

Welcome

Welcome to the Understanding Animals conference and the 2019 meeting of the Australasia Africa region for the International Society of Applied Ethology (ISAE).

We are so excited to bring you this year's program which is a culmination of expert presentations from researchers across disciplines – from ethologists to anthropologists – all working to understand and improve the lives of animals. Across two days, you will hear about research on a multitude of species – from humans to alpacas, utilising a diversity of methods and from different theoretical perspectives. This conference aims to bring us all together. To build powerful networks of experts who can bridge the gap across disciplines in order to address current and future challenges in animal welfare. Over afternoon tea on Friday, we have the opportunity to start this journey with a collaborative workshop which we hope will launch some innovative research projects and networks. Settle in for an exciting two days!

We welcome you all to Wellington and hope you enjoy the scientific program, discussions, social events and networking.

With best wishes,

The Understanding Animals organising committee
Ngaio, Amanda, Tamara, Kate & Kris

About ISAE

ISAE was created in Edinburgh on June 4, 1966 as the Society for Veterinary Ethology. It rapidly expanded to cover all applied aspects of ethology and other behavioural sciences relevant to human-animal interactions. The Society also quickly became increasingly international: it now has an international federal structure as well as regional representatives around the world. ISAE has an official journal which is peer-reviewed publishes a peer-reviewed society journal, *Applied Animal Behaviour Science* is the official journal of ISAE. You can learn more about ISAE, and become a member of the society, at www.applied-ethology.org. We have nearly 700 ISAE members worldwide! Our regional Facebook page can be found at www.facebook.com/ISAEAA



Organising Committee

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Dr Amanda Doughty	<i>Allflex, AUS</i>
Dr Tamara Diesch	<i>Ministry for Primary Industries, NZ</i>
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We would like to sincerely thank all of our
sponsors for their conference support

Principal Sponsor: DairyNZ



Sponsors



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UNIVERSITY OF NEW ZEALAND

Venue

The Royal Society of New Zealand, 11 Turnbull Street Thorndon Wellington
Ph: +64 4 472 7421 <https://royalsociety.org.nz>

Refreshments

Morning tea, afternoon tea and a light lunch will be provided each day of the conference in the Kete o te Wānanga room.

Social dinner

For attendees who have indicated they would like to join the casual dinner on Thursday night, we have booked tables for 6pm at Press Hall (78 Willis Street, Wellington). You are welcome to make your way there yourself or join our walking party which will leave the Royal Society at 5:30pm (approx. 25 minute walk).

Transportation

Car and parking

Murphy Street is an off-ramp of the southbound motorway, accessible northbound via Molesworth Street. A small number of short-duration visitor carparks (limited to 1 hour maximum) are available, including one disabled park. Please use marked bays only and register your vehicle at reception on arrival. For visits exceeding 1 hour, metered street parking may be available (limited to 2 hours) on Murphy Street and there is a Wilson Parking pay & display carpark adjacent to our premises off Halswell Street.

Taxi

Wellington Corporate Cabs: www.corporatecabs.co.nz
Green cabs Wellington: www.greencabs.co.nz/wellington-taxis
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Bus

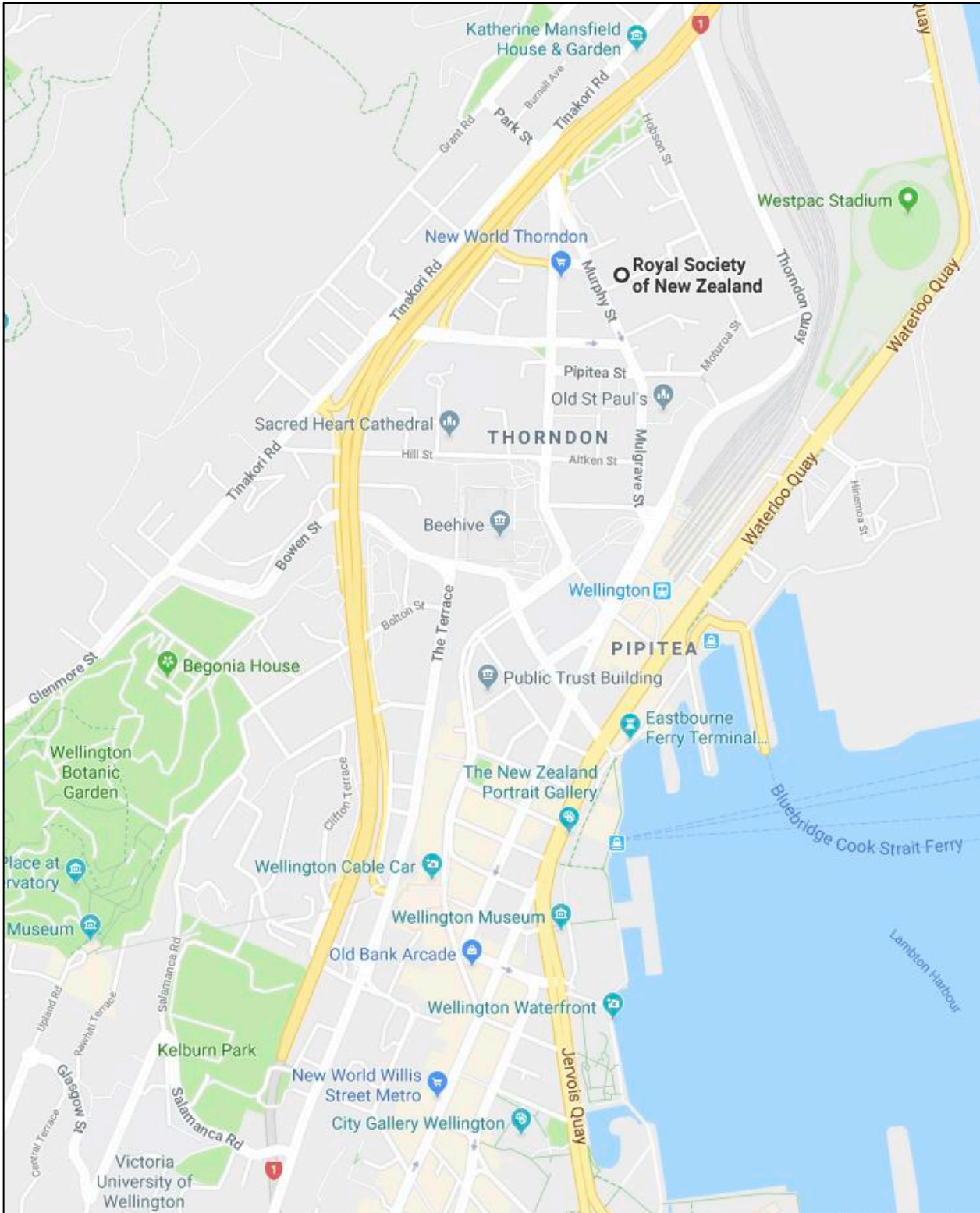
Take Bus 14 from the train station: www.metlink.org.nz/

Airport taxis and shuttles

1. www.wellingtonairport.co.nz/transport/taxis-shuttles/
2. www.supershuttle.co.nz/app/
3. www.combinedshuttles.co.nz/
4. www.nzbus.co.nz/airportflyer/home



Map of Inner Wellington



Google maps. Map data. 2019.



Instructions for presenters on arrival

(for more details please refer to the Presenter Guidelines)

Oral presentations

Please have your presentation saved on a USB memory stick ready and take this to the volunteer IT personnel for uploading **before** your session begins. If you have videos or sound clips embedded in your presentation, allow enough time during a break to test the functionality of these. Please introduce yourself to your Session Chairperson at least 10 mins before your presentation session.

A reminder that all presentations (excluding keynotes) are 15 mins in total with an allocated maximum time for speaking of 12 mins, leaving 3 mins for questions and discussion.

Poster presentations

Posters are divided into two groups and each poster group will display their posters on a different day. For specific details of your day please see the program.

On arrival, you will be given an assigned number which will indicate your poster's location. Please put up your poster before 9am on the day of your assigned poster session. Posters will be visible the entire day and presenting authors are asked to stand by their posters during the *lunch session* on their assigned poster day.

Posters need to be removed by the authors by the end of their session. Posters that aren't removed will be discarded (recycled) by the organisers.



Thursday 21st November – Applied Behaviour

Registration table opens from 8:30am		
SESSION 1. Chaired by Kris Descovich		
9:00	Welcome and opening by the ISAE Regional Secretaries	
9:10	Award presentations	
9:15	Seer Ikurior	<i>Evaluation of tri-axial accelerometers to classify the behavioural activity of sheep and potential use for remote monitoring of gastrointestinal nematode parasitism</i>
9:30	Rebecca George	<i>Is the Rat Grimace Scale a clinically useful tool to evaluate visceral pain in a model of chemotherapy-induced mucositis?</i>
9:45	Danila Marini	<i>Social influence on the effectiveness of virtual fencing in sheep</i>
10:00	Jade Fountain	<i>Operant learning is disrupted when opioid reward pathways are blocked in the laying hen</i>
10:15	Derek Schneider	<i>Cattle behaviour and location assessed from the sky in a feedlot bedding study</i>
10:30	Morning tea	
SESSION 2. Chaired by Amanda Doughty		
11:00	Plenary: Nat Waran	<i>One Welfare: Supporting positive outcomes for animals and humans</i>
12:00	Lunch and Poster Session 1	
SESSION 3. Chaired by Cheryl O'Connor		
1:00	Caralyn Kemp	<i>Behaving at the zoo: The effect of uniform presence on the behaviour of zoo visitors</i>
1:15	Arvind Sharma	<i>Cows' avoidance distance and its association with health and shelters in India</i>
1:30	Leonie Lee	<i>The architecture of horse welfare: Improving horse welfare with ethologically-informed equine facility design</i>
1:45	Paige Matthews	<i>Alpaca behaviour - Insight into lamb attraction</i>
2:00	Teresa Collins	<i>Observer consensus of sheep welfare during the pre-export phases of the live-export industry</i>
2:15	Laura Hunter	<i>Can we determine cow sleep stages from lying posture?</i>
2:30	Afternoon tea	
SESSION 4. Chaired by Dana Campbell		
3:00	Lorelle Barrett	<i>Pekin ducks are motivated to lay in their preferred nest substrate</i>
3:15	Lindsay Matthews	<i>Theory driven understanding linking behaviour and welfare: An example clarifies the paradox of 'free-ranging' poultry</i>
3:30	Mark Learmonth	<i>Ethical dilemmas for natural living concepts of zoo animal welfare</i>
3:45	Alexandra Whittaker	<i>Inherent factors influencing judgement bias responses in rats</i>
4:00	Close	



Friday 22nd November – Animal Welfare

<i>SESSION 5. Chaired by Alexandra Whittaker</i>		
9:00	Welcome	
9:10	Principal sponsors: DairyNZ	<i>World leading animal care</i>
9:15	Plenary: Rebecca Ledger	<i>Pulling together multidisciplinary perspectives to achieve worthwhile animal welfare legal precedents</i>
10:15	Morning tea	
<i>SESSION 6. Chaired by Caralyn Kemp</i>		
10:45	Anne Galloway	<i>How NZ media stage farmed animal welfare controversies</i>
11:00	Laureline Guinefollau	<i>Does early animal exposure improve veterinary students' interpretation of equine behaviour?</i>
11:15	Erin Jones	<i>How human culture defines dog culture: Methodology used to explore humane dog training in concordance with autonomy and consent and the implications for welfare</i>
11:30	Rochelle Morton	<i>Reducing the enforcement gap in animal law - an investigation into the causes</i>
11:45	Naomi Cogger	<i>One Welfare needs collaborations between epidemiology and animal welfare science</i>
12:00	Lunch and Poster Session 2	
<i>SESSION 7. Chaired by Ngaio Beausoleil</i>		
1:00	Jodi Salinsky	<i>Transparency, openness and exploring the possibility of an "openness agreement" for New Zealand and Australia</i>
1:15	Special guest: David Mellor	<i>Animal welfare science: Moving from problem-solving towards promoting positive experiences</i>
2:15	Workshop & afternoon tea	<i>"Wicked" problems in animal welfare. A collaborative workshop on tackling the big issues through multi-disciplinary partnerships</i>
4:15	Close	



Poster Sessions

#	POSTER SESSION 1	
1	Gosia Zobel & Heather Neave	<i>Eating differently: Competitive feeding behaviours at three feeder heights relates to personality traits in goats</i>
2	Dana Campbell	<i>Behavioural and welfare comparison of electric tape and virtual fencing in cattle</i>
3	Ann Wilson	<i>Management and human interaction effect on the behaviour and welfare of African lion (<i>Panthera leo</i>) cubs used in wildlife tourism interaction activities</i>
4	Emma Dunston-Clarke	<i>Influences of exercise enrichment on feedlot cattle behaviour and productivity</i>
5	Saiful Bari	<i>Outdoor ranging but not rearing enrichments reduced fearfulness of adult free-range hens</i>
6	Azadeh Jalali	<i>Comparison of cat handling techniques and behavior during a vaccination procedure</i>
7	Amira Goma	<i>A concise review about the role of lateralization as a welfare indicator in cattle</i>

#	POSTER SESSION 2	
1	Gemma Lowe	<i>Influence of milk allowance on the suitability of automated behavioural and physiological measures as indicators of neonatal calf diarrhoea (NCD)</i>
2	Stuart Brown	<i>A search for predictive biomarkers of ovine pre-partum vaginal prolapse</i>
3	Janet Sayers	<i>"Bad dog" story telling in the New Zealand media from 1995-2018</i>
4	Jeanette Anderson	<i>Cadmium in cat foods: Is it a risk to the health and welfare of cats</i>
5	Sally Meakin	<i>Contributing to better animal welfare by teaching communities to understand animals</i>
6	Mia Cobb	<i>Which kennel management practices do people consider important to the welfare of dogs living in kennel facilities</i>
7	Cynthia Todd	<i>Effects of an abrupt dietary change on the feeding behaviour of dairy goats</i>



Plenary Speaker Biographies

Professor Natalie Waran BSc (Hons), PhD (Cantab)

Natalie (Nat) gained a first class Zoology degree from Glasgow University in 1987 and was awarded the Graham Kerr Memorial Prize for Zoology. She was awarded her PhD from Cambridge University's Veterinary School funded by the British Veterinary Association in 1991. In 1990, she joined Edinburgh University to direct a new and unique Masters programme in Animal Welfare and after 14 years made the life changing move to New Zealand where she was invited to become the Chair of Animal Welfare at Unitec Institute of Technology in Auckland. After 6 years, as Head of the School of Natural Sciences and Associate Dean (Research) in the Faculty of Social and Health Sciences, in 2011 she returned to Edinburgh University to develop a new International Centre of excellence for Animal Welfare Education. As the inaugural Jeanne Marchig Chair of International Animal Welfare and the International Dean for the Veterinary School, she developed working partnerships with overseas Governments, Universities, Professional bodies and NGOs, to develop and deliver innovative capacity building initiatives within the area of One Welfare. In 2016, Nat returned to New Zealand to take up the position of Professor of One Welfare and Executive Dean at the Eastern Institute of Technology. She still retains a Hon Professorial position at Edinburgh and continues to work in the field of international animal welfare education.

Nat has produced more than 100 research publications and describes herself as an applied scientist by training, and an educationalist at heart. Her research and education interests are in the field of 'One Welfare' – exploring the relationship between animal and human health and welfare, an interdisciplinary area combining aspects of; social sciences, health and veterinary sciences with education, ethics and law.

Dr Rebecca Ledger BSc (Hons), MSc, PhD

Dr Rebecca Ledger is an animal behaviour and animal welfare scientist based in Vancouver, Canada. She has a BSc (Hons) in Biology from the University of London, an MSc in Applied Animal Behaviour and Animal Welfare from the University of Edinburgh, and a PhD in companion animal behaviour and welfare from Brunel University. She is also a Fellow of the Royal Society of Biology. Currently, most of her time is spent informing the Court on issues involving animal cruelty, animal suffering and 'dangerous dogs'. She has been retained on more than 120 cases spanning Canada, many of which have resulted in precedent-setting decisions.



Special Guest Speaker

Professor Emeritus David J Mellor BSc (Hons), PhD, Hon.Assoc.RCVS, ONZM

*Animal Welfare Science and Bioethics Centre, School of Veterinary Science,
Massey University, Palmerston North, New Zealand*

David Mellor's professional interests during the last 54 years have included: the fetus, birth and the newborn; pain and stress assessment and alleviation; livestock slaughter, developing fresh conceptual frameworks in animal welfare science; and value systems applied to animal welfare. He has 550 publications in these areas, 325 of which are major works, including 6 books. He has made sustained contributions to understanding animal welfare science and its applications throughout the last 37 years, and although retired he is still active in these areas.

During the last 27 years, David has served on numerous national and international animal welfare advisory committees, working parties and other groups, and provided consultancy advice to government departments and other bodies in various countries. He has wide experience of integrating scientific, veterinary, industry, consumer, animal welfare, legal, cultural and ethical interests while developing animal welfare standards, regulations and laws in New Zealand and internationally.

David Mellor has been recognised internationally for his contributions: e.g., in 2007 he became an Officer of the New Zealand Order of Merit; in 2015 became an Honorary Associate of the Royal College of Veterinary Surgeons, UK and received the Universities Federation for Animal Welfare (UFAW) Medal for outstanding international contributions to animal welfare science; finally, he and his colleagues in the Animal Welfare Science and Bioethics Centre received the 2016 Massey University Medal for Team Research Excellence.

Now retired, he is Professor Emeritus and Foundation Director of the Animal Welfare Science and Bioethics Centre at Massey University in New Zealand. He has a BSc (Hons) from New England University, Australia (1966), and a PhD from the University of Edinburgh, Scotland (1969).



Plenary Speaker Abstracts

ONE WELFARE: SUPPORTING POSITIVE OUTCOMES FOR ANIMALS AND HUMANS

Professor Nat Waran

Professor of One Welfare/Executive Dean, Eastern Institute of Technology, Napier, New Zealand

Hon Professor, Jeanne Marchig International Centre for Animal Welfare, RDSVS, University of Edinburgh, UK

Arguably, the field of Animal Welfare Science emerged following publication of the ‘Brambell Report’ in the UK in 1965, after which the UK Farm Animal Welfare Council was born, and the ubiquitous ‘Five Freedoms’ emerged. In 1967, Professor Brambell in addressing the first meeting of the Society for Veterinary Ethology (now the International Society for Applied Ethology) held in Edinburgh, stated that *‘any sufficient estimate of an animal’s welfare must be based on an understanding of the ethology of the species, as well as the very difficult question of what an animal feels’*. Over the past 50 or so years, input from various eminent ethologists, physiologists and veterinarians have helped shaped the field of animal welfare, through the development of research questions and methodologies, as well as most importantly discussing and agreeing a definition of animal welfare. In moving beyond those original Five Freedoms, there is now agreement that welfare or well-being is a multidimensional phenomenon based upon life experiences and circumstances, characterized by how an individual animal feels as well as how it functions. Whilst recognition of animals as sentient beings, marks a significant change in the way science has traditionally viewed animals, this is not universally understood nor accepted, and this is especially the case where there are significant competing human welfare agendas. Professor Nat Waran is an international animal welfare scientist, who believes that animal and human welfare are inextricably connected. The work she has been involved with particularly in developing countries, has led to her assertion that we need to apply a human-centric lens if we want to progress animal welfare and effectively influence attitudes and ultimately behaviours towards animals. In this presentation she will provide examples of One Welfare in action, and explore why a ‘One Welfare’ approach can help support positive outcomes for both animals and people.



PULLING TOGETHER MULTIDISCIPLINARY PERSPECTIVES TO ACHIEVE WORTHWHILE ANIMAL WELFARE LEGAL PRECEDENTS

Rebecca Ledger, BSC Hons (London), MSc (Edinburgh), PhD (Brunel), FRSB

The science of animal welfare is advancing rapidly. Animal welfare legislation, generally, is not. This lag provides a stay for many acts that cause animals to suffer – acts, which are often misaligned with prevailing societal values in terms of how animals deserve to be treated, and for which ‘more humane’, or ‘less inhumane’ alternatives are often available.

But, there is a faster and more efficient way to bring about legislative change. Specifically, expanding the way in which ‘*suffering*’ is assessed and defined within the current legislation to be in line with current scientific perspectives, has led to a surge in precedent-setting animal cruelty prosecutions in Canada over the last 5 years. These prosecutions instantly create case law, which raise the legal standard in terms of how animals must be treated according to the rule of law.

Getting to this point has been possible because of the application of the Five Domains Model, particularly when there is little or no physical evidence of harm, plus collaboration between individuals in a number of disciplines, including animal welfare scientists, humane organizations, law enforcement, and the legal profession. By working together, so Canada has seen worthwhile legal precedents set in animal law that have not needed to wait for legislative change, but which hasten the updating of relevant laws at the Provincial and Federal level.

ANIMAL WELFARE SCIENCE: MOVING FROM PROBLEM-SOLVING TOWARDS PROMOTING POSITIVE EXPERIENCES

Professor Emeritus David J Mellor

Animal Welfare Science and Bioethics Centre, School of Veterinary Science,
Massey University, Palmerston North, New Zealand

In order to understand current animal welfare science thinking it needs to be placed in the context of how previously dominant conceptual frameworks have contributed to the developmental trajectory of relevant theory and applications. The following areas will be considered: problem-based thinking and investigation; limitations of the Five Freedoms paradigm; biological significance of negative experiences animals have; surviving or thriving as animal welfare objectives; the Five Domains model for assessment of animal welfare; positive animal welfare experiences and their promotion; and finally, reconfigured animal welfare aims that promote positive experiences.



Abstracts (listed in order of the presentation schedule)

EVALUATION OF TRI-AXIAL ACCELEROMETERS TO CLASSIFY THE BEHAVIOURAL ACTIVITY OF SHEEP AND POTENTIAL USE FOR REMOTE MONITORING OF GASTROINTESTINAL NEMATODE PARASITISM

Seer Ikurior¹, Nelly Marquetoux², Rene Corner-Thomas^{1,3}, Ian Scott¹, Stephan Leu⁴, Bill Pomroy¹

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The ability to objectively measure behavioural changes has clear application for assessing animal health and welfare. Behavioural changes, such as reduced activity, may indicate poor wellbeing or disease. Tri-axial accelerometers can afford a sensitive platform for measuring such effects. In this study we validated the ActiGraph wGT3X-BT[®] tri-axial accelerometer for its ability to identify periods of grazing, standing, lying and walking for sheep. This unit has yet to be evaluated for this specie. Three experiments were conducted involving six ewe-lambs fitted with an accelerometer mounted on a neck collar. Acceleration data was collected at 30Hz. Lambs were in a grazing paddock (Experiment One), a holding pen (Experiment Two) or walked through a lane way (Experiment Three). All six lambs were filmed during these experiments and a behaviour profile was created from videos by annotating activity of each animal at five seconds intervals. Behaviour from video were coded by a single assessor. Accelerometer data were aggregated to five seconds intervals and merged with the annotated behaviour data. By using random forests for classifying behavioural patterns of lambs on the created dataset of annotated and accelerometry data, an out-of-bag "cross-validation" model returned an overall estimate of error rate of 10.5% giving an overall model accuracy of 89.5%. Higher levels of accuracy in distinguishing between activity were achieved when combining lying and standing behaviours. Thus, the final model accurately predicted grazing at 94%, standing combined with lying at 88% and walking at 78%. A further "sensitivity analysis" of prediction was performed by removing the six ewe-lambs one after another for training the model and then testing for accuracy of prediction for each animal. This resulted in overall model accuracies of 89%, 87%, 88%, 88%, 92% and 87% for each respective round of sensitivity analysis. These results demonstrate the ability of the ActiGraph wGT3X-BT[®] to distinguish different activities in ewe-lambs. This output can be applied in a variety of contexts to assess animal welfare metrics. For instance, infection with gastrointestinal nematodes can alter the grazing behaviour of ruminants and reduce voluntary feed intake. The above results can thus be used to remotely evaluate the effect of parasite infection on behaviour.



IS THE RAT GRIMACE SCALE A CLINICALLY USEFUL TOOL TO EVALUATE VISCERAL PAIN IN A MODEL OF CHEMOTHERAPY-INDUCED MUCOSITIS?

Rebecca P. George ¹, Gordon S. Howarth ^{1,2} and Alexandra L. Whittaker ¹

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The Rat Grimace Scale (RGS) is a non-invasive method used to evaluate affective pain response. This characterisation of affective pain is valuable for various animal models of disease such as mucositis; a painful side effect of chemotherapy treatment. The RGS is well-studied and validated for the assessment of acute pain rodent models in post-surgical procedures. However, in the face of visceral pain, such as intestinal mucositis, the RGS is less studied. Previous mucositis studies have primarily focused on disease severity and pathological outcomes, yet fail to include a measure specific to affective pain, in spite of pain reduction being an essential clinical goal. This study aimed to assess the efficacy of the RGS for visceral pain in a rat model of chemotherapy-induced mucositis. A secondary aim was to examine whether changes in other measures of affective state, including the disease activity index (DAI) and open field test (OFT), reflected the grimace responses recorded. Opioid analgesics were administered to determine if the responses were pain-specific. Female tumour bearing Dark Agouti rats (n=60) were allocated to either saline or 5-Fluorouracil alone, or with co-administration of opioid analgesics; morphine, fentanyl and oxycodone. RGS and DAI were performed at 5 time-points; 24 hours prior to injection of tumour inoculum, 24 hours prior to 5-FU or saline administration, and 24 hours, 48 hours and, 72 hours post-5-FU or saline injection. The OFT was conducted 72 hours post 5-FU or saline administration. No differences in RGS scores or OFT were demonstrated between groups. A significant difference was observed between treatment groups in DAI scores, with a progression in clinical signs until 72 hours post-chemotherapy injection. Analgesic agents, morphine and oxycodone increased DAI score compared to saline and 5-FU controls. Whilst, a significant increase in RGS scores were observed across time, the scores were consistently low and frequently below the threshold of scoring with a point system. The current study failed to validate the RGS as a measure of chronic pain in a rat model of chemotherapy-induced mucositis. DAI appeared to be a sensitive and reliable indicator of wellbeing. However the DAI is not specific to pain and therefore may not be useful in guiding assessment strategies. Alternative measures of emotional affect should be investigated; for example, activities of daily living. A reliable method for pain assessment in animal models such as this is urgently required to improve translational validity of the model to human clinical practice, in addition to safeguarding animal welfare, and meeting regulatory requirements.



SOCIAL INFLUENCE ON THE EFFECTIVENESS OF VIRTUAL FENCING IN SHEEP

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Virtual fencing is an emerging technology with the ability to contain sheep within a boundary through associative learning of the pairing of an audio warning cue and an electrical stimulus. With the strong flocking behaviour shown by sheep, there may be potential to collar only a proportion of animals to gain effective control, however little is known about this approach. We tested the ability for virtual fencing to control a small flock of sheep with differing proportions of the group exposed to the virtual fence (VF). The behavioural time budgets (lying/standing/walking) of sheep were monitored using HOB0 accelerometers and location was measured using GPS. Thirty-six Merino sheep were identified as leaders, middle or followers by moving them through a set of yards prior to treatment allocation, then sheep were allocated to groups balanced for order of movement. The treatments (n=9 per group) included applying the VF collars to the following proportions of animals within each group: 1) 100 % 2) 66 % (n = 6 VF; n = 3 no VF) 3) 33 % (n = 3 VF; n = 6 no VF) 4) 0% (no VF; free to roam the paddock). The flocks were given access to a paddock (80 x 20 m) for two consecutive days for six hours per day. Group 100% and Control were tested on the first two days and groups 33% and 66% were tested on the following two days. Sheep in groups with the virtual fence were prevented from entering an exclusion zone that covered 50% of the paddock. The virtual fence was effective in preventing sheep from entering the exclusion zone in the 100% and 66% groups but not the 33% group. Behavioural data were aggregated into 15 min intervals and further collated and presented as proportion of total time spent in a behaviour. A treatment and day effect was seen ($P < 0.05$) for all behaviours. On day one, sheep in the 33% spent less time lying (3%) compared to control (9%) and 100% (15%). On day two, the 66% group spent more time lying (28%) compared to the control (12%) and 100% (13%). Differences in standing behaviour were seen between the 100%, 33% and 66% groups on day one (81%, 93% and 89% respectively, $P < 0.05$). On day two the 100% group spent 81% of their time standing which was significantly different ($P < 0.05$) to 33% (90%) and 66% (70%). For walking behaviour, the 100% group spent significantly more time walking on day one and two (5%) compared to the 66% group (1%). Differences in behaviours may have been due to sheep adapting to the system, as they were only exposed for a short period of time. This study demonstrates that social influences can affect both the effectiveness of the virtual fence and behavioural patterns in sheep. Further studies using larger group sizes and conducted over longer periods of time are needed to confirm these findings.



OPERANT LEARNING IS DISRUPTED WHEN OPIOID REWARD PATHWAYS ARE BLOCKED IN THE LAYING HEN

Jade Fountain¹, Susan J. Hazel², Terry Ryan³, and Peta S. Taylor¹

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There is limited research into mesolimbic function specific to birds, and specifically how reward might affect learning in chickens. Reward is comprised of two separate processes; 'wanting' and 'liking'. 'Wanting' is shown to be regulated by dopamine, while 'liking' is shown to be regulated by opioids. A more thorough understanding of how laying hens experience reward in their environment can give insight into provision of individual preferences that optimise health and wellbeing with implications for welfare improvements. This study examined the effect the opioid antagonist nalmefene has on learning in laying hens.

Eighteen laying hens were randomly assigned into either a treatment group or a control group. Hens in the treatment group ($n = 9$) were administered an opioid antagonist (0.4mg/kg nalmefene in 0.9% saline injected intramuscularly into the pectoral muscle) to disrupt the reward pathway. Hens in the control group ($n = 9$) received 0.9% saline (0.5 mL/kg intramuscularly into the pectoral muscle). On day one of the trials no dosage was given, and all hens in the treatment and control group succeeded in passing a habituation task to expose the hens to the training table, cup and trainer. During the habituation task, hens followed a cup at a slow then fast speed across the length of the table. From day two onwards, hens were dosed thirty minutes prior to trials and trained on a series of three tasks using operant conditioning in which they were given one five minute sessions each day, over three consecutive days, to learn the tasks. The tasks consisted of (1) pecking a target, (2) colour stimulus discrimination, and (3) pecking a target on cue presentation. All tasks were trained by the same trainer who was blind to treatment, using clicker training; correct responses were marked with a clicker in a procedure called 'shaping'.

Data did not meet the criteria for normality and therefore was analysed with a Generalised Linear Mixed Model and included day, treatment and the interaction between day and treatment as fixed factors. The number of tasks completed was the dependent variable. Time of day was included in the model as a random factor but was not significant so was removed to improve model fit. Post-hoc comparisons were corrected using the LSD method (Least Significant Difference).

By day four, more control hens had completed Task 1 and Task 2 than hens that received nalmefene (completion of task 1: 66% of control hens, 0% nalmefene hens; task 2: 33% control hens, 0% nalmefene hens; $F_{(1,17)} = 100$, $p < 0.0001$). No hens in the nalmefene treatment group achieved any training task except the habituation task. This study demonstrates hens treated with an opioid antagonist failed to learn any tasks during operant training sessions over three days. We show that hens choose not to participate in operant tasks when the ability to experience reward is blocked, suggesting that performing operant tasks is rewarding to laying hens.



CATTLE BEHAVIOUR AND LOCATION ASSESSED FROM THE SKY IN A FEEDLOT BEDDING STUDY

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An overarching study was carried out to assess the performance and welfare benefits of providing woodchip bedding for cattle in a feedlot. As a part of this study, a methodology was developed to gather behavioural data from the cattle within the experimental pens in an efficient manner, ensuring there was no disturbance to the animals by human presence. To this end, an unmanned aerial vehicle (UAV) was used to collect imagery of the animals for processing.

The study was conducted over 109 days during winter months at the University of New England's SMART Farms research feedlot, Tullimba (Armidale NSW, Australia). *Bos taurus* steers (n=300) of varying breeds, 12-18 months of age and ~380kg, were exposed to one of three treatments; (1) Control (no bedding), (2) 15cm woodchip bedding (W15) or (3) 30 cm woodchip bedding (W30). To collect the behavioural data a UAV (Mavic Pro Platinum, DJI, Shenzhen) was flown at a height of 25m above ground level, a height selected that had no impact on animal behaviour. Flights were conducted one day each week (15 weeks in total) including 8 flights over seven hours between 0900 and 1600. The mission took approximately 9 minutes. Still images and video footage collected by the UAV were visually analysed between flights for the distribution of the cattle within each pen (front, middle or back sector) and the proportion of animals standing (but not eating), lying, or active (eating or drinking) in each pen sector.

Lying increased over time ($F_{(13,3306)}=23.6$, $P < 0.0001$), but there was no interaction between treatment and week on lying behaviour ($P = 0.119$). There was a main effect of treatment on lying behaviour ($F_{(2,3306)}=4.18$, $P = 0.015$) where more control animals were found to be lying than W15 ($t=2.81$, $P = 0.005$) and W30 ($t=1.94$, $p = 0.053$), however, this was numerically very small (Control 39 %; W15 36 %). Control cattle were more likely to lie down at the front of the pen compared to W15 animals ($t_{(1,8534)}=11.3$, $P < 0.001$) and W30 animals ($t_{(1,8534)}=6.7$, $P < 0.001$).

The use of a drone to collect imagery for analysis of animal behaviour was successful and allowed data collection without humans or vehicles influencing cattle behaviour. The control cattle were found to have the ability to compensate for muddy conditions by maintaining their lying behaviour budget through adaptation to the pad and by shifting their location to the front of the pen for resting.

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BEHAVING AT THE ZOO: THE EFFECT OF UNIFORM PRESENCE ON THE BEHAVIOUR OF ZOO VISITORS

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Improved scientific understanding has enabled zoos to adopt evidence-based housing and husbandry; thus, addressing welfare concerns. Visitors may also be a potential source of stress for zoo animals. Some studies on the 'visitor effect' have found that the presence of visitors (noise levels, crowd size, and activity levels) can be associated with negative animal welfare. However, zoo professionals are aware that visitors sometimes try to deliberately engage with the animals, by performing, what they consider to be, potentially negative behaviours (PNBs): that is, these actions are perceived to cause stress or compromise animal welfare. Such behaviours may include tapping on the glass, trying to get an animal's attention, and feeding/touching animals. There has been limited effort to quantify these more active forms of zoo visitor-animal interactions. To understand the prevalence of PNBs, and if visitors are aware that these behaviours are considered undesirable, visitors to Taronga Zoo, Australia, were observed at 6 locations under 3 conditions: observer not in zoo uniform and not obvious to the public (NU), observer in uniform and in a highly visible location (UV), and observer in uniform in the same location as for NU (UO). Observations were conducted for 1hr periods at 4 different times of day, for a total of 36hrs per location, with total number of visitors, number of people who performed PNBs recorded. Performance of PNBs was found to vary by location, in both proportion of visitors (0.51% \pm 0.01SD to 6.61% \pm 3.41SD) and in type of PNB performed; glass tapping accounted for the single largest proportion of PNBs (49%). The data were analysed using a model selection approach in R (Generalized Linear Model with binomial distribution), with each location analysed separately. Overall, visitors were less likely to perform PNBs at 4 locations in the UV condition compared to the NU condition (Tasmanian devil exhibit: $X^2=9.54$, $df=2$, $p=0.008$; macropod walkthrough: $X^2=10.69$, $df=2$, $p=0.005$; nocturnal house: $X^2=36.98$, $df=2$, $p<0.001$; and food outlet: $X^2=11.88$, $df=2$, $p=0.002$). Visitor numbers did not appear to affect PNB performance except at the meerkat exhibit ($X^2=8.18$, $df=1$, $p=0.004$), where PNBs decreased with increasing visitor number. There were some differences in the effect of condition on individual PNBs. These results indicate PNBs are more prevalent at some exhibits than others, and that visitors are aware that their behaviour may be undesirable, given that PNB performance declined in the presence of a uniform. The motivation to perform these behaviours needs to be understood so zoos can effectively educate visitors not to perform them. Zoos will need to be selective about which PNBs to target, to increase effective messaging to visitors: examining their effects, if any, on animal welfare, will be necessary. Further research to this end is being conducted.



COWS' AVOIDANCE DISTANCE AND ITS ASSOCIATION WITH HEALTH IN SHELTERS IN INDIA

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Cow slaughter is prohibited by law in India. As a result, old, infirm, unproductive and abandoned cows are sheltered in traditional retirement homes referred to as gaushalas, until they die of natural causes of death. The impact of human-animal contact is of particular interest for welfare assessment as traditional Indian farming and sheltering systems involve regular close human-animal contact. In a cross-sectional study across 6 states, 54 cow shelters were visited and 30 cows in each shelter were randomly selected (1620 in total) for the assessment of avoidance distance and other cow-based welfare parameters. Avoidance distance was assessed 1h after morning feeding. Cows standing at the feeding manger were approached from the front at a rate of one step/s, starting 2m away from the manger. The distance between the assessor's hand and the cow's head was estimated at the moment the cow moved away and turned its head. On a scale of 1, touched, 2, 0-50cm, 3, 51-100cm and 4, >100cm, 52% of the cows allowed touch by the assessor and another 32% scored a 2. Ordinal logistic regression modelling revealed positive associations of avoidance distance with the proportion of cows with dirty hind limbs ($p \leq 0.001$, Odds Ratio [OR] 1.98, 95% Confidence Interval [CI] 1.58-2.48), dirty flanks ($p \leq 0.001$, OR 0.56, 95% CI 0.42-0.75), hock joint ulceration ($p = 0.002$, OR 0.76, 95% CI 0.63-0.91), carpal joint injuries ($p < 0.001$, OR 0.72, 95% CI 0.62-0.82) and lesions on the body ($p = 0.006$, OR 0.80, 95% CI 0.68-0.94). A curvilinear association of avoidance distance was observed with body condition score ($p \leq 0.001$, OR 0.57, 95% CI 0.46-0.71), with high values in cows with extreme scores. There was also evidence of reduced avoidance distance in cows with high levels of hock joint hair loss ($p = 0.01$, OR 1.27, 95% CI 1.05-1.53) and hock joint swellings ($p = 0.002$, OR 1.28, 95% CI 0.09-1.50), hampered respiration ($p = 0.020$, OR 0.72, 95% CI 0.04-0.76) and diarrhoea ($p = 0.010$, OR 0.48, 95% CI 0.28-0.84) probably as a result of moving difficulties. The avoidance distance was thus affected by the levels of health and welfare in the cows, providing a vital insight into the factors affecting human-animal contact in the shelters.



THE ARCHITECTURE OF HORSE WELFARE: IMPROVING HORSE WELFARE WITH ETHOLOGICALLY-INFORMED EQUINE FACILITY DESIGN

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Research in equine ethology has identified some critical areas of horse welfare such as feeding, training, resting, and socialising. They have resulted in some important changes to horse management and husbandry by owners and carers. The importance of the horse's built environment has also been singled out as critical to horse welfare. In fact, these human-made environments can prevent or enable the intended outcomes and efficacy of equine welfare interventions. Whilst equine ethologists and horse behaviour experts have identified areas where horse facility design can be improved, their recommendations have had relatively less impact on horse owner and carer behaviour. This is unsurprising given that behaviour change in equine architecture requires specialist skills and significant investment in infrastructure. However, a failure to systematically apply ethological theory to all facets of horse management can seriously undermine all the good welfare intentions in the domains of feeding, training, resting, socialising and so forth. In this presentation, we provide a case study where ethology influenced all aspects of an equine architecture project. By considering a recent project designed for a small property in Cape Otway in Victoria, Australia, we illustrate how ethologically-sensitive design was used to improve the welfare of a small herd of domesticated horses. We will demonstrate how ethological principles can be applied to horse housing and facility design to support individual welfare interventions and enhance their combined value on equine quality of life. Our case study shows how ethological theories of equine welfare can be translated into practice through ethologically-informed design/architecture. Our case study also provides important considerations for how the built environment impacts the production and interpretation of empirical data.



ALPACA BEHAVIOUR – INSIGHT INTO LAMB ATTRACTION

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The loss of livestock from predator attacks is a major cause of human-wildlife conflict globally. The use of guardian alpacas to protect livestock such as sheep from predators is one way producers are trying to reduce lamb losses. Although guardian alpacas are used worldwide, rigorous scientific evaluation of alpaca guarding behaviour is lacking. One way that alpacas may be successful in their guardian role is to bond and stay in close proximity with the livestock they are protecting. This has been observed in the field with sheep producers claiming that alpacas do show interest towards lambs and have been known to stay with abandoned animals. Female alpacas are known to bond closely with and defend the young (cria). In this research we aimed to investigate whether alpacas are more interested in lambs than in other novel objects, odors and sounds and in doing so be able to identify the sensory inputs that may be attracting an alpaca to a lamb. We hypothesized that the visual appearance, odor or sounds associated with lambs could act as a trigger for maternal behaviours and therefore they would show a greater interest towards lamb stimuli than other novel stimuli in their environment. To test this hypothesis, we conducted a novel object arena test in which both male (n=12) and female (n=12) alpacas were presented with stimuli that represent different aspects of lambs and other novel stimuli for comparison. These aspects included sight (lamb model, ewe model, foot stool as a control shape), sound (lamb bleat, baby alpaca bleat, lion's roar as control sound), smell (amniotic fluid, vinegar as control smell) and live stimuli (live lambs and live ewes). The alpacas were tested individually and given two minutes in the arena (7mx22m) with the individual stimuli. Behavioural responses towards stimuli were recorded for analyses. These behaviours included time spent alert (looking directly at stimuli), in close proximity (within 1m radius of stimuli) and sniffing stimuli with nose to stimuli contact and time spent pacing around arena. Using Wilcoxon statistical tests, we found that the alpacas spent significantly more time ($49.1 \pm 16.4s$) exhibiting alert behavior towards the live lambs than the live ewes ($34.2 \pm 14.9s$; $p < 0.001$); and spent significantly longer within a metre radius of the live lambs ($24.4 \pm 33.2s$) compared to the live ewes ($6.5 \pm 10.3s$; $p < 0.01$). In relation to smell alpacas spent a significantly longer time exhibiting alert behavior towards the amniotic odor ($6.58 \pm 7s$) compared to the vinegar control smell ($2.3 \pm 2s$; $p < 0.01$). The alpacas also spent more time exhibiting alert behavior towards the lamb model ($31.8 \pm 19.6s$) than the foot stool control stimulus ($21.5 \pm 15.7s$; $p < 0.05$). These results indicate that the alpacas show a greater interest to lamb stimuli, in particular the live lambs, than other novel stimuli and that a combination of the factors of sight, smell, noise and movement are the most likely sensory attractants for the alpacas. The interest toward the lamb stimuli and the preferred close proximity toward the live lambs supports anecdotal observation from sheep producers, showing us that they do exhibit the ability and interest to stay close to lambs. However, further research will be needed to determine if staying in close proximity to lambs correlates to guarding effectiveness.



OBSERVER CONSENSUS OF SHEEP WELFARE DURING THE PRE-EXPORT PHASES OF THE LIVE-EXPORT INDUSTRY

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Livestock are exposed to several stressors during the pre-export phase of the export supply chain. As livestock are usually raised in extensive farming systems, the processes of yarding, trucking, and exposure to novel environments (feedlots and ship) can be stressful. Establishing methods that effectively determine the behaviour and the demeanour of animals when exposed to these different stressors is an important first step for welfare assessment. In addition, determining whether different observers can reach consensus on this assessment is required. Wethers (n=240) from four farms were divided into a total of 12 groups and marked with stock marker to allow easy identification of animals for filming. Behaviour and video recording of the sheep were recorded pen-side at each stage; on farm within six hours of mustering, after penning on arrival at the feedlot, again at the feedlot prior to loading onto trucks, and 30 minutes after loading onto the ship. An ethogram was used to assess sheep behaviour by one observer at the pen, while films were edited to be approximately one minute in duration. Using Qualitative Behaviour Assessment, 12 novel assessors scored the sheep using 10 terms (a fixed list) per video clip. Principal Component Analysis (PCA) was used to analyse the 576 assessor scores. Repeated measures ANOVA and Tukey's post hoc analysis was then used to determine if PC scores significantly differed between the farm, both feedlot timepoints and on the ship. Sheep were scored as significantly more *agitated* and *nervous* on the farm than the other timepoints on PC1 (30.5% variation). Sheep were found to be significantly more *interested* and *alert* at the feedlot on PC2 (24.5% variation) than on farm or ship. Sheep were found to eat significantly more at the feedlot ($F_{3,8} = 18.95$, $p < 0.001$) and ruminate more at the second feedlot timepoint and on the ship ($F_{3,8} = 14.99$, $p < 0.001$). As societal concerns surrounding live export are demanding greater transparency from the industry, developing methods where multiple assessors are able to reach agreement on and describe livestock demeanour is an important step.



CAN WE DETERMINE COW SLEEP STAGES FROM LYING POSTURE?

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Sleep is an essential function for all animals and its importance is increasingly being discussed in the human literature. Sleep restriction can have severe implications for many important health and welfare domains such as mental and physical health, immunity, development and social interactions. Little is known about the importance of sleep for livestock welfare. This is mainly due to difficulties in accurately determining when an animal is asleep. The gold standard to stage sleep in animals is to use polysomnography (PSG); using electroencephalography (EEG) to record brain activity, electrooculography (EOG) for eye movements and electromyography (EMG) for muscle tone, however this method is delicate and impractical to apply in a large-scale study with unrestrained livestock.

Cows must lie down to sleep, therefore factors in the environment that affect cows lying behaviour are likely to have a significant impact on sleep. Cows adopt a characteristic tucked position with the neck turned and resting on the flank or ground and eyes closed, and occasionally will lie in a completely laterally recumbent posture. Previous studies in dairy calves have indicated that head position could be used with some accuracy to predict sleep stage in calves however it could not be used reliably in adult cows. The aim of this project was to continue to investigate the use of lying position and head posture in the prediction of cow sleep stages.

PSG recordings were made from 5 non-pregnant, non-lactating dairy cows managed individually in a 5m x 5m deep bedded straw pen at the SRUC Acre Head Research farm in Dumfries, Scotland. Readable data from 164hrs of recordings were scored into five stages of sleep from light to deep from PSG traces in 30 second epochs. Postures and head positions were scored from corresponding video recordings.

When in REM sleep tucked posture with head resting was observed in 78.51% of epochs, lateral lying in 14.8% and other positions in 6.68%. However, REM sleep made up only 44.08% of all epochs observed in the tucked posture while 47.91% of epochs were scored as light sleep or awake. REM sleep position varied between cows with some cows almost exclusively achieving this stage in a tucked position while others were in REM sleep in a laterally recumbent position at least half the time. Non-REM deep sleep was observed in 58.84% of epochs when the cow was lying upright with the head low, however NREM sleep made up only 6.39% of all lying with head low epochs.

This data supports previous findings that lying posture and head position cannot be used accurately to estimate sleep stage in adult dairy cows. There are individual preferences for lying postures in deep sleep stages and estimates of sleep from postural data alone are likely to be inaccurate and do not take all deep sleep stages into account. These findings also reinforce the need for further research into practical alternative methods of assessing sleep stages in large animals to measure and understand the importance and effect of sleep quality on animals' lives.



PEKIN DUCKS ARE MOTIVATED TO LAY IN THEIR PREFERRED NEST SUBSTRATE

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Nest design can contribute to floor-laying behaviour in farmed poultry, if the provided nests are not attractive to laying birds. Chickens and quails have known preferences for nest substrate, but whether Pekin ducks do is unknown. The aims of this study were to 1) determine if Pekin ducks exhibit preferences for nesting substrate; 2) assess the motivation of ducks to access their preferred substrate, and 3) assess the ducks' response when access to the preferred nest is restricted, by looking for stress-induced hyperthermia (SIH), measuring the concentration of corticosterone in egg albumen, and assessing behavior.

Twelve laying female Pekin ducks were used. Preference testing was conducted to determine which of three nesting substrates (sawdust, hemp fibre, or astroturf) the ducks preferred. Then, a behavioural demand test was used to assess the motivation of ducks to access their most preferred substrate. Ducks were required to push through an increasingly weighted door (0-120% of individual bodyweight, four consecutive nights per workload) to gain access to their most preferred substrate, before the door was blocked and access to the preferred substrate was prevented. Their least preferred substrate was freely available through an unweighted door during the experiment. Surgically implanted data loggers recorded core body temperature every five minutes. Eggs were collected each morning for radioimmunoassay analysis of corticosterone concentration. Behaviour was video-recorded, and associations between passing, or attempting to pass, the door to the preferred substrate and incidences of SIH were identified.

Sawdust was determined to be the most preferred substrate (David's Score = 1.43), and astroturf the least preferred (David's Score = -2.32). Six of twelve birds completed all door workloads and attempted to push the blocked door to access the sawdust. The area under the curve of hyperthermia (AUC) was larger when the door to the sawdust was blocked ($p = 0.008$) compared to other workloads. The response did not diminish, with no difference in the AUC between nights 2-4 of the blocked door compared with night 1. Descriptive analysis of behaviour showed that on the first night that the door to the sawdust was blocked, all birds pushed at the door more, and most looked through it more. On nights 2-4 of the blocked door, pushes at that door were decreased while the number at the least preferred door increased. Rates of wing flapping, pecks at the behavioural demand unit, and pacing behaviour were higher in most birds when the door to the sawdust was blocked. Egg corticosterone did not differ across workloads or when the preferred substrate door was blocked.

Laying Pekin ducks prefer manipulatable nesting substrates. Access to a preferred nesting substrate carries a high level of importance for ducks, because most ducks were willing to expend increasing effort to pass through a push-door for access to the preferred nesting substrate. The ducks exhibited signs of stress, likely due to frustration, when they were unable to access their preferred substrate, as indicated by SIH. Candidate behavioural indicators of frustration in Pekin ducks were identified. The results indicate that nesting ducks in commercial farms should be provided with a manipulatable substrate, such as sawdust.



THEORY DRIVEN UNDERSTANDING LINKING BEHAVIOUR AND WELFARE: AN EXAMPLE CLARIFIES THE PARADOX OF 'FREE-RANGING' POULTRY

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A common understanding of free-ranging systems for domestic poultry (*Gallus g. domesticus*) is that most birds will be on the range for much of the day. The reality is far from this, with studies under laboratory and commercial production conditions revealing that the majority of birds in both egg and meat production systems spend most of their time in, or adjacent to, indoor housing. The aim of this paper is to provide a theoretical explanation for the differences between the public's expectations and a birds-eye view of free-range environments, and implications for future poultry production systems. Modern poultry are descended from the Asian Red Jungle Fowl, which through evolution, successfully adapted by, for example, foraging under or near thick overhead cover and using 3-D space for safe roosting. The legacy of these adaptations is seen in the behavioural needs of modern poultry hybrids. Selection for increased egg production has resulted in some alterations in behaviour, e.g. a decreased willingness to forage for food, but the need to forage, perch and nest and fear of aerial predators remain high. Ecological habitat selection theory posits that the proportions of a population distributed between different habitats is a direct function of the relative value of the habitats. Habitat value is increased by positive features such as high food availability and decreased by negative attributes such as predation risk. In commercial free-range meat and egg production systems, birds are unevenly distributed, typically with higher proportions of individuals indoors. These distributions are relatively insensitive to changes in the availability of positive attributes outdoors (e.g. additional food or shelter) but are highly sensitive to aversive attributes on the range, e.g., rainfall reduces ranging activity. The observed distributions show that indoor environments are more highly valued than outdoors. Viewed from an evolutionary perspective and associated behavioural legacy, this is not surprising as highly valued behaviours are catered for in a prey-safe environment indoors. The relative insensitivity of poultry habitat distributions to the provision of supplementary resources outdoors (e.g. food, added aerial protection) suggests that enhancing ranging by changing these features is contra-indicated. The sensitivity of the distributions to aversive climatic features outdoors suggests creating more benign conditions may stimulate ranging. Interestingly, from a theoretical perspective, environments providing protection from aerial predators/adverse climates whilst also allowing performance of some extra high-valued activities, e.g. dustbathing under natural light, do not require an outdoor range. A covered veranda attached to indoor housing is one practical option that provides these options. Empirical support for this theoretically driven notion comes from a recent evaluation of commercial production systems with meat chickens: welfare was higher in indoor systems with a covered veranda than conventional systems without one, and not different from systems with range access.



ETHICAL DILEMMAS FOR NATURAL LIVING CONCEPTS OF ZOO ANIMAL WELFARE

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Zoological institutions often face complex ethical and practical dilemmas in terms of balancing education, visitor satisfaction, conservation and animal welfare. It is agreed by some that zoos are not ethically wrong *in principle*, but there are some contradictions and indeed ethical concerns for zoos *in practice*. In many zoological facilities, the key concept of *natural living* is often over-extended to what has been termed *wilding*. Basically, that is attempting to keep zoo-housed animals as completely *wild animals* residing in *wild habitats* with little to zero human contact at all times. However, there are logical pitfalls with this. Treating captive animals exactly the same as wild counterparts is practically impossible for most zoo-housed species (although there may be caveats for some miniature, non-ranging species). *Natural living* has been a very useful key animal welfare conceptual framework, especially for initially identifying what may be of importance to animals. However, the concept has faced multiple valid criticisms, and sometimes practical application of the concept is flawed (as it is with *wilding*). Most often, definitions of natural living focus on animals' expression of *natural behaviours*, although natural behaviours do not necessarily indicate positive well-being of an animal, nor positive welfare states. It is suggested that *highly-motivated behaviours* (natural or not) may be a better indicator of what is important to captive animals, especially for their internal affective states. It is also suggested that mixed naturalistic-artificial environments may better accommodate zoo-housed animals' needs, rather than aesthetic "natural-only" environments. Whilst, zoo animals generally are still considered *wild* animals, it must be acknowledged that we may have started these animals down a path towards domestication, even despite our best efforts to prevent this. Finally, as we are now in the *Anthropocene* era, it is suggested that human-animal interactions may indeed be natural, and necessary, for enhancing animals' lives within zoos.



INHERENT FACTORS INFLUENCING JUDGMENT BIAS RESPONSES IN RATS

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In recent years there has been a shift in focus in animal welfare science towards the assessment of positive affective states. However, whilst there are well-established physiological and behavioural markers of negative affect, measures of positive affective state have been less well-characterised. Behavioural tests have perhaps received the most attention, with a focus on the judgement bias test (JBT). JBT's have been developed for use in a range of non-human animals including: rodents, pigs, dogs, and horses. The tests appear to have considerable utility in the assessment of valence of affective state as corroborated by established measurement methods. However, based on our studies examining a rat active choice JBT (Figure 1), we assert that there are a range of factors, routinely present as a result of housing or innate biology, which may influence outcomes in the JBT. Some factors identified include: sex, phase of oestrous in females, and social status. There is a growing body of evidence to suggest that male and female cognitive bias expression, on exposure to identical conditions, is not equivalent. However, fewer studies have examined possible reasons for this difference. Our work implies that female rats, when in the dioestrous phase of oestrus, respond to a group housing test situation with an increased number of 'pessimistic decisions' compared to other phases of the cycle. In two studies we also identified that dominant animals of both sexes, identified through dyadic interactions, made more 'optimistic' decisions than those identified as subordinate. This finding was supported by the observation of reduced anxiety behaviour in the open-field test. Social status was found to be a greater modifier of judgment bias response than housing density or cage space allocation. This paper will present our findings from the rat generally, and suggest that they may be extrapolated to other species. Our proposal is that researchers should continue to use and develop JBTs in animals, but with consideration for some of the inherent, and not easily controlled for factors, that may modify these responses. In developing an awareness of these factors it should be possible to account for these in data analysis. In so doing, the validity and reliability of judgement bias testing will be enhanced.



HOW NZ MEDIA STAGE FARMED ANIMAL WELFARE CONTROVERSIES

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Media representations of controversy play a significant role in shaping how people understand cultural practices and values, including those relating to farmed animal welfare. Our research first aimed to identify which issues receive the most media attention in New Zealand, and which types of expertise are considered relevant to the issue at hand. We collected news articles and editorials on animal farming published in national urban and rural media (e.g. *Stuff*, *NZ Herald*, *Farmers Weekly*) between 2015 and 2019 and sorted them according to the issues raised (e.g. bobby calves, winter grazing, *M. bovis*) and the types of expert knowledge used to stage the issue (e.g. academic, farming, government, animal advocacy). From the results we created four representative archetypal characters that appear in almost all stories: the Villain, the Defender, the Diplomat, and the Hero. This paper summarises the cultural beliefs, norms, and values associated with each archetype—including who is called on to play which role, and how their narratives shape particular issues in particular ways. Finally, we offer some critical reflections on the implications of the relatively low inclusion of animal welfare science expertise, and an almost complete absence of lay perspectives in how these controversies are staged.



DOES EARLY ANIMAL EXPOSURE IMPROVE VETERINARY STUDENTS' INTERPRETATION OF EQUINE BEHAVIOUR?

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Horses are a social prey species that use subtle body posture changes to communicate and interact with conspecifics. Due to their size and innate flight response, a failure to identify equine behavioural signals may increase the risk of both human and animal injury. Horses in the veterinary teaching environment are often handled by novice students, who may be exposed to this species for the first time during practical classes. Therefore, the aim of this research was to describe veterinary students' animal exposure prior to their degree and quantify their ability to interpret correctly the behaviour of horses.

Students (n = 214) enrolled in either the first (pre-clinical), or the fourth (clinical), year of the five-year veterinary programme completed a paper-based questionnaire. The questionnaire consisted of four parts. After providing demographic information, students were asked eight questions related to their previous animal exposure and experience. The second part tested their understanding of equine behaviour using a picture of a horse. Students were asked to identify the horse's behaviour from a list of 12 terms, and select which of the horse's body parts they used to interpret the behaviour. The third and fourth sections of the questionnaire focused on students' self-assessed handling skills and knowledge of learning theory; however, results will not be part of this particular study.

The interpretation of equine behaviour was used as the dependent variable in a multivariable logistic model, and a multiple correspondence analysis was performed to visualise the relationships between the students' selected behavioural terms and the information gathered in the survey.

Students were mostly females (148/185 - 80%) from an urban environment (121/183 - 66%), and pet owners (164/181 - 91%) with a good self-reported confidence around small animals (172/186 - 92%). Self-reported confidence around large animals and horses did not differ across years of the programme ($p = 0.68$ and $p = 0.91$, respectively). Although only 26% of first-year students and 32% of fourth-year students considered themselves as experienced with horses, a majority had had a previous contact with horses prior entering the programme (92% and 83%, respectively). Fourth-year students identified the appropriate behaviour of the horse more frequently than first-year students (adj OR = 3.02, 95% CI: 1.33-7.17, $p = 0.01$). Pet ownership (adj OR = 4.89, 95% CI: 1.3-23.78, $p = 0.027$) and an early equine experience as of the presence of horses on property while growing up (adj OR = 4.46, 95% CI: 1.86-11.62, $p = 0.001$) also increased the odds of use of correct behavioural terms.

Although the ability to interpret correctly the behaviour of the horse increased with advancement in the veterinary programme, an early animal exposure appears to have a persistent positive effect on students' interpretive skills.



HOW HUMAN CULTURE DEFINES DOG CULTURE: METHODOLOGY USED TO EXPLORE HUMANE DOG TRAINING IN CONCORDANCE WITH AUTONOMY & CONSENT AND THE IMPLICATIONS FOR WELFARE

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The human-dog interspecies relationship is unique: dogs and humans have evolved along side one another, sharing the same environmental niche for thousands of years. Dogs have the ability to interpret our slightest gestures, to read our facial expressions, and respond to the subtle tones in our voice. Because of these invaluable abilities, dogs have been bred selectively to benefit our needs. Despite this, not all human-dog relationships are positive. In order to understand why some relationships fail, it is important to first disentangle the underpinnings of how these relationships affect all members. Most social science-oriented research focuses on the human benefit of pet ownership or how humans are affected by dog ownership. Alternatively, most ethological studies examining canine behaviour do not include the human member or household dynamic as confounding variables. In order to understand why some relationships negatively impact dogs, we need to be able to create a connection between cognitive behavioural studies and social science as a way to address such vexing ethical terrain. To do so, we need to understand what social constructs have created “the dog” and the impact our interactions have on “the dog” in order to improve their welfare. The current paper considers the methodological utility of merging social science and cognitive behavioural research. I do this by outlining the approach taken in my current PhD study that aims to address the societal norms surrounding who is “the dog”, how this impacts the adoption of humane training, and the interjection of knowledge used to facilitate an augmentation of both consent and autonomy. In order for consent to occur, there is an implication that a two-way *conversation* must occur. But what does this really mean? And what does this look like? And how can we allow our dogs to act autonomously and still keep them safe from allegorical and physical perils of our shared environment? *Can we?* It’s an ethical dilemma I plan to untangle. The mixed methods approach of this study allows both qualitative and quantitative investigations. For example, interviews will consider such questions as who is the dog to the human? And who is the dog to the dog? These responses will lead to a survey which looks at how social constructs influence training and management. Both approaches will be preceded with a daily journal as well as a critical analysis of humane training and emotional welfare. The welfare of companion dogs must extend beyond simply providing adequate amenities and provisions; it needs to also consider the psychological effects of training and management, both positive (clarifying the conversation) and negative (dictation and limitations of conformity). Collectively, this will contribute to the research backing a standardization and regulation within both the welfare sector, and the dog training industry.



REDUCING THE ENFORCEMENT GAP IN ANIMAL LAW – AN INVESTIGATION INTO THE CAUSES

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The last few decades have seen increased public concern regarding animal welfare. With this growing concern, researchers have started to question the efficacy and role of law in the regulation and promotion of animal welfare. A number of weaknesses have been identified; from the ambiguity of the language used in legislation, the questionable reliability of using charitable bodies for enforcement, to the severity of the penalties imposed for offences. These weaknesses create a gap between the ambitious goals of animal law enforcement and the practical reality of the animal law justice system. This gap is defined as the 'enforcement gap'. With preliminary focus on the South Australian (SA) jurisdiction and comparisons where possible to other Australian state-based and national jurisdictions, this interdisciplinary research sought to investigate this concept further, through identifying the causes of the enforcement gap. Topics of interest are the difficulties animal law enforcement agencies face, the legislation and associated provisions, as well as the public's role in enforcement.

Thus far, the penalties handed down for animal welfare offences have been investigated. Animal welfare legislation in SA underwent amendments in 2008, which saw all the maximum penalties for offences doubled. This commitment to increased penalties arguably provides evidence of the legislature's intent, in that Parliament aimed to 'get tough' on offenders in relation to penalties. Studies have speculated that the legislative intent behind the increased penalties was not being reflected in the courts, creating this gap between the penal expectations and current reality. This research sought to gain evidence to confirm or disprove these speculations, by quantifying the average custodial sentence and monetary fine handed down in court before and after the 2008 amendments. Furthermore, trends relating to the species of animal affected and the demographics of the offender were identified.

A total of 314 RSPCA (SA) closed case files from 2006 to 2018 were converted into an electronic form for analysis. Since the amendments, the average penalties have doubled in magnitude; fines have increased from \$700 to \$1535, while prison sentences have increased from 37 days to 77 days. However, as a proportion of the maximum penalty, no change has occurred; both datasets only used 10% of the maximum penalties. Cases of companion animal abuse were most commonly tried (75% of all cases) in comparison to farm animal abuse, and the offences were more prevalent in the lowest socioeconomic areas of SA. We conclude that although the average penalties have increased, the use of maximum penalties has not changed after they were subjected to a substantial increase. Therefore, it is debatable whether these increases to average penalties are enough to effectively punish animal abusers, or if alternative penalties, such as court mandated counselling, should be utilised more widely by the sentencing courts.

Following on from this study, the enforcement gap concept is being investigated further throughout the enforcement process, with the aim to reduce the gap between the ambitious goals and practical reality of animal law enforcement.



ONE WELFARE NEEDS COLLABORATIONS BETWEEN EPIDEMIOLOGY & ANIMAL WELFARE SCIENCE

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One Welfare has been borne out of a realisation that positive outcomes in animal welfare, human wellbeing and the environment are interconnected. Undertaking research in a One Welfare paradigm requires interdisciplinary teams that will conduct at least some of their research in the field, rather than the laboratory. The need to leave the laboratory has three drivers. Firstly, not all factors of interest can be randomised, for example, age, sex and breed of an animal. Secondly, not all conditions can be studied experimentally because the conditions would be unethical or impossible to replicate. For example, it is unethical and practically impossible to cause a whale stranding. Similarly, laboratory studies are limited when it comes to an understanding of the likely impacts of climate change on animal welfare. Thirdly, while experimental studies typically have high internal validity, they do not always generalise well outside of the laboratory as they don't capture the inter-relationships between animals' people and the environment. For these reasons, it makes sense to undertake observational studies to advance One Welfare. Observational studies can appear simple, leading some to believe that conducting them is just a matter of common sense. However, as Professor Rothman, an internationally recognised epidemiologist, said: *"The problem with this view is that the kind of common sense that is required may be elusive without training in epidemiologic concepts and methods"*. Historically the science of epidemiology has focused on understanding risk factors for disease. However, there is no reason that an epidemiological approach could not be applied to understanding factors associated with the positive and negative welfare states in animals. This presentation will explore some of the key issues in the design of observational studies using examples drawn from the author's work in a number of areas, including farm working dogs and bobby calves. The flow of ideas in any collaboration is never in one direction. Therefore, we will also reflect on how application of the animal welfare science, in particular, the five domains framework, can result in better epidemiological studies by encouraging a view that considers good animal welfare as more than just the absences of disease. The presentation will conclude with a road map for implementing observational studies in a One Welfare world.



TRANSPARENCY, OPENNESS AND EXPLORING THE POSSIBILITY OF AN “OPENNESS AGREEMENT” FOR NEW ZEALAND AND AUSTRALIA

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Many of us working with animals in research know the importance of transparency and openness. We also believe in its power to educate and increase the welfare of animals and the people working with them. If we do not put out accurate messages, then the public will listen to the inaccurate messages that they get elsewhere. There have been polls on public support of animal research for science and medical purposes that have showed declining support. Although we can understand why secrecy may have been required in the past, the argument is no longer viable and this silence is backfiring on us in many ways. The animal rights activists have gained traction with the public and have been increasingly clever with messages, such as: 1) animals are not needed and replacement options are available, 2) animals are not appropriate models in research looking to benefit humans and research will not suffer if animal use ends immediately, and 3) animals in labs are mistreated.

Animal advocacy organisations have argued for over a century that the scientific community should be more open about working with animals in research. Until recently, however, most research institutions have been reluctant to draw attention to the animals in their care – a response undoubtedly driven by past misrepresentation or fears of targeting by activists. A voluntary program launched in the UK in 2014 has seen a striking reversal of this defensive approach. Known as the Concordat on Openness on Animal Research, the program invites research organisations to make a public pledge to be more proactive in informing the broader community about their animal research programs. Signatories include over 120 of the UK’s most prominent research bodies, and reported outcomes are consistently positive. Similar openness agreements are now established or well advanced in several European countries and discussions are underway in the US. Presentations at recent ANZLAA and ANZCCART conferences have suggested that there is considerable interest in openness agreements (such as the UK Concordat) in the Australian and New Zealand animal ethics, laboratory animal care and animal research communities. This presentation will include resources and ideas for doing more with transparency and openness and outline information gathered and progress made exploring the possibility of an openness agreement for Australia and New Zealand.



EATING DIFFERENTLY: COMPETITIVE FEEDING BEHAVIOURS AT THREE FEEDER HEIGHTS RELATES TO PERSONALITY TRAITS IN GOATS

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Goats are natural browsers, feeding at a range of heights. The objective of this study was to determine how personality traits affect competitive feeding behaviours at different heights. Thirteen female non-lactating goats were group-housed in a single pen. One of three feeder heights (Floor, Head, and Above) was provided daily for 12 d (4 randomized presentations of each height) containing *ad libitum* alfalfa haylage and a top-dressed supplement, refreshed twice daily. Feeding space was restricted to 13.5 cm/goat. During the first 90 min after feed delivery, competitive behaviours were recorded immediately behind, and to the side of, the feeder. Personality traits of each goat were assessed individually at the start and end of the study, using 2 novelty tests (unfamiliar environment; novel object) followed by 2 fear tests (startle response to sudden sound; sight of a dog). For each goat, duration and/or frequency of behaviours in each test were correlated across the two repetitions and thus averaged. Twenty behavioural measures were entered into a sparse PCA (specific for data with limited subjects) yielding 4 factors (personality traits) explaining 62.6% of the variance: fearful-avoid, bold-approach, exploratory-interested, and attentive-cautious. A multi-variable regression model tested the effects of each trait, feeder height, and their interaction on competitive feeding behaviours. Goats scoring higher on 'fearful-avoid' were less involved in aggressive feeding interactions and were consistent in how frequently they received aggression across feeder heights; goats that scored lower on this trait received more aggression at the Head compared to the Floor feeder ($P=0.04$). Goats scoring higher on 'fearful-avoid' were displaced more often resulting in lower feeding time, especially at Head and Above feeders compared to Floor feeder ($P<0.01$). Goats scoring higher on 'bold-approach' engaged in more aggression while feeding ($P=0.02$), pushed more to access the feeder ($P=0.02$) and engaged in more agonistic behaviours at the Floor compared to the Above feeder ($P=0.04$). Conversely, goats scoring low on 'bold-approach' received more aggression at the Head and Above feeders compared to the Floor feeder ($P<0.01$). Goats scoring higher on 'attentive-cautious' tended to receive more feeding aggression ($P=0.09$); goats scoring low on 'attentive-cautious' received less aggression at the Floor compared to the Head and Above feeders ($P<0.06$). The 'exploratory-interested' personality trait was not associated with any competitive feeding behaviours. These results show that personality traits explain variability in feeding aggression and feeding time under restricted feeding conditions; these differences also related to the height of feeder. Commercial feeding systems should meet the needs of all individuals, and thus offering feed at different heights may allow individuals opportunities to express their feeding preferences.



BEHAVIOURAL AND WELFARE COMPARISON OF ELECTRIC TAPE AND VIRTUAL FENCING IN CATTLE

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Virtual fencing technology has the potential to revolutionise management of the livestock industries. Virtual fences, which are communicated via signals to the animals rather than the presence of a physical fence, can restrict animals in areas that are challenging to fence. The eShepherd™ automated virtual fencing system operates via GPS technology and provides stimuli via a neckband device - an audio tone followed by an electrical stimulus when the animal approaches a virtual boundary. Previous trials conducted with the pre-commercial prototype of the eShepherd™ system have demonstrated that cattle can be contained by the virtual fence. Individuals rapidly learn the association between the stimuli and start avoiding the boundary based on the audio cue alone but with high individual variation in learning and interactions with the virtual fence. Animal welfare is a priority consideration for the commercial implementation of virtual fencing systems. It is critical that all individuals are able to learn the association between the cues, that normal patterns of behaviour remain, and that the virtual fence does not elicit an on-going (chronic) physiological stress response. The current study assessed the effects of a virtual fence, in comparison to an electric tape fence, to contain eight groups of eight 12-month old steers within a six hectare area across eight separate paddocks for four weeks following one week acclimation to the paddocks. Cattle were assessed across two cohorts (four groups/cohort) from January until March 2019 in Armidale, NSW. Body weight and faecal samples from each animal were taken weekly. Faecal samples were processed for cortisol concentrations. IceQube R® fitted to the leg measured individual lying and standing time and the virtual fencing neckbands recorded GPS location and all audio and electrical stimuli administered to the cattle. Cattle were maintained within their allocated area by both fence types across the four-week period. There were no differences between fence types in terms of cattle body weight ($P = 0.73$) and body weight of all animals increased across time ($P < 0.001$). The fence type statistically influenced the total standing time ($P = 0.02$) with more standing in cattle from the virtual fence groups (mean \pm SEM electric tape: 12.07 ± 0.04 h; virtual fence: 12.35 ± 0.04 h), however, this difference was biologically not large. There were no differences between fence types in faecal cortisol concentrations ($P = 0.39$) and the concentrations decreased across time for all cattle ($P < 0.001$). All cattle learned to respond to the audio cue alone but learning rate varied between individual animals and fence interactions (with the virtual fence) continued across the trial duration. Interactions with the electric tape were not able to be monitored. These results indicate that virtual fencing technology can effectively contain animals in a prescribed area and that it does not have significant behavioural and welfare impacts on the cattle. Further work should confirm these findings across even longer periods to ensure social and legislative acceptance of the utilisation of virtual fencing technology for managing grazing livestock.

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MANAGEMENT AND HUMAN INTERACTION EFFECT ON THE BEHAVIOUR AND WELFARE OF AFRICAN LION (*PANTHERA LEO*) CUBS USED IN WILDLIFE TOURISM INTERACTION ACTIVITIES

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Tourism activities involving contact interactions with wildlife are offered globally on a variety of platforms ranging from accredited zoos with conservation and education associated initiatives to informal markets in underdeveloped countries where illegally sourced animals from the wild are used. Trends in international ethical tourism are growing as discerning travellers ask questions pertaining to their impact on these animals. Interacting with African lion cubs particularly in South Africa is, however, still a popular activity. This study identified the effect of management styles including aspects of interaction, on the behaviour and welfare of these cubs.

Three anonymous and varying facilities containing three, four and five cubs each were used in the study. Continuous sampling, by one observer, took place for ten minutes per cub per hour, from 0900h – 1200h and again from 1300h – 1600h. Facility A was sampled for 10 days over a 13-week period, Facility B 15 days over a 21-week period and Facility C 12 days over a 21-week period. Facility and Behaviour, as well as the interaction between these two, were included as the main effects in a generalized linear model with a negative binomial distribution and a log link function. Repeated measures of each animal were accounted for statistically as observation day was nested within individual animal effects, included as a random factor in the model.

For all significant predictors, pairwise comparisons were performed using Wilcoxon rank-sum tests, to identify significant differences between factor states. All tests were two-tailed and considered significant for $p < 0.05$. P-values for the outcomes of the tests were adjusted for multiple test comparisons. Facility A and B were determined as being significantly similar to each other and significantly different from Facility C. Human interaction numbers as a continuous predictor for broad ethological categories (inactive, play, grooming, conscious, locomotion, aberrant and aggression behaviours) was not significant across facilities, however, interchanging of sub behaviours by cubs within Facility pair AB, elude to possible coping strategies. Age of cubs was significant across facilities. Management differences such as interaction commencement age of cubs, training of cubs, behaviours of interactors, use of set tour times versus erratic or continuous interactions, use of trained staff versus volunteers and care givers all further influence cub behaviour. Such complex environments with multiple stress-inducing factors need to be understood for their possible additive effects on animals and their behaviour.

Positive and negative emotional states were explored through behavioural responses. Pacing was reflective of certain fear and frustration inducing events but not indicative of stereotypy, as it was performed in response to and not in the absence of, such stressors. Non-lactational suckling decreased and was last observed in a cub at 66 days of age and may have been performed to increase metabolic hormone release (a physiological requirement activated by the act of suckling and lacking in artificially fed animals which tend to consume large quantities of milk in too short a time). Play with humans as well as grooming of humans, albeit at a very low frequencies indicated opportunities for positive human animal interactions. Excessive inactivity for Facility C cubs however, resulted in deprivation of other behaviours through a lack of frequency. This malfunction-induced behaviour (an induced behaviour which does not function to attain the goal it is intended) could be associated with a mental pathology akin to depression.



INFLUENCES OF EXERCISE ENRICHMENT ON FEEDLOT CATTLE BEHAVIOUR AND PRODUCTIVITY

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Feedlots provide barren environments that cattle are often exposed to for long time periods. Finding an enrichment that is low cost, easily implemented and that has a positive impact on behaviour and productivity is not a simple process. While rotating stationary brushes have been found to be beneficial for dairy cattle, implementing these in feedlots with large pens and higher stocking densities has not been considered practical. As many Australian cattle are raised on extensive grazing systems, their exposure to humans prior to a feedlot system is minimal and can result in stress during handling. This study aimed to determine whether providing opportunities for cattle to exercise in or outside (in laneway) of the pen and increased exposure to human handling impacted behaviour and productivity.

Bos taurus cattle on a 120-day program in a feedlot in Western Australia were studied between day 40 and 80. Cattle (n=300) were split across three pens and were weighed every 40 days during their feedlot program, with weights before, during and after the study provided. Two pens were under different exercise regimes (pen 1 = exercised in pen, pen 2 = released into laneway), with the third being a control. Cattle under treatments were exercised 2-3 times a week for approximately 20 minutes. During weighing on day 40 and 80, crush temperament scores and crush exit speeds were collected for approximately 30% of each pen. On days 41, 60 and 79, a novel person test, where an unfamiliar person walks calmly diagonally through the pen, and an avoidance test were conducted on the cattle while in their pen. Ethogram analysis on cattle behaviour prior to, during and post novel person test will provide a snap shot of cattle activity in response to human exposure. Activity analysis outside of this was not possible in this study.

Analysis and replicates are currently being conducted, however, preliminary results indicate that a decrease in observed avoidance distance was greater for the in-pen exercised cattle versus the other two groups, while weight gains between day 40 and 80 unexpectedly showed the control group to have a higher weight gain. Further analysis will provide detail on the impact of the two types of exercise enrichment, with the in-pen treatment expected to have a larger influence on human-animal interaction behaviour due to the increased exposure to humans. Through encouraging exercise and increasing exposure of cattle to human handling, a calmer demeanour and a higher weight gain is expected. This provides the first analysis of exercise enrichment within Australia and has the capacity to not only enrich cattle wellbeing at feedlots, but to also increase productivity.



OUTDOOR RANGING BUT NOT REARING ENRICHMENTS REDUCED FEARFULNESS OF ADULT FREE-RANGE HENS

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Free-range layer production has been increasing within Australia. Adult free-range layers can range freely outdoors but the pullets are typically reared indoors. This disparity in environments may result in adult hens being less adaptable and more fearful in the free-range housing system. Rearing enrichments may reduce adult fearfulness, or hens that range frequently as adults may subsequently show reduced fearfulness. In this study we reared 1386 Hy-Line Brown[®] chicks indoors across 16 weeks with 3 enrichments; a control group with standard floor litter housing, a novelty group with different novel objects altered at weekly intervals, and a structural enrichment group with custom-designed structures to facilitate perching. Pullets were housed in a free-range system at 16 weeks of age and were allowed to range outdoors daily from 25 weeks of age. At 62 weeks, 135 hens were selected from the three rearing treatments and from two different ranging groups. 'Indoor' hens did not access the range, 'outdoor hens' accessed the range daily as identified by individual radio-frequency identification tracking. Individual fearfulness behavioural tests including a Tonic Immobility test (TI), Emergence Test (ET) and Open Field Test (OFT) were carried out on all hens across a period of two weeks. There were no differences between rearing treatments ($P = 0.26$) or ranging groups ($P = 0.12$) in the duration of TI. In the case of the ET, outdoor hens emerged from the test box into an open area sooner than the indoor hens ($P < 0.001$), but there were no differences between rearing treatment groups ($P = 0.92$). In the OFT, outdoor hens showed a faster latency to step ($P = 0.0001$), latency to vocalise ($P = 0.004$), more steps ($P < 0.0001$), and more vocalisations ($P < 0.0001$) than the indoor hens. There were no effects of rearing enrichments on any of these variables (all $P \geq 0.05$). Overall, the rearing treatments did not influence the fearfulness behaviour of hens late in the production cycle but outdoor rangers were less fearful. This confirms previous comparisons between indoor and outdoor free-range hens and shows that individual variation in ranging behaviour is present even following rearing enrichment treatments.



COMPARISON OF CAT HANDLING TECHNIQUES AND BEHAVIOR DURING A VACCINATION PROCEDURE

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Stress is an adaptive mechanism that evolved to assist individuals dealing with threats in their environment. Cats often show fear or aggression-related behaviors in unfamiliar environments or in the presence of unfamiliar people. Proper restraint and handling techniques are essential for minimizing the stress in regular wellness veterinary examination (e.g., vaccination) to improve the quality of life in pet animals. The current study compares the stress response of cats while using two models of restraint techniques during a vaccination procedure. Restraining techniques for cats differ regarding to previous handling experiences and the client's comments about the cat's behavior. In this study, the following two restraint techniques were applied before vaccination:

- 1) Grasping the scruff of the neck and then placing the cat on the examination table in lateral recumbency along with extending the head and hind legs.
- 2) Placing the cat on the examination table and stand to one side of the cat and then running the hand closest to the cat over its back.

The study was conducted at Royal Pet Clinic based in Sari. Thirteen males and seven female cats, both Persian and domestic short hair breed, were included in the study between 21 June and 21 July 2019. All cats were clinically examined before vaccination. The median age (range: 1.5-38 months), weight, and temperature of the cats were 8.47, 2.52, and 38.5 respectively. Ten cats were selected for each technique and the stress response was scored using a seven-level behavioral measure (non-invasive) before, after and during each restraining technique following vaccination. The score was based on a previously validated stress ethogram for domestic cats which evaluates 11 separate attributes via observation as follow: body, belly, legs, tail, head, eyes, pupils, ears, whiskers, activity and vocalization. A single numeric score was given to each cat at different time points while using each restraining technique in the current study. Data was analyzed using the Mann-Whitney Test to determine the difference in stress responses between the restrain procedures as well as the interaction of stress scores between the observation time points. While the second techniques produced a higher stress response in cats, restraining technique was not a significant predictor for stress response in cats ($p = 0.27$). A higher behavioral response was observed during vaccination in comparison to the response observed before and after the procedure. However, there was not a significant difference in median stress scores when the time points (before = 1.95, during = 2.75, and after vaccination = 2.4, and before = 2.05, during = 3.3, and after vaccination = 2.9 for the first and second technique respectively) were compared to each other ($p = 0.85, 0.08, 0.12$ for before, during, and after vaccination respectively). Our results suggest that more handling procedures should be included and compared with each other along with using a larger study population. Evaluating different handling methods while conducting more invasive veterinary procedures is also recommended to create a broader view instead of focusing on the vaccination in particular.



A CONCISE REVIEW ABOUT THE ROLE OF LATERALIZATION AS A WELFARE INDICATOR IN CATTLE

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The United Kingdom (UK) Farm Animal Welfare Council suggested that standards for the welfare of animals should not only ensure that animals have a 'life worth living' but also a 'good life', that emphasising the importance of positive experiences for good welfare. In this review we will investigate the evidence of associations between lateralization and other welfare indicators in cattle e.g. limb preference, lying side, side of parlour and ear posture at the level of the individual. Some studies revealed a negative effect of being milked on the non-preferred side on milk production. Lateralized walking in cattle in a T-maze reflects their affective state. Thus, understanding how animals process information about their environment can help by improving the quality of housing and developing management routines to avoid distress and suffering.

The time available for welfare assessments is limited in commercial contexts. Thus, there is a need to identify smaller sets of indicators that address animal health and welfare. Behavioural indicators are time-consuming to record but reliable. Lateralized behaviour is one measure that is not a uniquely human attribute, but common among vertebrates' brains with asymmetric representation of functions, reflecting an animal's ability to cope with the challenges facing it and, thus, could be a potential indicator of their welfare. It is necessary to know the threshold of lateralisation responses to environmental stimulation for the development of lateralization as a welfare measure. Stimulation in early life prepares an individual for a world that will be challenging to the animal's cognitive capacity, and appropriate responses are enhanced by lateralization. The basic functional lateralization pattern, common to all vertebrates, is that the left hemisphere is specialized in the well-established patterns of behaviour under familiar conditions and the right hemisphere specialized in detecting and responding to unexpected or novel stimuli in the environment.

This can provide useful insights into other animal welfare-related topics, such as animal personalities and coping with stress. For example, the valence of emotion animal experience, as visual stimuli of high emotional valence have been shown to elicit turning to the left side, as a result of selective activation of contralateral brain structures. In addition, there is an advantage of the right ear in processing conspecific vocalizations and of the left ear in processing threatening stimuli. Furthermore, it could be also useful in farm management, such as lesser levels of fear and aggression if handled from the correct side. For instance, left side food presentation has been demonstrated to increase milk production and reproduction, this suggests the existence of a link between the processing of positive stimuli (food), and somatic processes that control reproduction in the cow's right hemisphere. Thus, cerebral lateralization research may provide practical applications to improve farm-animal welfare as well as financial gain for the farmers.



INFLUENCE OF MILK ALLOWANCE ON THE SUITABILITY OF AUTOMATED BEHAVIOURAL AND PHYSIOLOGICAL MEASURES AS INDICATORS OF NEONATAL CALF DIARRHOEA (NCD)

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Early disease detection is essential for promoting earlier diagnosis and treatment to minimise the impact of disease. As automation increases in the livestock industry, it would be beneficial for early disease indicators to be incorporated into automated systems to support remote, reliable monitoring of animal health and welfare. An enteric disease, neonatal calf diarrhoea (NCD) is a leading cause of calf morbidity and mortality worldwide. A major challenge diagnosing NCD is the reliance on overt clinical symptoms which often do not arise until significant intestinal damage has already occurred. We investigated the influence of milk allowance on the suitability of behavioural (feeding, drinking and lying behaviours) and physiological (infrared temperatures and respiration rate) responses, individually and in combination as early NCD indicators. 120 heifer calves were randomly assigned to 5 L/d or 10 L/d milk allowances and monitored daily for naturally occurring NCD. Automated feeders recorded milk feeding behaviour, and infrared cameras automatically recorded eye and cheek temperatures. Accelerometers recorded lying behaviour, and water drinking behaviour was recorded using an automated water system and video observations. Respiration rate was determined from flank movements. Calves diagnosed with NCD (n=112) were used as their own controls, with data analysed relative to clinical identification (d 0) using the t-test and Theil-Sen estimator. Prior to clinical signs (across d -6 to 0), feeding behaviours typically only changed for calves on the 10 L/d milk allowance with increased total ($P<0.001$) and rewarded visits to the feeder ($P=0.013$), and decreased milk consumption ($P=0.011$). Infrared temperatures only changed significantly for calves on the 5 L/d milk allowance, with a decrease in eye ($P=0.013$) and cheek ($P=0.006$) temperatures. Regardless of milk allowance, lying time ($P=0.028$, 5 L/d; $P=0.011$, 10 L/d), number of lying bouts ($P<0.001$, 5 L/d; $P=0.007$, 10 L/d), and average bout duration ($P<0.001$, 5 L/d; $P=0.002$, 10 L/d), all changed significantly. The only change in water drinking behaviour was an increase in total trough visit duration for calves on the 5 L/d milk allowance ($P=0.029$). Respiration rate showed no change regardless of milk allowance. For calves on the 10 L/d and 5 L/d milk allowances, total number of visits to the feeder ($P<0.001$) and number of lying bouts ($P<0.001$), were the most suitable indicators of disease, respectively. Regardless of milk allowance, combinations of feeding and lying behaviours, and additionally infrared temperatures for calves on the 5 L/d milk allowance, provided the strongest composite indicators of disease. The lack of change in feeding behaviour for calves on the 5 L/d milk allowance, likely reflects a reduced ability to alter feeding behaviours in response to disease whilst still ensuring enough consumption to maintain function. Occurring as the animal generates a fever, decreased infrared temperatures only for calves on the 5 L/d milk allowance, likely reflects a lower metabolic rate. Results indicate milk allowance should be considered when determining which measures will act as the optimum early indicator/s of disease. Assessing these measures, we aimed to facilitate the development of non-invasive, automated systems capable of identifying animals displaying early signs of disease, enabling earlier treatment and isolation, to prevent the spread of disease. Resulting systems could improve decision making abilities for farmers, decrease economic costs and ultimately improve calf health and welfare. All procedures involving animals in these studies were approved by the AgResearch Ruakura and University of Waikato Animal Ethics Committees under the New Zealand Animal Welfare Act of 1999.



A SEARCH FOR PREDICTIVE BIOMARKERS OF OVINE PRE-PARTUM VAGINAL PROLAPSE

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Ovine pre-partum vaginal prolapse (known as bearings in sheep) occurs within a few weeks prior to lambing and unless treated both ewes and unborn lambs will die and so is an important animal welfare issue. Rates of prolapse in New Zealand vary from 0.1 to 5% per annum, varying between season and farms and is a worldwide problem. Much research has been undertaken over many years to determine the cause of this condition but no clear etiology has emerged. In this study plasma samples were collected prior to prolapse occurring in order to determine physiological changes leading to prolapse. 650 ewes were ear tagged and blood sampled on one day prior to lambing, 27 of these ewes subsequently prolapsed. The farmer recorded the tag numbers and date of occurrence for prolapsing ewes to enable a comparison of the plasma profile of prolapsing ewes to non-prolapsing ewes. An improved method for running sheep plasma on 2D gels was developed resulting in improved protein spot resolution along with a lower coefficient of variation for spot volume. Using this improved method samples were subjected to 2D DIGE (two dimensional differential in gel electrophoresis) to determine if there were differences between the protein profiles of ewes that were about to prolapse and control ewes. Results show only a few differences between controls and pre-prolapse samples. One of these was haptoglobin, a major acute phase protein in ruminants, in which some isoforms were upregulated approximately 3 fold prior to prolapse occurring. This may indicate an inflammatory response due to either infection or injury. The haptoglobin isoform spot volumes were added together to calculate a global haptoglobin response and a haptoglobin assay was then used on the same samples which correlated well with the global haptoglobin gel data ($r^2 = 0.91$). Another finding was that alpha-1B-glycoprotein was down regulated close to prolapse, however the biological significance of this is unknown. It also was found that there was a negative correlation between cortisol and days to prolapse from sampling ($r^2 = 0.36$) *i.e.* ewes closest to prolapse had higher plasma cortisol concentrations than controls. Field observations indicate that ewes can prolapse whilst standing, which should not be possible if they are relaxed, due to negative intra-abdominal pressure. Together these observations raise the question “could stress or heightened anxiety raise intra-abdominal pressure and lead to prolapse?” These findings should stimulate more research in this area. One possibility is that alternative farm management practices (*e.g.* reduced use of dogs with pregnant ewes) may reduce stress in ewes leading to lower rates of prolapse on farms with problems with this condition.



'BAD DOG' STORY TELLING IN THE NEW ZEALAND MEDIA FROM 1995-2018

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The media has an important role in forming opinions and public sentiment about dogs and their owners, which in turn affects dog welfare. There is often considerable media coverage of incidents involving dog attacks on people and other animals. Media representation of dogs influences public sentiment and debate about the law, local government policy, dog welfare agencies, individual dog owners and dogs. This paper will present preliminary research investigating 'bad dog' stories in the NZ media. The research questions are twofold: What are the themes and patterns in 'bad dog' story telling in the NZ media? Is there a prototypical media 'bad dog' story, and what are the implications of this stereotype for dog welfare? This research involves two stages. The first stage involves systematically collecting dog stories from 1995-2018 from key news sources to identify patterns in media coverage, for example changes in the number of stories and nature of stories over time. Secondly, indicative 'bad' dog stories will be analysed to understand how the media responds to, potentially influences public opinion about dog-human relations, and helps to construct 'dangerous dog' discourse. Data from Stage One is analysed using NVivo to code for key concepts and phrases. For instance, a simple search in Newztext using the term "dog bite" retrieved 1205 items. Uncleaned indicates that dog biting is the highest it has been since 1995, even higher than a significant spike in 2003. This suggests that particular dog attacks – in 2003 it was of a single incident involving a 7 year old child – are especially significant. Stage Two of analysis uses Burke's victim-villain-hero framework for analysis to show how dogs can be made villains through media stories. Implications of this research include understanding how dog welfare stakeholders might be able to influence the media to achieve better outcomes for dogs.



CADMIUM IN CAT FOODS: IS IT A RISK TO THE HEALTH AND WELFARE OF CATS

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This research investigated the levels of cadmium in three randomly-selected commercial meat-based cat foods, manufactured from New Zealand livestock by-products, in order to obtain an estimation of the cadmium levels that cats may ingest. Cadmium (Cd²⁺) is an impurity naturally present in phosphate rock, and consequently all phosphate fertilisers, which are used to increase production from grazing pastures. Internationally, there have been concerns over soil cadmium levels and their potential carry-over into the food chain. Cadmium can be toxic at low doses, has a long biological half-life, and is associated with a range of pathologies in humans including cancers, osteoporosis, and kidney disease. Once ingested cadmium tends to accumulate in mammalian organ meats, particularly kidney and liver, which are nutritionally important and common ingredients in feline diets.

Samples of these three commercial cat foods were crushed and homogenised prior to analysis. Samples were then digested in 10mL of 69% HNO₃ and assessed by Graphite Furnace Atomic Absorption Spectrophotometry (GFAAS; PerkinElmer Analyst 600, PerkinElmer, Christchurch, New Zealand). Cadmium content values were compared to those reported in the literature, and the permitted levels as regulated for in both human and production animal foods given no limits for pet foods exist. Little data is available regarding cadmium levels in cat foods, although one European study reported levels of 0.6 – 2.47 µg/g (DM basis) in a range of commercial diets. Results from our work established cadmium levels ranged from 0.123 – 0.520 µg/g (dry matter (DM) basis) and that on a per kg basis, a cat consuming only these diets, would ingest between 4.29µg and 18.68µg/Cd/week, on a kg bodyweight basis (see Table 1 below). The highest dose represents more than five times the maximum intake by adult humans in regions of Europe with heavy environmental contamination from industry.

Table 1 - Proximate analysis (on a DM basis), estimated daily intake, and cadmium content of 3 canned cat foods. The daily intake is based on a 4kg cat with a maintenance energy requirement of 1038kJ.

Diet ID	Ash %	CP %	kJ/kg	Cd (mg/kg)	DM intake (g)	Cd intake (µg/day)	Daily intake (µg/kg BW)
1	6.2	48.5	2330	0.131	44.64	5.8	1.5
2	11.0	52.7	2390	0.520	43.40	22.6	5.65
3	9.6	56.1	2380	0.123	43.57	5.4	1.3

As cats experience high levels of Chronic Kidney Disease (CKD) it is possible that ingestion of high levels of cadmium could be detrimental and exacerbate this condition. Further research is required to determine if these cadmium levels have a detrimental effect on kidney function and the health of cats. Work is also required to explore if there are potential genetic and/or functional differences in mechanisms protective against cadmium toxicity and transport and/or deposition of cadmium.



CONTRIBUTING TO BETTER ANIMAL WELFARE BY TEACHING COMMUNITIES TO UNDERSTAND ANIMALS

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More than 63% of Australian households own a pet, with 91% of them feeling “very close” to their pet. Often when students are asked to draw their family, animal companions are included, signifying that animals are valued household members. However, over 10,000 reports of animal mistreatment are made each year to RSPCA Victoria, Australia. While the enforcement of animal protection laws is vital in responding to these reports, we must develop and deliver effective programs that prevent its occurrence if we are to achieve our vision of ending cruelty. Animal welfare education seeks ways to change attitudes and behaviours. RSPCA Victoria offers education as a preventative strategy, delivering a comprehensive program to develop and nurture respect, kindness, empathy and positive attitudes towards people and animals.

Our programs are informed by a strong evidence base, relevant in both content and application while also being immersive and experiential. We take an integrated approach, making powerful connections to learning curriculum and principles of learning and teaching. Our programs also address critical educational processes, creating a more just and wise social world. Ethically aware students are empowered to take action, making changes to ensure a sustainable and just world for future generations. Since 2003, over 200,000 students have taken part in an education session with RSPCA Victoria Education and Learning. The program now focuses effort to reduce animal cruelty and neglect in geographic areas of Victoria which have been identified as cruelty hotspots. A typical program example being Meadow Glen Primary School, which sent 78 Prep students and 77 Grade 3 students to the RSPCA Education Centre in Burwood East over three days in August and September 2018. Students participated in three hours of activities including: visiting the on-site education barn to meet farm animals; touring the shelter adoption facilities; and engaging with lessons around the five freedoms and animal rescues.

All students completed a knowledge evaluation at the beginning and end of each visit, answering questions around knowledge, attitude and behaviour towards animals. Between 5-8 weeks after the excursion, students repeated the evaluation. Consistent with previous knowledge retention data, Prep students at Meadow Glen Primary School demonstrated an increase in knowledge of the needs of pets following the RSPCA education session. Furthermore, work samples confirmed that most students could retain their knowledge when tested in the weeks following. Most significant was a 30% increase in students recognising that animals need shelter and a 25% increase in students identifying that animals need vet care. Grade 3 students demonstrated increased knowledge of the needs of pets following the RSPCA education session and retained the knowledge in the following weeks. Most significant was the increase of Grade 3 students that also showed improvement in their willingness to spend time with their pets, talking to their pets and exercising their dogs following the education session. In addition, students increased their expression of empathy in the questions relating to their feelings and actions toward an injured animal.

This cohort experienced some challenges around understanding the some of the concepts presented in the questionnaire. Specifically, the questions around animal’s capacity to feel. These misunderstandings may be compounded by low literacy scores for the group and maturity level of students.

Evaluation continues to be challenging. Studies examining the results of various welfare education programs, demonstrate that there are changes in attitudes and knowledge following participation. However, empirical evidence falls short of demonstrating long-term effects. Longitudinal studies and research are expensive and often financially prohibitive for not-for-profit organisations. Education of young people is key to shaping the community’s future attitudes toward improved animal welfare. Programs require financial commitment and clear organisational alignment of values to be sustainable and change attitudes that drive human behaviour change toward animals. Animal welfare is now a mainstream societal issue, shaping consumer product choices and the practices of our primary producers. RSPCA Victoria’s education service, with its varied programs, provides learners with excellent opportunities to consider the implications of animal welfare issues, their communities and their society.



WHICH KENNEL MANAGEMENT PRACTICES DO PEOPLE CONSIDER IMPORTANT TO THE WELFARE OF DOGS LIVING IN KENNEL FACILITIES?

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There is considerable public interest in the welfare of dogs that spend at least part of their lives housed in kennel facilities, such as working and sporting dogs. The impacts of living in environments that limit social, physical, and behavioral opportunities are generally well understood in other animals, such as livestock and zoo animals. Research exploring the effects of the kennel environment and its enrichment on the behavior and physiology of dogs is emerging. However, human perceptions concerning what is important to the welfare of kenneled dogs have been overlooked. What people believe is important will influence their behavior, with direct relation to care provided to animals and the underlying social license of related industries to operate. This presentation will share the results of study that evaluated the perceived importance of specific kennel management practices relating to canine health, kennel facility design and routine, social interactions, and environmental enrichment. Over 2,000 self-selected adults completed a voluntary, internet-based questionnaire. Descriptive statistics were compiled for most data. Responses from the sections 'perceived importance of kennel management practices', and 'agreement rating for statements regarding enrichment and dogs housed in kennel facilities', were separately subjected to principle components analysis (PCA) to identify common patterns underlying the observed variation in attitudes. A between groups multivariate analysis of variance was performed to investigate differences in age, employment role and gender for respondents with recent or current experience working in kennel facilities. A Bonferroni probability adjustment (alpha level of 0.008) was used for all multiple comparisons. This exploratory study found great variety in the perceived importance of kennel management practices relating to canine health, kennel facility design and routine, intra- and inter-specific social interactions and environmental enrichment. Differences in beliefs and attitudes were identified based on kennel facility experience, employment role, age, and gender, highlighting potential areas of discordance that may contribute to occupational stress and staff turnover. People working in different jobs may prioritise different management practices as a reflection of their training and normative beliefs consistent with their industry's culture. Although there is general consensus as to what is most important to the welfare of dogs housed in kennel facilities, attitudes toward kennel facilities and their impact on canine welfare vary across different industry sectors, between kennel industry roles and with individual respondent features such as age and gender. Priority was given to survival (food, water and shelter) and physical health needs (veterinary medication, parasite control and vaccinations), with social and enrichment activities attracting ratings of less perceived importance. The results also suggest that research findings published in the scientific literature may not be successfully translating into evidence-based changes in industry practice. Future models to assess animal welfare should include the critical dimension of human-animal interaction. The beliefs, attitudes, and consequent behaviors of people interacting with dogs housed in kennels will determine how living in captivity impacts upon the experiences and welfare of the resident dogs.



EFFECTS OF AN ABRUPT DIETARY CHANGE ON THE FEEDING BEHAVIOUR OF DAIRY GOATS

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Our objective was to investigate how an abrupt dietary change affected the feeding behaviour of dairy goats. Thirty-two multiparous, pair-housed Saanen does (mean, range: weight = 60.2 kg, 44.0–75.5; DIM = 118 days (d), 109–123) were randomly assigned to a dietary treatment: MIXPAST (perennial ryegrass, timothy, prairie grass, white clover, red clover, lucerne, chicory, plantain; mean DM=22.2%; n=9 pairs), or ii) RYEPAST (perennial ryegrass and white clover pasture; mean DM=24.1%; n=7 pairs). For familiarisation, both diets were fed between d -17 and -10. Assigned dietary treatment was fed, beginning on d -9. Doe pairs were changed to the opposite diet on the morning of d 3. Feeding behaviour data were collected from d 0 to 5 (i.e. 3 d before and 3 d after the switch). Feed was cut daily at 1400h, delivered at 1500 and 0700h; refusals were weighed at each feeding. All occurrences of feeding were coded. End of a feeding bout was defined as head removal from the feeder for >30-seconds and no chewing activity. Daily feed intake, feeding duration and feeding bout frequency were determined. Generalized linear mixed models were constructed to examine the effects of dietary treatment and day on the percentage change from baseline for each feeding behaviour parameter. Baseline was calculated for each parameter as the mean across d 0 to 2. During baseline, does consuming MIXPAST had greater feed intake compared to those fed RYEPAST (4.9-kg DM/doe/d, SE=0.2 vs. 4.4-kg DM/doe/d, SE=0.1, $P=0.04$). Dietary treatment did not affect baseline feeding duration (5.0-h/doe/d, SE=0.2 vs. 4.8-h/doe/d, SE=0.2, $P=0.44$) or feeding bout frequency (51.7-bouts/doe/d, SE=7.9 vs. 67.2-bouts/doe/d, SE=7.0, $P=0.16$). Does switched from MIXPAST to RYEPAST had decreased feed intake (-5.0% change, SE=1.3) and feeding duration (-3.0% change, SE=3.7), and increased feeding bout frequency (+27.8% change, SE=9.3) relative to baseline. In comparison, does switched from RYEPAST to MIXPAST exhibited less of a reduction in feed intake (-0.5% change, SE=1.1, $P=0.02$), had greater feeding duration (+8.7% change, SE=3.2, $P=0.03$), and performed fewer feeding bouts (-9.5% change, SE=8.2, $P<0.01$). A treatment by day interaction was observed for feed intake after the dietary change ($P<0.01$); does switched from MIXPAST to RYEPAST did not return to baseline intake levels within 3 d of the feed change (d 3= -4.1% change; d 4= -5.9% change; d 5= -4.8% change, SE=1.7), and those switched from RYEPAST to MIXPAST initially showed a reduction in intake and then rebounded with greater than baseline feed intake on d 5 (d 3= -5.9% change; d 4= -2.2% change; d 5=+6.4% change, SE=1.5). Differences by day for feeding duration (d 3=+2.1% change; d 4=-0.9% change; d 5=+7.3% change, SE=3.1, $P=0.03$) and feeding bout frequency (d 3=+20.1% change; d 4=+11.0% change; d 5=-3.6% change, SE=6.7, $P<0.01$) were observed. Dairy goats responded to an abrupt dietary change by altering their feeding behaviour; however, the response can be influenced by diet. Feeding management practices should take into consideration that goats may need more than 3 d to adjust to a dietary change.

