal group and had a higher incidence of *Campylobacter*. Furthermore, a later weaning age appeared to mitigate these effects: later weaning age was associated with better coat condition and marginally non-significant decreased probability of *Campylobacter* infection. We found a chronic effect of weaning by sex on coat condition, whereby later weaned males (but not females) were more likely to have better coat condition at 3 years of age. Taken together, these results corroborate earlier research highlighting the benefits of a later weaning age.

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TRAP-NEUTER-ADOPT (TNA) AS A WELFARE FRIENDLY SOLUTION FOR IMPROVING UNWANTED DOGS WELFARE

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Dog overpopulation and dog relinquishment are worldwide problems with consequences that include shelter euthanasia, free-roaming populations, culling, and impaired animal welfare. Impaired animal welfare affects not only abandoned and free-roaming dogs, but also other wild and domestic animals. Overpopulation and abandonment can be reduced and ultimately eliminated through increased responsible adoption, neutering, improved veterinary care, and encouraging a cultural transition towards responsible pet ownership. In Israel, new governmental initiatives started in 2018, as part of a Dog Population Management (DPM) program. This program features the principal of TNA (Trap-Neuter-Adopt). Out of 104 municipal veterinary services, 34 applied and received incentives for: 1) free neutering for owners that kept mature intact dogs; 2) removing free-roaming dogs from the streets, neutering them and responsibly rehome them; 3) funding adoption days and; 4) communication with the general public regarding the importance of responsible dog ownership. The overall objective of this research was to examine the impacts of these governmental initiatives on dog welfare in Israel. Records of 545,324 dogs registered on the Israeli governmental dog database from 2016-2021 were included in the analyses; 2016-2017 was the period before the initiatives and 2018-2021 was when 34 of the municipalities received the incentives. Common parameters for DPM program evaluation indicated positive impacts of the initiatives on reducing dog overpopulation and improving dog welfare in Israel. For example, mixed effects linear regression models revealed that dog neutering rate was higher by 3.44% [2.12,4.7]; (coefficient; [95% Confidence interval]) in recipient municipalities as compared to non-recipient municipalities. In addition, across all municipalities, dog neutering rates increased by 2.56% [1.80,3.32] in 2018-2021 as compared to 2016-2017. Across all municipalities, median neutering age was significantly higher by 3.27 [1.51,5.03] months in 2018-2021 as compared to 2016-2017 since intact dogs' owners changed attitudes towards neutering. More than 7,500 dogs were successfully rehomed. The number of dogs rehomed per week was increased by three activities that the municipalities could perform in the same week: communication with the public (1.32 [0.79,1.86]), organizing adoption days (0.9 [0.04,1.83]), and picking up more free-roaming dogs (0.13 [0.08,0.18]). Of the rehomed dogs, 76% were successfully registered after a year by the same household. In summary, TNA was found to be a promising component of a national DPM program, to ensure animal welfare, sustainability, and public health; by higher number of free-roaming dogs picked up and successfully rehomed, rather than euthanasia or longer stay on the streets/shelter.

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ETHICS ASSESSMENT WHEN PUBLISHING ANIMAL WELFARE RESEARCH IN AN INTERNATIONAL SCIENTIFIC WORLD

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Ethics assessment is essential in studies that involve sentient beings. This includes research on animal behaviour and welfare, which sometimes includes human subjects (e.g., animal owners, farmers, caretakers, and consumers). Ethics review mechanisms within institutions are long established in many regions, but processes may be non-uniform across different cultures and geographical contexts. The authors of this abstract comprise the Editors-in-Chief of the journals Applied Animal Behaviour Science (IC and PP) and Animal Welfare (HDRG and BLN), the current and former Ethics Officers of the International Society for Applied Ethology (ISAE; AW and IASO), as well as the current ISAE Development and Assistant Development Officers (MCC and J-YC). Some of the authors are also editors for other journals. We are therefore dealing with ethics assessments and statements from a variety of studies on animal behaviour and welfare. Harmonisation of ethics assessment across the globe is highly improbable and need not be the ultimate goal. Improving transparency of reporting for both animal and human studies, particularly in the ethics statement and procedure description, will make ethics assessment by reviewers and editors easier. On the poster presented at this conference, we raise a number of ethics questions associated with scientific studies of animal welfare, including those involving humans. The participants of the conference will be encouraged to contribute their points of view. In general, ethical considerations should be a continual process from the outset of a research idea until the final manuscript. There is a need for continued dialogue on ethics within the animal behaviour and welfare research community.

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DOES AFFECTIVE STATE ALTER THE HEDONIC VALUE OF A SOCIAL REWARD IN LABORATORY MICE?**Ryan Nolan¹, Candy Rowe², Matthew Leach³ and Jane Hurst¹**¹ Mammalian Behaviour and Evolution Group, University of Liverpool, Wirral, UK² Institute of Biosciences, Newcastle University, Newcastle, UK³ School of Natural and Environmental Sciences, Newcastle University, Newcastle, UK*ryan.nolan@liverpool.ac.uk*

Anhedonia is the reduction or loss of hedonic pleasure from rewarding activities, and a core symptom of Major Depressive Disorder in humans. Depression-like symptoms, such as anhedonia, are also observed in animals and can be an indicator of poor welfare and affective state. Picking up laboratory mice by the tail induces negative affective states and reduces the hedonic value of food rewards compared to non-aversive tunnel handling. Whether handling method affects hedonic responses to other reward types, such as social rewards, has not been investigated. One important social reward for mice is the major urinary protein, darcin: a pheromone released in urine of male mice that is highly rewarding to females. Darcin is responsible for female attraction to male odour, and induces both spatial learning and remembered attraction to an individual male's airborne scent. Here, we manipulated the affective state of female mice using handling method to assess whether this influenced hedonic response to darcin. We predicted that mice handled by tail would show a reduced learned preference for the location of darcin relative to mice handled by tunnel in a conditioned place preference test (CPP). Female C57BL/6 mice were handled exclusively by either tail or tunnel during routine husbandry and for nine additional brief handling sessions, and then placed in an experimental arena containing petri dishes in two distinct stimulus locations for 10 minutes. On the learning day, one petri dish contained a control scent stimulus (urine without darcin), whilst the other contained a rewarding scent stimulus (urine containing darcin). The following day, no scent stimuli were present while a hedonic response (more time spent in the previously rewarding location) was assessed. The results from this study will contribute to growing evidence concerning the effects of handling method on laboratory mice. The approach also has the potential to provide a novel method for measuring anhedonia that requires less training than previously published methods.

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HANDLING METHOD AFFECTS ANXIETY-LIKE BEHAVIOUR BUT NOT MEASURES OF CHRONIC STRESS**Janja Novak¹, Ivana Jaric¹, Marianna Rosso¹, Reto Rufener², Chadi Touma³ and Hanno Würbel¹**¹ Animal Welfare Division, Vetsuisse Faculty, University of Bern, Bern, Switzerland² Department of Infectious Diseases and Pathobiology, Vetsuisse Faculty, Institute of Parasitology, University of Bern, Bern, Switzerland³ Department of Behavioural Biology, University of Osnabrück, Osnabrück, Germany
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Studies have shown that non-aversive handling methods (i.e. tunnel or cup handling) can reduce behavioural measures of anxiety and stress in comparison to picking mice up by their tail. Despite increasing studies showing effects of handling method on welfare and data quality in animal research, tail handling continues to be used routinely. This is mostly due to the lack of evidence of a positive effect of tunnel handling on stress physiology, as current evidence in support of non-aversive handling is mostly restricted to behavioural outcomes found after extensive daily handling. While this type of handling may be relevant for habituating the animals to handling before behavioural testing, the results may not apply to routine husbandry practices. The aim of our study was to assess whether and to what extent, different handling methods during routine husbandry induce differences in behavioural and physiological stress responses in laboratory mice. To put the effects of handling method in perspective with other forms of chronic stress, we compared these effects to a validated paradigm of unpredictable chronic mild stress (UCMS). We housed mice of two strains (Balb/c and C57Bl/6) and both sexes either under standard laboratory conditions (CTRL) or under UCMS. Half of the animals from each housing condition were tail handled and half were tunnel handled twice per week, once during a cage change and once for a routine health check. Handling duration did not exceed a couple of seconds and mirrored standard husbandry procedures. We found strain dependent effects of handling method on measures of anxiety: tunnel handled Balb/c mice interacted with the handler more than tail handled mice and tail handled mice had fewer entries in open arms of the elevated plus maze. We found no effect of handling method on time spent in open arms of the elevated plus maze. Animals undergoing UCMS showed increased plasma corticosterone levels in a stress reactivity test and reduced preference for sucrose, indicative of chronic stress. However, we found no effect of handling method on these measures. Our results therefore indicate that routine tail handling may affect exploration and voluntary interaction with the handler, but may not be a significant source of chronic husbandry stress. Our results also highlight strain dependent responses to handling methods.

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ARE PALATABILITY ASSESSMENTS A VALID MEASURE OF HEDONIC RESPONSES IN *EQUUS CALLABUS*?**Claire O'Brien¹, Sebastien MacBride¹ and Matthew Parker²**¹ Institute of Biological Environmental and Rural Sciences, Aberystwyth University, Wales, UK² School of Pharmacy and Biomedical Sciences, University of Portsmouth, UK

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Anhedonia is the inability to experience pleasure from otherwise rewarding stimuli. It is a core feature of clinical depression in humans, which is one of the leading causes of significant occupational and performance-related impairments worldwide. Anhedonia is often measured through self-report measures in human patients, but in animal models measuring hedonic states typically involves the use of palatability assessments using sucrose-based tastants. Methods have been validated in several animal models such as in rodents, primates, dogs and pigs, with (1) choice of tastant and (2) technique for analysing consumption patterns being adapted across species. Subsequently, palatability assessments have been used to measure the influence of environmental factors on the hedonic value of reward and identify animals displaying anhedonic symptoms, highlighting various ethical and welfare issues related to certain captive/domesticated settings.

Recent research has suggested the use of palatability assessments for investigating anhedonia in horses, but currently no method has been fully validated to establish the optimal approach to measure hedonic responses in the horse. Due to post-ingestive factors such as satiety, fatigue of the mastication muscles, etc., simple consumption of daily dietary components alone may not be a direct measure of food palatability in horses. Certain consumption patterns may instead reflect hedonic reactions more accurately, especially with sucrose-based tastants, but techniques for measuring responses can vary widely across species. For instance, licking microstructure is a valuable method of measuring hedonic responses to sucrose-based solutions in rodents, but is not feasible in pigs and is replaced with consumption time per approach (CT/A). Measuring the relationship between orofacial responses to tastants can also bear little resemblance between species, most likely due to differences in the underlying facial anatomy. This study therefore aimed to evaluate the palatability responses to different sucrose concentrations using lick blocks to ascertain whether this methodology would be a valid measure of hedonic responses in horses.

Across five days, 10 horses were video recorded in their stables while exposed to different sucrose concentrations in the form of custom-made UniBlock® licks (20, 25, 30, 35, 40%), counterbalanced for order, over five consecutive 10-minute tests. Palatability was estimated through consumption patterns (consumption time per approach, CT/A), facial expressions (EquiFACS) and consumption during a 2-minute period. Here we present the findings of the study and discuss whether this methodological approach validates the use of palatability assessments in order to identify the consummatory component of anhedonia in the horse.

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MANUAL AND PRECISION LIVESTOCK FARMING (PLF) ASSISTED WELFARE COMPARISON BETWEEN TWO HOUSING SYSTEMS USED IN ORGANIC EGG PRODUCTION

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One of the emerging trends in small-scale family farming is the use of mobile housing systems for keeping poultry on pasture. This is a farming practice loosely defined by the (EC) No 889/2008 (“Organic Regulation”) is being promoted as a more natural and stress-free method in comparison with traditional housing. The current work is a comparison between two housing systems in southern Italy during the transitional period of autumn-winter 2021 (52 days). It includes one organic certified coop with access to an open yard (30 hens) and three independent mobile housing units (12 hens). The welfare assessments included two on-site manual evaluations using an adopted Welfare quality[®] protocol for laying hens. Additionally, all of the 42 hens were individually tracked by a walk-over-weight PLF system. The system collected continuous data regarding weight gain trends and vitality using pressure sensible sensors and cameras for tracking abnormal behaviour in the presence of predators. The results showed extremely positive welfare scores for both housing systems as both have high standards of certified organic production. In most aspects, only marginal differences were found which included animal clinical conditions, housing space, access to resources, enrichment measures, and response to novel objects. The main difference was found in the qualitative behaviour assessment where hens housed in mobile units had noticeably higher scores for positive behaviour and almost complete absence of negative aspects (Figure). This might be attributed to the availability of pasture and its continuous change on a daily basis. Hens were actively occupied with foraging activity during all observation periods compared with the coop yard where such activity accrued only sporadically. The PLF system showcased the good housing conditions for both systems, with vitality and weight trends being similar for both and without incidents of weight loss or mortality. Visual control of behaviour did not detect group flight behaviour even when the presence of potential predators (stray dogs) was identified in short proximity. In conclusion, mobile housing of laying hens has a similar high welfare standard as a well-managed traditional coop with yard access. In fact, the access to fresh pasture may enhance positive aspects of hen’s qualitative behaviour. While the walk-over-weight PLF system was able to monitor basic welfare and housing quality it failed to detect subtle differences in behaviour without further improvements to the AI algorithm.

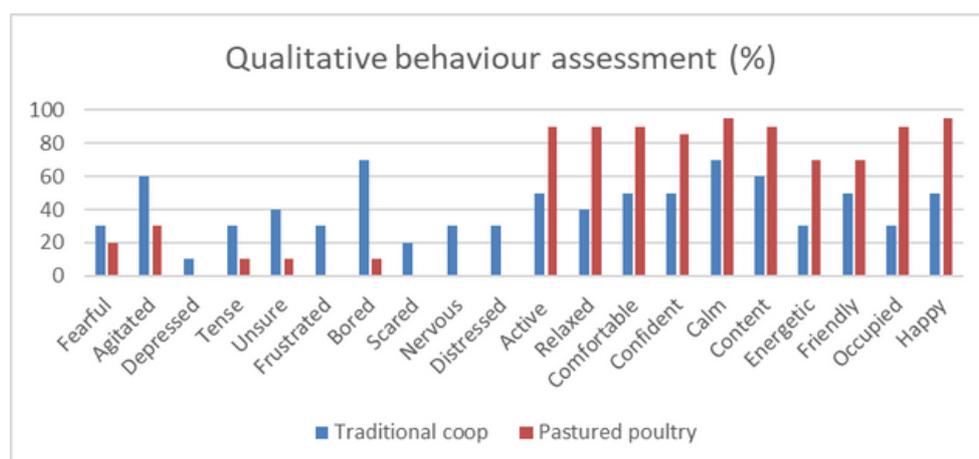


Figure: Qualitative assessment of negative (left) and positive (right) behaviour for laying hens in traditional coop housing and mobile housing units (expressed as a percentage of overall observed animals).

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WEEKLY ALTERNATION AND CONTINUOUS PRESENTATION OF ENVIRONMENTAL ENRICHMENT ON BEHAVIOUR OF GROWER PIGS**Ayoola A Oluyemi, Olufemi A Adebisi and Temitope O Bankole**Department of Animal Science, University of Ibadan, Ibadan, Nigeria
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The inability to provide appropriate environmental enrichment for animals in confinement has been a great contributory factor to the incident of adverse behaviour in pigs, thereby interfering with the welfare of the animals. Therefore, presenting adequate enrichment capable of eliciting required stimulus to divert the attentions of animals from exhibiting these negative behaviours is pertinent. Also, there is possibility that an enrichment will not generate the expected stimulus due to habituation. Hence, this experiment was conducted to study the effect of weekly alternation and continuous presentation of enrichment on the behaviour of grower pigs. Forty-five crossbreeds (Largewhite X Landrace) grower pigs were distributed into five treatments in triplicates arranged in completely randomized design for eight weeks. Two object types were used as enrichment; polyester rope (PR: 14mm, blue, open ended, knotted at interval) and soft wood (SW: 55 x 5.0 x 4.5cm) which were suspended from the roof to the shoulder height of the animals. The treatments were, CT: (without enrichment), PRC: (Continuous presentation of 2 pieces of PR), SWC: (Continuous presentation of 2 pieces of SW), (PR+SW)C: (Continuous presentation of 1 piece of SW and 1 piece of PR) , SW/PR: (Weekly alternation of either 2 pieces of SW or 2 pieces of PR). Behaviours were monitored using CCTV attached to each pen, for capturing Pen Component Manipulation (PCM), Pen-Mate Manipulation (PMM) and Enrichment Use (EU) using standard procedures. The results revealed significant differences in parameters measured across the treatments. PCM in CT continuously increased from week one to eight while PRC, SWC and (PR+SW)C reduced till fourth week before picking up again till the study ends, while SW/PR consistently decreased throughout the experiment. PMM progressively increased in CT than treatments with enrichment from week one to eight. However, while the observation for PRC, SWC and (PR+SW)C fluctuates, SW/PR continuously reduced from week one to eight. Fluctuation in the EU was observed across the treatments up to week five when constant decrease was observed till week eight in the PRC, SWC and (PR+SW)C, while SW/PR increased continuously from week five to eight. From the study, it was shown that alternation of enrichment devices increased behavioural response of grower pigs than continuous presentation. Consequently, weekly alternation of soft wood and polyester rope had better effect as an enrichment than their continuous presentation, thus reducing adverse behaviours towards pen-mate and pen component, which improves the welfare of pigs.

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IMPLEMENTATION AND USE OF A NOVEL WELFARE ASSESSMENT TOOL TO IMPROVE PRIMATE BEHAVIOURAL MANAGEMENT PROGRAMS**Carly I O'Malley¹, Emilie Paterson² and Patricia V Turner^{1,2}**¹ Global Animal Welfare and Training, Charles River, Canada² Department of Pathobiology, University of Guelph, Canada*carly.o'malley@crl.com*

Primates play an important role in biomedical research and there is an ethical obligation to provide the best welfare for every stage of life. For global organizations, there may be asynchronous implementation of refinements to improve primate welfare, different regulations across countries, and a wide variety of research purposes to consider. Regular welfare assessments based on primate-specific evidence-based indicators are important for promoting effective animal care and use programs by ensuring an animal's affective state, behavior, and physiology are suitable for scientific study, deviations from approved protocols or negative welfare states are identified and corrected quickly, and that animal use, housing, and husbandry standards are optimal, continue to meet the animals' needs, and provide positive experiences. Welfare assessment should also consider cumulative use and humane endpoints. Recognizing the need for more formalized welfare assessment, a Primate Welfare Assessment Tool (PWAT) was developed to establish global guidelines and best practices, benchmark current practices and monitor progress of improving welfare within the company. The PWAT was developed, beta tested, and a pilot was conducted in Fall 2021. Two sites located in different continents used the PWAT, including room, site, and culture of care assessments, and a user survey was completed following use of the tool. Based on the user survey, the assessment was easy to complete, and personnel were satisfied or very satisfied with the look, feel, and accessibility of the forms in SmartSheets. "Easy to use," "site level assessment," and "animal behavior" were named as the most important features, and the PWAT was considered valuable or very valuable for assessing and improving primate welfare. Personnel gave the PWAT 8.7/10 for their overall experience with using the tool. The PWAT took ~7h over 6 rooms for the room-level assessment, 30min for the site-level assessment, and <1h for the culture of care assessment. The pilot also identified areas for improvement for the tool - primarily redundancies and needed clarifications, especially considering the global nature of the tool and language translations. Based on the pilot, the tool was reduced from 167 to 102 criteria. The PWAT was used to identify challenges and recommendations for each site that would allow them to make decisions on what aspects of their program to prioritize to improve primate welfare including staff training on primate behavior, conducting regular behavioral assessments, and implementing more habituation and training. The PWAT will be implemented across global sites in March 2022.

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THE EFFECT OF DOG COLOUR, SIZE AND ENVIRONMENT ON A HUMAN APPROACH-STOP TASK USING VIDEOS OF A SIMULATED DOG MODEL DISPLAYING AGGRESSIVE BEHAVIOURS**James A Oxley¹, Helena Ransome-Prince¹, Georg Meyer², Iain Cant³, Giuseppe M. Ballantuono³, Matthew Butcher³, Andrew Levers³ and Carri Westgarth¹**¹Institute of Veterinary and Ecological Sciences, University of Liverpool, Leahurst Campus, Cheshire, UK² Department of Experimental Psychology, University of Liverpool, Liverpool, UK³ Virtual Engineering Centre, Daresbury, UK*Carri.westgarth@liverpool.ac.uk*

Dog aggression is an ongoing concern for public health (physical injuries and psychological trauma) and dog welfare (relinquished, rehomed, seized, or even euthanised). However, the physical appearance (e.g., size and coat colour) of a dog may play a role in individual perceptions of a dog (e.g., black dog syndrome) and whether it is safe to approach. To date minimal research has been conducted using real-time assessment of human behaviour around aggressive dogs, for ethical reasons.

A stylised Labrador known as DAVE (Dog Assisted Virtual Environment) was developed which displays aggressive behaviours based on the canine ladder of aggression, and where the environment, coat colour and size can be altered. An online survey was shared through social media for a one-month period (September – October 2021) and was open to adults (≥ 18) from all countries. Participants were randomly allocated one of five videos of the simulated dog in a design allowing direct comparisons of yellow versus black coat colour, small versus medium and large size, and the indoor versus outdoor environment. Each participant was asked to play the video and press stop at the point if/where they would stop approaching the dog. Kruskal-Wallis and Mann Whitney U tests were used for group comparisons.

A total of 1590 participants from 59 countries were included in analysis. Individuals moved significantly closer to the yellow (median stop time = 22.1s) than the black dog (median time = 17.5s; $p = 0.010$) and significantly closer to the small (median time = 29.3s) compared to the medium (median time = 22.1s; $p < 0.001$) and large (median time = 25.6s; $p < 0.001$) dog. There was no evidence of difference in proximity to the dog in the indoor and outdoor environment ($p = 0.94$).

This study provides novel insight into human proximity behaviour in the presence of an aggressive dog in real time that can be experimentally controlled and is ethical for dog and human welfare. The tendency for people to approach closer to lighter coloured or smaller aggressive dogs may have implication for dog bite prevention strategies.

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AUTOMATED LABELLING OF FACIAL FEATURES IN DOMESTIC DOGS**Marie-Claire Pagano¹, Cameron Smith^{1,2} and Lucy Asher²**¹ School of Natural and Environmental Sciences, Newcastle University, Newcastle, UK² Department of Electronic and Electrical Engineering, University College London, London, UK*M.Pagano2@newcastle.ac.uk*

Facial expressions, dynamic changes of facial features, may cue affective states in non-human animals when interpreted in the context of emotion eliciting stimuli. Whether manual or automated, facial expression analysis consists of three main tasks: 1) facial landmark recognition; 2) feature extraction; 3) expression recognition or classification. Automating facial expression analysis can aid in consistently processing large datasets and may reveal changes missed by the human eye. Domestic dogs pose unique challenges to facial feature recognition tasks since they vary greatly in their facial morphology. We aimed to develop a method to automatically label and track facial features of domestic dogs from videos collected by participants using DeepLabCut, a deep learning pose estimation toolkit.

Dog owners carried out emotion eliciting experiments resulting in 50 dog participants (175 videos). We manually labelled the facial features of 1110 frames taken from 37 videos (26 individuals) to train the model. We selected dog facial features, such as the upper and lower eyelids, outer and inner eyelids, eyebrows, ears, nose, and mouth that have been found to be involved in facial expressions and are salient to both humans and dogs. We carried out an active learning framework by correcting inconsistent labels from previous models and retraining for 400,000 iterations. The model had a higher average training error (5.91 pixels) but a lower average error when applied to test data (12.45 pixels) than the previous model, suggesting an improvement in generalising its performance to novel data.

We explored whether predictor variables: the landmark type, ear morphology (upright, floppy, drop), the cephalic type (brachy-, meso- and dolichocephalic), the emotion conditions and the colouration of the dog (multicoloured and solid) or the random factor: the dog's ID alone, explained the average likelihood predictions, a measure of the model's certainty that the placement of a label is correct. The landmark and the emotion condition models differed significantly from the null model including only the random factor (chisq: 1272.9, 19.18, anova: $P < 0.001$) with the null better explaining the average likelihood predictions of label placements (AIC full: 1217.33, 383.62 vs AIC null: 372.45). The individual features (ear type, cephalic type, and colouration) did not differ significantly from each other.

DeepLabCut offers a means to automatically label facial features in dogs. The model's performance was affected by the individual ID and/or uncontrolled variation in the videos such as image quality and relative distances between the dog and camera.

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GRAZING RESTRICTION INDUCES WOOL PULLING BEHAVIOUR IN SHEEP AND IT CAN BE EVALUATED THROUGH WOOL INSPECTION**Ricard Pares¹, Pol Llonch¹, Xavier Manteca¹ and Xavier Such²**¹Department of Animal and Food Science, School of Veterinary Science, Universitat Autònoma de Barcelona, Bellaterra, Spain² Grup de Recerca en Remugants, Department of Animal and Food Science, School of Veterinary Science, Universitat Autònoma de Barcelona, Bellaterra, Spain*Ricard.Pares@uab.cat*

Abnormal behaviours are less frequent in ruminants than other species, but they should not be underestimated. In sheep, one of the abnormal behaviours is wool pulling. It may appear due to restrictive environment or husbandry deficiencies but also as a redirected behaviour when sheep are deprived of adequate levels of activity or oral stimulus. In order to improve sheep welfare, it's necessary to understand the drivers of wool pulling. For the assessment of wool pulling, as it causes bald areas that could be distinguishable from other causes, presence of bald patches in wool cover could be used as a proxy indicator. A study evaluated the effect of grazing restriction on wool pulling behaviour, and wool cover inspection as an indicator of wool pulling. The study included a herd of 40 pregnant Ripollesa breed housed in an open barn for a period of 10 weeks, divided into two groups: a control group (C) had daily access to grazing from 10:00 to 15:00, and experimental group (E) remained in permanent housing throughout the experimental period. In both groups, behaviour was video-recorded two days per week during the following intervals: morning (6:00 to 6:15), afternoon (16:00 to 16:15), and evening (21:00 to 21:15). Wool cover was visually assessed in all sheep at weeks 1,4,7 and 10, using a four-scale score based on previous studies: (0) absence of bald areas, (1) presence of bald areas lower than 5 cm., (2) presence of bald areas greater than 5 cm., and (3) presence of bald areas greater than 50% of wool cover. Wool pulling behaviour was not observed in group C throughout the experimental period, whereas it was present in group E from week 5 to 10, mainly during the afternoon period (16:00 to 16:15). No signs of wool pulling were observed in group C (mean value score was 0 throughout the period) while herd mean scoring value in group E increased progressively in weeks 4, 7 and 10 (0.1, 0.45 and 0.70, respectively). In conclusion, prolonged grazing restriction induces wool pulling behaviour, which can be assessed using a 4-scale wool cover score in sheep herds.

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EARLY BEHAVIOURAL INDICATORS OF GASTROINTESTINAL PARASITISM IN EXTENSIVELY FARMED SHEEP FOR A PRECISION LIVESTOCK APPROACH TO WELFARE MANAGEMENT**Michelle C Reeves^{1,2,3}, Heather C McDougall¹, Fiona Kenyon¹, Jessica E Martin²,
Emma M Baxter³ and Cathy M Dwyer³**¹ Moredun Research Institute, Midlothian, UK² Royal (Dick) School of Veterinary Studies, University of Edinburgh, Midlothian, UK³ Animal Behaviour and Welfare, SRUC, Midlothian, UK*michelle.reeves@sruc.ac.uk*

Sheep face several welfare challenges in extensive management conditions, including gastrointestinal (GI) parasitic infection. While the effects of GI parasites on sheep health and production levels are understood, it is unclear what kind of impact they have on the sheep's welfare, especially at sub-clinical infection levels. For example, it is possible that levels of discomfort would increase. The aim of this study was to identify early indicators of GI parasitism and understand its welfare impact on sheep, using behavioural observation, AWIN welfare indicators and Precision Livestock Farming (PLF) tools. Twenty-four Scottish Mule ewes and their twin lambs were divided into four experimental treatment groups. Half of the animals were treated with an anthelmintic drench, acting as a "low parasitism" (LP) group while the other half were not treated and acted as a "high parasitism" (HP) group facing naturally occurring infection. Within each of these two groups, half of the ewes and lambs wore collars (HP-T/LP-T) containing an accelerometer and a proximity logger. The other half of the sheep did not wear collars (HP-NT/LP-NT). Behavioural observations were carried out in person using scan sampling to record maintenance behaviours and behaviour sampling to capture rare, short-duration behaviours such as playing and sucking bouts. During the observation periods, the proximity loggers in the collars recorded the animal's approximate location and 15 nearest neighbours every 5 minutes while the accelerometer collected tri-axial data at a rate of 12.5Hz (12 samples/second). Lamb behaviour was not significantly affected by parasitology or technology treatment group. The factors impacting behaviour were whether the lambs were weaned ($p < 0.001$), and the time of day they were observed ($p < 0.001$). Wearing collars impacted lameness ($p = 0.047$) and dag score ($p = 0.01$) in lambs. The accelerometer data did not reveal a significant difference between HP and LP lambs ($p = 0.28$). It appears that sub-clinical gastrointestinal parasitism does not impact lambs' welfare to a degree where behavioural change occurs. Wearing technology on collars had a mixed impact on the welfare of the lambs in this study, although further research is required to solidify this finding.

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PROGRESS OF PRIMATE ENVIRONMENTAL ENRICHMENT LITERATURE 1978 – 2019**Samuel Richardson**

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Captive primates being behaviourally, and socially complex animals exist in environmental conditions which negatively affect their mental and physical health. Environmental enrichment is an extensively utilised tool which aims to improve animal welfare through the provision of stimuli. However, without an understanding of how enrichment research is developing, enrichment implementors are constrained in their ability to improve their animal's welfare, and future research is hindered. Therefore, I collated data from 227 primate enrichment articles to present research trends and outcomes, with the aim of updating our understanding of how primate environmental enrichment research is progressing. Most articles recorded behaviour (n = 203) while few recorded physiological data (n = 20). Inequity exists between the most researched category of feeding enrichment (n = 87) and the least being training (n = 14) and olfactory enrichment (n = 5). The articles featured 71 primate species shared between zoological (n = 57) and laboratory-based studies (n = 22). More articles represented laboratory conditions (n = 135) than zoological (n = 87). Over 99% of articles achieved their goals, which represents a possible publication bias in favour of publishing beneficial welfare outcomes. A meta-analysis of all published primate enrichment research should be conducted to better understand the enrichment category welfare benefits, and the relevance of individual enrichment to each species. Future primate enrichment research should focus on increasing underrepresented enrichment categories, species, and environmental conditions.

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A FIVE DOMAINS APPROACH TO ASSESSING THE WELFARE OF DAIRY DONKEYS**Karen J Rickards, Fiona Cooke and Stuart Norris**

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Assessment of animal welfare is a complex process that needs to incorporate measures of physical and psychological health including both animal and environmental indicators. The animal's own experience of their environment and health needs to be considered to gain a full understanding of their welfare status. Donkeys are found in many different environments globally, performing a variety of roles so it is important to have a robust, objective and repeatable way to assess their welfare. In this study, we carried out welfare assessments on 191 dairy donkeys on seven different farms in Europe using the Equid Assessment Research and Scoping (EARS) tool. Two separate protocols were used, one for foals and one for production animals, to reflect the different health related issues and husbandry associated with different age groups. Qualitative Behaviour Assessment (QBA) was incorporated into the assessment to provide information about the emotional state of the donkeys. QBA assessments were carried out for groups or for individual animals dependent on their usual living circumstances and all donkeys at each farm were assessed. Data were collected using Open Data Kit Collect and results disseminated through dashboards using R Shiny. For EARS, 56 foals were assessed and 135 donkeys in production. Ten percent of the donkeys in production and 20% of the foals were very thin (body condition score = 1/5). Seventy eight percent of the donkeys in production had signs of hoof neglect linked to overgrowth and/or incorrect trimming and 33% showed an avoidance response in the observer approach test. Thirty two percent of the foals showed signs of morbidity, which included dullness, swollen joints, diarrhoea, lymphadenopathy, tachypnoea and abdominal pain. QBA identified prevalent behaviours such as uncomfortable, distressed, withdrawn, bored and apathetic, which consistently placed the donkeys in the negative mood with low energy quadrant on the principal component axes. The EARS and QBA analysis was found to be consistent with donkeys identified as being in poor physical health or being managed in unsuitable ways experiencing higher distress, apathy and aggression than those with better health or husbandry practices. The assessments provided a baseline for animal welfare on dairy farms and identified some key areas for improvement. Farm owners received reports with recommendations and by using these validated assessment tools it will be possible to evaluate the effect of any interventions to improve welfare.

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DAM (*CANIS FAMILIARIS*) WELFARE THROUGHOUT THE PERI-PARTURIENT PERIOD IN COMMERCIAL-BREEDING KENNELS**Aynsley Romaniuk¹, Shanis Barnard¹, Jennifer Weller², Hsin-Yi Weng¹, Sriveny Dangoudoubiyam¹ and Candace Croney¹**¹Department of Comparative Pathobiology, Purdue University, Indiana, USA² Agri-Food & Biosciences Institute, Northern Ireland, UK*aromaniu@purdue.edu*

In commercial-breeding (CB) kennels, dams spend a large proportion of time in the peri-parturient period. Dam physical and behavioral health throughout this period can significantly impact their own welfare and that of their offspring. The current study aimed to identify changes in physical, physiological and behavioral metrics that might be associated with changes in the welfare states of dams throughout the peri-parturient period in CB kennels. Dams (n= 59) from eight CB kennels in Midwestern USA were tested at 6 and 1-week prepartum, and 4 and 8-weeks postpartum. At each time point, experimenters conducted a stranger approach test and visual physical health examination and collected hair for hair cortisol concentration (HCC) and feces for fecal glucocorticoid metabolites (FGM), fecal immunoglobulin A (IgA) and parasite analyses. Results using linear mixed-effects models indicated that dams exhibited more affiliative responses to stranger approach at 4-weeks postpartum than 6-weeks prepartum ($p=0.03$), a significant increase in HCC from 4-weeks to 8-weeks postpartum ($p=0.02$), and a significant increase in FGM from 1-week prepartum to 8-weeks postpartum ($p=0.04$). These changes are likely due to increased energy requirements and hormonal variations during lactation, but may also indicate shifts in welfare related to changes in the dams' environments (e.g., presence of conspecifics, kennel design), and management (e.g., amount of caretaker interaction, etc.) when moved to and from whelping pens. There was no significant change in fecal IgA over time ($p>0.05$). No major physical health concerns were observed. The percentage of dams with intestinal parasites was 11%, 4%, 23% and 15%, at each respective time point. Results from a repeated measures correlation indicated a significant correlation between FGM and fecal IgA ($r_{rm}= 0.23$, $p=0.002$), which may have implications for future welfare studies requiring strategic selection of metrics. This is the first study exploring changes in behavioral and health metrics throughout the peri-parturient period in dams from CB kennels. Our findings appear to be associated with natural biological changes that occur during this time. However, future research should further investigate the effects of changes in environmental conditions and management factors throughout the peri-parturient period on dam welfare.

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A HUMANE DEATH FOR BLACK SOLDIER FLY LARVAE (*HERMETIA ILLUCENS*) USED IN FOOD AND FEED**Lizzie Rowe, Erika de Castro and Miha Pipan**

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The recent expansion of the insect farming industry raises important ethical questions over the standards of care that these mini livestock should receive during their life and death. Scientific investigation into the sentience of insects is in its infancy, and yet there is evidence to suggest that some insect species can feel physical and mental experiences. In the face of current uncertainty over their ability to feel, the precautionary principle (taking precautionary measures to avoid causing harm) is a widely accepted approach to ensure that we minimise the risk of causing suffering, should evidence supporting sentience later emerge (as it has done for many animals previously considered incapable of feeling such as fish, cephalopods and decapods). This approach also ensures that insect farming companies meet growing societal expectations that insects, as living creatures, are treated with respect.

Therefore, according to this principle, standards should be put in place to protect the welfare of farmed insects. A humane death is an important aspect of good welfare standards: affording animals a death free from pain and suffering, which can be achieved by killing an animal instantly.

A widely used method of killing insects for food and feed is blanching (immersion in hot water or water vapour). Blanching is often cited as causing instant death, and yet there is no published empirical data to support this.

We set out to pilot a methodology to determine the lowest temperature of water needed to cause instantaneous death in black soldier fly larvae (BSFL), one of the most commonly farmed insect species. Instantaneous was defined as within one second, and death was defined as lack of response to mechanical stimulation and loss of turgidity.

Larvae (n = 20) were individually immersed into 90-degree water and withdrawn after one second. This was repeated at temperatures reduced by 5 degrees until the majority ($\geq 65\%$) of larvae were not dying instantly, at which point the experiment was terminated. Any larvae that were still alive after immersion were placed in boiling water to induce death.

Results indicated the proxy measures used to determine death need further refinement, in part through a clearer understanding of BSFL neurology and whether post-mortem reflex activity occurs.

This pilot represents the first step in investigating humane death in BSFL; we will present the results with the aim of stimulating future work and collaboration on this important topic.

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HUMAN-ANIMAL RELATIONSHIPS IN ANIMAL AGRICULTURE: EVOLVING PERSPECTIVES ON DEVELOPING RESPECTFUL RELATIONSHIPS WITH ANIMALS**Erin B Ryan¹, Daniel M. Weary¹ and Becca Franks²**¹ Animal Welfare Program, University of British Columbia, Vancouver, BC, Canada² Department of Environmental Studies, New York University, NYC, USA*erin.ryan@alumni.ubc.ca*

Animal agriculture, a system that employs over one billion people and results in the slaughter of over one hundred and fifty billion animals each year, represents perhaps the most profound intertwining of human and animal lives on the planet. And yet, research on the human-animal relationships at the centre of these systems has focused on only a narrow range of relationship states. Here we discuss the possibility of investigating deeper human-animal connections, and how improving these relationships may improve the lives of the animals used in agriculture and the people who care for them. Considering the range of possible relationships between humans and animals on a continuum, we present evidence showing that the majority of these relationships exist at one end of a continuum; these relationships are asymmetric, with the brunt of the inequality being faced by animals. We describe the use of Shared Reality as a framework for studying human-animal relationships, including close, intersubjective relationships (which involves shared attention and mental states between subjects). We also describe other scholarly traditions that encourage learning from, and taking the perspective of nonhuman animals, and discuss how these approaches provide new insights into close human-animal relationships and how these might be better fostered in animal agriculture. We conclude that close relationships are possible in agriculture and likely to be of mutual benefit, and that the lack of opportunities for such relationships constitutes an underrecognized harm in our food systems.

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NOT GOOD ON FOOT? THE OCCURRENCE OF CLAW ASYMMETRIES DURING THE LIFETIME OF FATTENING PIGS (*SUS SCROFA*)**Sarah Seufert¹, Nina Volkmann^{1,2}, Johannes Schmidt-Mosig^{1,3} and Nicole Kemper¹**

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Claw abnormalities, particularly claw asymmetries, are associated with lameness in pigs, and represent an important welfare issue. Asymmetric claw growth can result in incorrect, painful loading of the joints of the entire limb and can imply an increased occurrence of claw sole ulcerations. As the asymmetry of pigs' claws is promoted by housing the animals on hard floors, the aim of the present study was to record and analyse claw asymmetries during pigs' lifetime.

Observations were conducted on a German research farm and its slaughterhouse. The claws of the fattening pigs were photographed at three points in time: as a suckling piglet ($n = 515$), as a weaned piglet at the age of four weeks ($n = 490$) and at the slaughterhouse ($n = 307$). The images of the claws were used by one observer to classify the claw asymmetries using a scoring system ranging from 0 (no visible asymmetry of the claw) to 3 (strong asymmetry). Observer reliability was evaluated using a random sample (100 images), which was evaluated by two experienced persons, and the agreement was calculated using Krippendorffs' alpha. Similar to the classification of the claw asymmetry, the sole ulcerations were scored on a 0 to 3 scale. A descriptive analysis was performed to show frequency distributions of claw asymmetries on all four claws during lifetime of the fattening pigs. For the occurrence of intermediate to severe claw sole ulcerations, the odds ratios (OR) for the maximum rated value of claw asymmetry were calculated.

The results showed that already in new born piglets, asymmetric claws were present in considerable numbers as already 3% showed intermediate asymmetries of Score 2. From the third day of life until slaughtering, asymmetric growth of the claws was detected increasingly. Claw sole ulcerations were only detected in slaughtered pigs and the prevalence was 64.2%. The risk of the occurrence of an ulceration was 3.6 times higher with strongly asymmetrical claws compared to slightly asymmetrical claws (OR = 3.6; CL = 1.4 – 8.8; P = 0.0064), and even higher for pigs showing intermediate asymmetrical claws (OR = 2.7; CL = 1.5 – 5.0; P = 0.0014).

The study showed an increase in the prevalence of claw asymmetries, which can lead to serious pathologies, such as claw ulcers, in the further course of animals' life. Most likely, the unbalanced weight load of the individual claws in combination with hard floors leads to the occurring damage of the claws.

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**DEVELOPMENT AND ENCODING OF AROUSAL IN MONGOLIAN GERBIL AND DJUNGARIAN HAMSTER
INFANT VOCALISATIONS****Yara Silberstein and Marina Scheumann**

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Acoustic communication is essential to coordinate human and animal social interactions. Especially the communication between pups and their parents is important for their survival. Previous studies in several mammalian species showed that pups signal their emotional state vocally, which can be used as a non-invasive welfare indicator. Using a comparative approach we investigated the impact of sociality on the encoding of arousal in infant vocalisations during ontogeny between a highly social rodent species, the Mongolian gerbil, and a solitary species, the Djungarian hamster.

Vocalisations of 28 (14 ♀, 14 ♂) Mongolian gerbil and 30 (16 ♀, 14 ♂) Djungarian hamster pups were recorded in a semi-soundproof chamber in the Institute of Zoology at the University of Veterinary Medicine in Hannover. We applied an experimentally-induced separation paradigm, which is suggested to induce different arousal levels, in four age groups. In the low arousal condition, a single pup was placed in an arena isolated from its siblings and parents. In the high arousal condition, a single pup was additionally stressed by simulating a predator. The recordings were scanned for infant vocalisations using a semi-automatic detection system (DeepSqueak) and call rates were calculated for each subject and context. Additionally, we performed a multiparametric sound analysis of different call types produced by both species and compared their results.

Both species showed ultrasonic (USV) and audible calls (ADV) in the recordings. Thereby, the USV rate showed an age-dependent decrease, in contrast to an age-dependent increase of the ADV rate in both rodents. During the first two age groups, before eye opening, the pups of both species produced mainly USV calls in the experimental conditions, which showed only minor differences in their acoustic parameters comparing the two conditions. After eye opening pups decreased their USV call rate in both conditions and switched to ADV calls in the high arousal condition. Additionally, transitions between USV and ADV calls were observed for the gerbil. Both species showed a similar pattern in their vocal behaviour, indicating no effect of sociality on the ontogenetic development at the first four weeks of life. Vocal reaction to the same conditions differed, indicating a greater independency of pups, which might result in a different emotional perception of the condition. This should be taken into account when considering adjusting social and housing situations to increase welfare.

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INFLUENCE OF BEDDING HYGIENE AND COLOSTRUM MANAGEMENT IN DAIRY CALVES' HEALTH

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Calves are born agammaglobulinemic and naturally vulnerable to pathogenic agents before developing their immune system. Therefore, soiled environments and bad hygiene practices can greatly increase the risk of infectious diseases. Passive immune transfer (PIT), with colostrum consumption, can help the calf cope with the microbiological load in the environment; however, PIT is greatly affected by management colostrum practices. So, calves housed in soiled conditions and with PIT failure are prone to a high occurrence of diarrhoea, pneumonia, and omphalitis. This study aimed to relate calves' bedding hygiene and colostrum practices to calves' health. Data from 24 calves were collected in two dairy farms until calves were sold (15 to 30 days) or weaned (60 days). At every calving, birthplace (maternity pen), cow, calves' pens and calf hygiene were assessed using visual scoring systems. Nesting score was evaluated to assess bed comfort related to physical injuries and respiratory diseases. Colostrum intake, time and method of administration was recorded, and IgG level was estimated with a Brix % refractometer. PIT was evaluated by total serum proteins (TSP) 24h after birth. On days 2, 7, 30 and 60, health status was evaluated with a health scoring system to detect diarrhoea, pneumonia, omphalitis, and physical injuries. In this study, birthplace hygiene was poor, but calves' pens had good scores on hygiene and nesting score. Colostrum practices seemed adequate, and mean Brix % values ($23.71 \pm 2.31\%$ Brix) were just above the breaking point for high-quality colostrum (21%); however, there was a high failure of PIT (50% of the calves), with subsequent elevated diseases' prevalence (diarrhoea [75%] and pneumonia [25%]). Failure in PIT could have been more related to the quantity of colostrum (3.30 ± 0.73 litres) or microbiological quality. Diseases occurred mainly after one week of life, suggesting no influence of the birthplace's poor conditions. Calf's cleanliness score, no cases of omphalitis and physical injuries can be related to the calves' clean and comfortable beds. Also, a multi regression model ($R^2=0.7$; $P=0.001$) showed a positive relation between TSP and total litres of colostrum and Brix, but not with time and method. It highlights the importance of quantity and quality of colostrum, with no significant changes on PIT if colostrum is consumed within $2:05 \pm 1:08$ hours.

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A GUIDE TO PRACTICAL TOOLS FOR IMPROVING SCIENTIFIC VALIDITY, ANIMAL WELFARE, AND HEALTH & SAFETY**Adrian Smith and Bente Bergersen**

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Concerns about the quality of animal experiments are not new. Historically, these concerns focused on ethical issues and the harm inflicted upon animals, relative to the benefits from the experiments. More recently, scientists themselves have increasingly criticised their validity, reproducibility and translatability. This criticism has tended to focus on issues such as observer bias and poor reporting. While these are extremely important, those of us who have managed animal facilities or supervised field studies for many years have witnessed a large number of other issues, related to the animals themselves and their surroundings, which need to be considered when planning and conducting animal experiments.

Norecopa's staff have spent many years producing, collecting and disseminating guidelines and practical tools for implementing all the three Rs (Replacement, Reduction and Refinement) of Russell and Burch. These are available in a free database, currently consisting of 8,900 pages, which is updated many times a week: <https://norecopa.no>

This presentation will give examples of some of the tools which scientists, in collaboration with animal care staff, can use to conduct better experiments, from the conception of an idea and all the way to scientific publications. Use of these tools should also make it considerably easier to answer the questions posed to them during the manuscript submission process.

At the heart of the toolbox lie the PREPARE guidelines, which were developed over a 20-year period in close collaboration with scientists (<https://norecopa.no/PREPARE>). PREPARE consists of a checklist (currently available in 25 languages) and a website which provides more information on each topic on the checklist. This presentation will demonstrate the very latest developments in PREPARE.

This is a win-win situation: for science, for animal welfare and for health and safety at work.

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THE USE OF COMPANION ANIMALS IN MEDIA: WELFARE IMPLICATIONS AND A POSSIBLE REGULATORY SOLUTION

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Media-driven popularity of dog and cat breeds has long been recognised, with an increase in demand for certain breeds following their appearance in movies, tv shows, advertisements etc. This rise in popularity can potentially have detrimental effects on the welfare of these animals, for a number of reasons. Firstly, certain breeds, such as brachycephalic (short-muzzled, flat-faced) dogs and cats, suffer from a plethora of health problems caused by selective breeding for a desired appearance. The ubiquitous presence of these breeds in media allows for the normalization of physical characteristics associated with impaired welfare and often drives breeders to enhance specific features that are considered favourable, thus creating even more extreme phenotypes. Secondly, certain breeds are frequently portrayed in the media having had surgical procedures done solely for cosmetic purposes, such as cropping ears and docking tails. Similarly, this leads to a normalization of these unnatural appearances, consequently creating demand for unnecessary, painful mutilations. Finally, a growing demand for a specific appearance/breed is accompanied by a rise in harmful breeding practices, such as backyard breeders and puppy mills, unethical breeding procedures, illegal pet trade etc.

Israel has specific regulations under the Animal welfare act 1994 (AWA) regarding the use of animals in media (defined as films, tv shows and commercials). These regulations require a permit from the veterinarian appointee under the AWA, providing that they are satisfied that no suffering will be caused to the animal during the show, in preparation for it and in the manner of keeping the animals. The AWA prohibits interfering with live animal tissue for cosmetic purposes, thus banning cropping and docking practices as well as presenting cropped/docked animals in media. An exception can be made if the appointee is convinced that this will advance the purpose of the act, e.g., for educational reasons. This has led to a more natural representation of certain breeds in Israeli media. Can similar restrictions be stipulated for the media use of certain breeds, which suffer from impaired welfare by their very existence? We suggest amending the regulations, allowing the appointee to exercise discretion in deciding whether presenting a certain animal in media is consistent with the spirit of the law, i.e., to promote animal welfare, rather than hinder it. Hopefully, similar legislation will be adopted by other countries, consequently diminishing the visibility of certain breeds/practices in media and promoting ownership of responsibly-bred or mixed-breed companion animals.

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(ANTI-) SOCIAL ANIMAL. IS SOCIALITY A MATTER OF THE REARING PROCESS IN TURKEYS?**Jenny Stracke¹, Alicia Krasny², Stefanie Tensfeldt² and Nicole Kemper²**

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Generally, turkeys (*Meleagris gallopavo*) are sociable animals, that, under natural conditions, live in groups with a relatively stable social structure. Sociality therefore is an important behaviour in this species, however up to now, there is only scarce scientific knowledge available. Runway tests can be used to indicate sociality in birds. In the present study, the influence of two rearing systems was tested in a runway test adapted from studies in quail. The hypothesis was, that the behaviour in this test paradigm would be strongly influenced by the early post-natal period.

The study was performed on an organic farm, housing turkeys (Cröllwitzer x Hockenhull) under German standards. Two rearing systems were compared. Rearing system 1, reared animals in small groups (~0.16 m²/animal; 30 animals/group) without the presence of the mother or an adult animal. In rearing system 2, animals were raised in groups (~0.16 m²/animal; 15 animals/group) with the presence of an adult foster mother. Altogether, 60 animals from three rearing periods were used for this study. All animals were individually tested in a runway test for five minutes each in the 8th week of life, testing their behavioural reaction to either familiar or unfamiliar conspecifics. Behavioural parameters were analysed using linear mixed models. The rearing system was found to have an effect on the locomotion (walking: $F=7.9$; $p<0.01$; standing: $F=7.2$; $p<0.01$), with animals from system 2 being more active. Furthermore, an effect of the interaction between rearing system and status of the conspecifics (familiar / unfamiliar) was found for the latency to pass through one third of the runway ($F=6.3$; $p<0.05$). However, pairwise comparisons did not provide significant differences between specific groups. Results also showed a significant effect of the rearing system to the behaviour “pecking at the partition from conspecifics” ($F=7.1$; $p<0.05$), with animals from system 2 pecking significantly more often. Furthermore, a significant effect of the interaction between rearing system and status of the conspecifics was found ($F=5.1$; $p<0.05$), with animals reared in system 2 pecking significantly more at unfamiliar conspecifics than chicks raised in system 1 in the same situation.

The presented results give first evidence, that the rearing period affecting behaviour in a social test setting, might be crucial for the development of sociality in later life. Deepen the understanding of these processes might contribute to improve housing and rearing conditions of turkeys and in consequence would enhance animal welfare.

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ANALYSIS OF DAIRY COWS' ACTIVITY USING A HYBRID MODELLING APPROACH FOR THE EARLY DETECTION OF HEALTH PROBLEMS**Masoomeh Taghipoor¹, Severine Bord², Laure Sansonnet², Quentin Bulk³ and Joon Kwon²**¹ Université Paris-Saclay, INRAE, AgroParisTech, UMR Modélisation Systémique Appliquée aux Ruminants, Paris, France² Université Paris-Saclay, INRAE, AgroParisTech, UMR MIA-Paris, Paris, France³ Ferme expérimentale AgroParisTech, Thiverval-Grignon, France*Masoomeh.taghipoor@inrae.fr*

Early detection of disease in animals allows farmers to refine the use of medicines (ex. antibiotics) and enables early intervention, reducing the potential pain an animal will experience. Animal activity is one indicator of the state of wellbeing of the animal, and one of the first indicators of the degradation of health and welfare in animals. The objective of this work was to study the potential of individual times-series activity data to forecast degradation in health state of dairy cows.

Activity data of dairy cows from experimental facility Thierval- Grignon during three years (2019-2021) were used in this work. Dairy cows were equipped with pedometers that recorded their activity (lying, changes in position and number of steps) every hour (min/hours). Sensors were also placed close to feeders recording the number of visits by each cow to the feeder and the duration of the visit. We had access to data of morbidity of animals during this period (disease, physiological state, treatment, etc) and daily milk yield.

Method. We developed a hybrid modelling procedure that coupled a dynamical model of milk yield with a machine learning algorithm for early detection of deviations in Milk yield. The model was developed in two steps: firstly, for each individual cow the theoretical milk yield in absence of all perturbations was estimated using existing models in the literature (ex. Perturbed wood model, BenAbdelkrim et al. 2020). Secondly, data of dairy cow's activity and production level were integrated in a random forest and gradient boosting machine learning algorithm to predict individual milk yield.

Results. The hybrid procedure was able to predict online milk yield of dairy cows, and consequently forecast deviations from the theoretical curve of production. These deviations are potential indicators of animal disease or problems related to animal well-being. The detected periods were then compared to morbidity reports, which highlighted the capacity of the model to forecast health problems. Detected deviations with no associated morbidity could be either due to the health problem not being detected by the farmer, or to problems with no impact on animal health but only on animal performance.

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THE USE OF PIGS VOCALISATIONS STRUCTURE TO ASSESS THE QUALITY OF HUMAN-PIG RELATIONSHIP

Céline Tallet and Avelyne S Villain

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Human voice is important for the development of piglets relationship with humans, and the quantity of vocalisations emitted by piglets in the presence of a human differs according to this relationship. Vocalisation structure is promising to assess pigs emotions and could encode the quality of human-pig relationship. This is what we tested here. Thirty piglets were tamed thanks to regular interactions with an experimenter talking and physically interacting with them, for two weeks three times a day from weaning; while 30 other piglets received only contact necessary for their good breeding. Two weeks later, we recorded their behaviour and vocalisations emitted in presence of the experimenter for five minutes. The test was reproduced two weeks later, after a period of conditioning using human presence and contacts as a reward for all piglets, supposed to lead to a positive human-piglet relationship for all piglets. Grunts structure was analysed and compared between tamed and untamed piglets, and before and after the conditioning period. Behavioural observations confirmed that taming lead to a positive attraction toward the experimenter in the test before the conditioning period. Grunts produced by tamed piglets were shorter than those produced by untamed piglets (means[se]: 305 [2.6] vs. 351 [3.9] ms, $p < 0.01$). When piglets were located closer to the experimenter, their grunts were shorter than while they were located further. The difference of duration was more important for untamed than for tamed piglets (grunts duration for untamed piglets when far: 357[4.3] and when close 335[8.4] ms; for tamed piglets when far from 325[3.4] and when close 272[3.9] ms for tamed , $p < 0.05$). This decrease in grunt duration when closer to the human was not maintained after the conditioning. When untamed piglets were located closer to the experimenter, the mean dominant frequency of their grunts was higher compared to when they were located further; but there was no effect of proximity to the experimenter in tamed piglets (untamed piglets when far: 323[1.9] Hz and when close 350[4.2] Hz; $p < 0.05$; for tamed piglets when far 320[1.9] and when close 342[2.3] Hz, $p > 0.05$). This effect did not remain true after the conditioning. In conclusion, the structure (i.e. duration, dominant frequency) of pigs grunts is closely linked with the quality of human-pigs relationship. We confirm that vocalisations are a key indicator of pig welfare that should be used to assess it, and, more precisely they encode the quality of the perception of humans.

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OPERATIONALIZE STUNNING OF CAPTURED PLAICE (*PLEURONECTES PLATESSA*) AND TURBOT (*SCOPHTHALMUS MAXIMUS*) AT SEA: PROVISIONS TO ENSURE IMPROVED WELFARE**Hans van de Vis¹, Michelle Boonstra² and Hendrik Kramer³**¹ Wageningen Livestock Research, Wageningen, The Netherlands² Wageningen Marine Research, The Netherlands³ MDV-Beheer, PH Urk, The Netherlands*hans.vandervis@wur.nl*

Due to societal developments there is a need for the fishing industry to become more sustainable. Animal welfare is one of the themes of sustainability. Captured fish can be protected at slaughter by rendering them unconscious prior to killing. Contrary to publications in various media, electrical stunning of captured sea fish, it not ready for use on board fishing vessels.

Demersal fish are the major target species of Dutch fishing cutters and, therefore, we decided to select plaice (*Pleuronectes platessa*) and turbot (*Scophthalmus maximus*). To improve welfare of these fish species, we aim to: 1) operationalize stunning of these species prior to killing, using the guidance of EFSA; 2) ensure that a fish product originates from a vessel that has indeed put stunning of into practice; 3) assist consumers to make an informed choice regarding fish products with improved welfare; 4) perform an inventory study to assess possibilities to valorize sea fish products with improved welfare; and 5) contribute to support by stakeholders regarding stunning of these species and to disseminate our results for use in education and utilization by fishermen not taking part in the project. We envisage that our project can serve as a blue print for fishing companies that are not part of our consortium.

In the first year of the project with a lifetime of three years the following results were obtained: 1) in a laboratory setting we established that for plaice a current density and field strength of 27.6 A/dm² and 7.6 V/cm in seawater are needed to induce an immediate loss of consciousness. For killing without recovery, the exposure to an electrical current has to be at least 5 seconds and a temperature drop of at least 9 °C, caused by transfer into a slurry of ice and water. EEG registrations were used to establish these specifications; 2) the project consortium decided to select the Fish Guide, which is available as an App for a smartphone to assist consumers to make an informed choice. Welfare criteria will be incorporated into this App; 3) a literature search showed that consumers are willing to pay a premium price for fish products with improved welfare; 4) workshops were held to inform stakeholders about the start of the project; 5) a first version of a knowledge file on fish welfare for people working in the Dutch / Belgian fishing sector was published on internet.

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THE USE OF BODY SURFACE TEMPERATURE TO DETECT VALENCE OF AFFECTIVE STATE AND MAGNITUDE OF FOOD REWARD

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There is an increasing requirement for reliable objective welfare indicators sensitive to both arousal and valence of the affective response. Body surface temperature, which depends on the activation of the sympathetic nervous system and can be measured non-invasively using infrared thermography (IRT). IRT is a potential measure that may indicate bout arousal and valence. In our previous work, acute restraint triggered rapid, sex-specific and lateralised changes in skin temperature that reflected the arousal level of acute restraint. Other studies suggested that thermal response from different body parts and thermal lateralisation may indicate valence of affective state. To investigate the response to a positive stimulus, a food reward, we collected continuous tail, left and right eye temperatures using IRT and behaviour measurements of 18 male and 18 female rats (*Rattus norvegicus*). Rats were placed in a test arena to which they were habituated, and received either zero (control), one or three sugary cereal-pellets (Cheerios) to determine whether the thermal response is proportional to the increasing intensity of a positive stimuli. They were filmed for 30 seconds before and 30 minutes after being exposed to the reward, to obtain individual baseline temperatures and changes in surface temperature in response to food reward, respectively. The concurrent behaviours were scanned every 10 s and analysed as a proportion of scans per 10 minutes. We found that tail and eye temperatures showed the same qualitative thermal response to food reward as to restraint, but the rate of recovery to baseline in tail temperature after the initial change differed between the control and the rewarded groups although the response did not differ between one and three rewards, and females showed a stronger response than males. There was no evidence of thermal lateralisation in rewarded rats as the thermal response did not differ between left and right eye. Behaviours also differed between control and rewarded rats (rewarded rats increased exploration) and sexes (females did more escape attempts and had longer latency to eat the reward than males). However, like the thermal response, the differences in behavioural response were not dose-dependent but the magnitude of reward may not have differed enough to affect arousal. In conclusion, although IRT allowed to distinguish rewarded and control rats, valence was not detectable from either the direction of surface temperature change from tail and eyes or from thermal lateralisation, and arousal levels did not differ between the two rewarded groups.

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CHANGING HUMAN BEHAVIOUR FOR ANIMAL WELFARE: THE CASE OF SHEEP TAIL DOCKING LENGTH IN AUSTRALIA

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Australian research has demonstrated that a large proportion of farmers are docking sheep tails shorter than recommended, increasing the risk of flystrike, cancers, arthritis and/or prolapses. A recent study conducted in Victoria, Australia, identified that knowledge and attitudes were key factors that influence farmers' decision to dock sheep tails shorter than recommended. Specific factors identified included a lack of knowledge of the recommended length, high importance placed on shearing ease, and high importance placed on flystrike prevention. Using the Behaviour Change Wheel which describes the key sources of behaviour (capability, opportunity and motivation - COM) and intervention functions to address them, this project aims to investigate and address this welfare issue of short tail docking in sheep in Australia through a behavioural intervention to encourage best practice.

Commercial sheep producers (n=40) will be recruited and randomly allocated to treatment groups (20 intervention, 20 control). To capture knowledge, attitudes, practice, and intention to change docking length, all participants will complete: 1) Pre-intervention online survey, 2) Intervention or control treatment, 3) Post-intervention online survey. Intervention treatment includes an informational video and phone interview to assess individuals COM to dock tails at the recommended length, and engage relevant behaviour change techniques. Control interviews will discuss mulesing. All interviews will be recorded and analysed thematically in Nvivo.

A total of 14 out of 40 interviews have been conducted so far. Preliminary results of intervention interviews (n=8) indicate that the intervention enhanced psychological capability and reflective motivation. Participants learnt something new, including the associations between short tails and prolapses (n=6), arthritis (n=5), and flystrike (n=3), or about the recommended length (n=2). Some acknowledged that at least some of their sheep tails were docked shorter than recommended (n=5), all of whom, at the end of the intervention treatment, stated they intended to dock at the recommended length in the future. This was also reflected in the pre- and post-intervention data, where intervention participants' intention to dock tails longer (scored on an agreement scale 1-5) almost doubled on average (pre=2.25, post=3.94) compared to control participants' (n=6, pre=2.16, post=2.75). It was also expressed that it is important to keep shearers happy (n=4). Of those who intended to change tail length, just one identified shearers as a potential barrier. These preliminary results indicate that this type of intervention was educational and persuasive to producers, resulting in changed intention to dock tails at the recommended length.

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HOW JAPANESE PEOPLE MAKE DECISIONS ABOUT THE HAPPINESS OF ZOO ANIMALS – A COMPARISON BETWEEN ZOO VISITORS AND PROFESSIONALS

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Public interest in animal welfare is rapidly increasing outside the West. Although science-based decision making should be used to address animal welfare issues, inevitably cultural and individual viewpoints also play a key role in the process. However, such attitudes and ways of thinking have rarely been described quantitatively in Japan. In this study, we reveal Japanese attitudes towards the happiness of zoo animals amongst two populations; zoo visitors and zoo professionals. Questionnaire surveys for visitors were conducted at two zoos in Japan (N = 1000) and those for professionals (zoo and aquarium staff) were conducted online (N = 306). In the questionnaire we used the term “animal happiness” because the concept of “animal welfare” is not prevalent amongst the general public. The questionnaire asked participants about their general attitudes towards animals, concepts of animal happiness, and levels of tolerance towards using animals as live prey (i.e., rabbits, mice, chickens, frogs, gold fish, sardines, octopuses, crayfish, clams, crickets and earthworms that may be used as live prey). Currently, there is no law prohibiting the feeding of live prey in Japan. Overall, both groups showed a high level of concern about the happiness of animals. However, when considering what is important for animal happiness, visitors mentioned more vague ideas of living in conditions “similar to nature”, whilst zoo professionals referred to more concrete factors (e.g., ability to perform natural behaviours and providing choice in their environment). The level of tolerance regarding live prey feeding was similar between the two groups. However, they differed in which species they thought were morally acceptable to use. Visitors often referred to personal preference or feelings of attachment when deciding which prey is acceptable to use, but professionals often referred to their intelligence or ability to experience pain and suffering. These results will help to influence the ongoing animal welfare policy making process in zoos and aquariums in Japan.

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DIFFICULT PARADIGM SHIFT? REASONS FOR CONTINUED ANIMAL USE FOR EDUCATIONAL PURPOSES REVEALED IN NON-TECHNICAL SUMMARIES**Miriam A Zemanova^{1,2,3}, Andrew Knight^{4,5} and Susanna Lybæk⁶**¹ Animalfree Research, Bern, Switzerland² Environmental Sciences and Humanities Institute, University of Fribourg, Fribourg, Switzerland³ Oxford Centre for Animal Ethics, Oxford, UK⁴ Centre for Animal Welfare, University of Winchester, Winchester, UK⁵ School of Environment and Science, Nathan Campus, Griffith University, QLD, Australia⁶ The Norwegian Animal Protection Alliance (Dyrevernalliansen), Oslo, Norway*AndrewKnightVet@gmail.com*

Animals have been considered an indispensable tool to teach about the functioning of living organisms, to obtain skills necessary for practicing human and veterinary medicine, as well as for acquiring skills for caring for and conducting experiments on animals in laboratories. However, the efficacy of this practice has been questioned in recent decades, and societal views have evolved to place a much stronger emphasis on animal welfare and ethics that needs to be reflected in our teaching and training practices. Currently, many alternatives to harmful animal use are available, and it is not clear why thousands of animals continue to be used every year for educational and training purposes. Therefore, this study aimed to identify reasons for the lack of uptake of non-harmful educational and training methods by analyzing recently published non-technical summaries in the EU and EEA Member States and to provide examples of alternatives for specific learning objectives. Results from non-technical summaries from 18 countries spanning the most recent years (2017-2019) revealed that the two main perceived reasons for continued animal use are: 1) the necessity to use a living animal for “proper” learning and 2) the lack of an adequate alternative. We argue that these reasons often do not reflect reality. In conclusion, we consider it is necessary to place a stronger emphasis on engagement with ethical questions that underlie the use of animals and careful consideration of how the learning objectives could be achieved through non-harmful alternatives.

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