Proceedings of the 43rd Congress of the International Society for Applied Ethology

Applied Ethology for Contemporary Animal Issues

Cairns, Queensland, Australia, 6-10 July 2009

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References: **1**. Banting, Schmidt and Banting (2000). J. Vet. Pharmacol. Ther. 23, Suppl. 1, E4. **2.** McDougall NMC 2009 **3**. Konigsson et al., (2002) J. Vet. Med. A 49, 408–414 **4**. Friton, Philipp and Kleeman (2002), 22nd World Buiatrics Congress Hanover. Boehringer Ingelheim Pty Limited ABN 52 000 452 308. Vetmedica Division, 78 Waterloo Road, North Ryde NSW 2113. Toll free: 1800 226 315. Metacam® 20 is a trademark of BI Vetmedica GmbH, 55216 Ingelheim/Rhein. BIV/4850

Proceedings of the 43rd Congress of the International Society for Applied Ethology

Applied Ethology for Contemporary Animal Issues

Cairns, Queensland, Australia, 6-10 July 2009

Edited by the Scientific Committee

Contents

Welcome to the lands "Down-under"

This is the first time in the 43-year history of the International Society for Applied Ethology that the annual congress has been held in this part of the world; indeed, it is only the second time that it has been held in the southern hemisphere. The Society started in 1966 in Scotland, as the Society for Veterinary Ethology and it took some years for the congress to be held outside of the UK (Ghent in 1974). It wasn't until 1992 that there was a move from Europe (to Pittsburgh, USA) and in 2000 the first southern hemisphere congress took place, in Brazil. It is important for the Society to continue to support congresses that take place outside of Europe, as doing so demonstrates that the Society is truly international. It also encourages participation and membership by people from parts of the world that may have different attitudes towards the use of, and place different values on animals. These people also face different challenges regarding the interactions between animals and humans, and the impacts that these interactions have on both humans and animals. This broadening of perspectives can only benefit the Society and its membership.

The theme and sub-themes of this congress were influenced by the challenges faced by Australia and New Zealand, and shared by other countries, in applied ethology. For example, both countries have large pasture-based livestock production enterprises. Monitoring livestock in extensive production systems is problematic but essential for animal and environmental management, as well as to assure high standards of animal welfare. Like other countries, New Zealand and Australia also have to contend with large numbers of introduced species that have adverse effects on native fauna and flora and, indeed, on other introduced species that are farmed. Furthermore, through the changes made to the landscape from farming, some native species can have adverse effects on other animals and the environment. So, the humane management of animal populations is a significant challenge in both countries. Of course, like the rest of the world, we are faced with the animal welfare issues associated with intensive livestock production; what to do every year with the thousands of unwanted and abandoned pets; and the effects on the animal-human interaction of rapidly increasing urbanisation.

We chose to showcase some "home-grown talent" in our selection of plenary speakers and were delighted when Lesley Rogers agreed to give the Wood-Gush Memorial lecture on her speciality of brain lateralisation. The choice of Lesley and her topic are in keeping with the desires of ISAE and the Wood-Gush Memorial Trust; congress organisers are "encouraged to favour persons of eminence in their field who would not normally contribute to an ISAE congress, but who can both inspire and provoke the members of the ISAE on subjects relating to applied ethology". Our nominated plenary speaker for the sub-theme of 'Animal welfare assessment and enhancement', John Barnett and his wife Jenny, were tragically killed when bushfires raged through parts of Victoria on "Black Saturday" (7th February 2009). We decided that it was fitting to have a tribute to John and his contributions to applied ethology and we are pleased that this will be given by John's friend and colleague of many years, Paul Hemsworth.

We have selected three topics related to the congress sub-themes that we hope will be controversial and, instead of workshopping them, are using them as the basis for facilitated discussions. We hope that they lead to some lively debate between participants and encourage communication between delegates on the first day of the congress that will continue throughout the remainder of the meeting. This year we are also trying something a little different with a selection of the posters; based on reviewer recommendations as to the form of presentation of an abstract, we have invited a number of authors to give a brief talk about their poster. We hope that this approach will raise the profile not only of the presented posters, but also all of the posters, which will be on display throughout the congress.

Staging an international conference during a global economic crisis, with the threat of an influenza pandemic and in a beautiful location on the other side of the world from many of the society's members has been both enjoyable and challenging. We thank you for being here and hope that you find the congress stimulating, educational and enjoyable.

Carol Petherick
Chair, Congress Organising Committee

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Congress Program

Tuesday, July 7

08:30-09:00	**OPENING CEREMONY**
	Hall A
09:00-10:00	**PLENARY** – Wood-Gush Memorial Lecture
	Hall A
	Chair: *Ruth C Newberry*, *Washington State University, United States*
	Brain and behavioural lateralization in perspective, including its relevance to animal welfare - 101 *Lesley J Rogers*, *University of New England, Australia*
10:00-10:30	Morning Tea and Poster Session A
	Hall C and D
10:30-11:10	**PLENARY ADDRESS** - Berry Spruijt
	Hall A
	Chair: *Drewe M Ferguson*, *CSIRO Livestock Industries, Australia*
	Cognition: a burden or blessing for animals in captivity? - 102 *Berry M Spruijt*, *Department of Biology, University Utrecht, The Netherlands*

11:10-12:30	**CONCURRENT**	
	Animal Emotion and Cognition	**Free Communications**
	Hall A	Meeting Room 1 & 2
	Chair: *Drewe M Ferguson*, *CSIRO Livestock Industries, Australia*	Chair: *Victoria Sandilands*, *SAC, United Kingdom*
11:10	To rely on own experience or to do what others do? - testing conflict of information in the domestic pig - 103 *Liat R Thomsen*, *University of Southern Denmark, Institute of Biology; Aarhus University, Department of Animal Health, Welfare and Nutrition, Denmark*	The effect of exposing chicken embryos to light during incubation on their post-hatch fear, physical asymmetry, and behavioral rhythms - 108 *Gregory S Archer*, *University of California, Davis, United States*
11:25	Emotion, cognition and welfare of birds - 104 *Gisela Kaplan*, *University of New England, Australia*	Red junglefowl have individual body odours - 109 *Anna-Carin Karlsson*, *Linköping University, IFM biology, Sweden*
11:40	Pigs adjust their foraging preference depending on who they are foraging with - 105 *Samantha M Jones*, *University of Bristol, United Kingdom*	Pleiotropic QTL affecting behaviour and morphology in a large F2 intercross in the chicken (Gallus gallus) - 110 *Dominic Wright*, *IFM, Linköping University, Sweden*
11:55	Responses to inequity: dominance and scrounging in egg cannibalism by laying hens - 106 *Ruth C Newberry*, *Washington State University, United States*	The effects of group size on nest-box use by Hy-Line Brown laying hens in furnished cages - 111 *Greg M Cronin*, *University of Sydney, Australia*

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12:10	Can simple visual discrimination learning be used on laying hens as on-farm assessment? - 107 **Franziska Kuhne**, *Department of Veterinary Clinical Sciences, Division of Animal Welfare and Ethology, Justus-Liebig-University of Giessen, Germany*	Effects of different forms of exercise on post-inhibitory rebound and unwanted behaviour in stabled horses - 112 **Raf Freire**, *Charles Sturt University, Australia*
12:25	Effects of previous handling on calf responses towards humans - 557 **James R Webster**, *AgResearch Ltd, New Zealand*	On-farm assessment and genetic improvement of calf temperament - 501 **Florence Phocas**, *France*
12:30-13:30	Lunch	
	Hall C and D	
13:30-14:10	**PLENARY ADDRESS** - Alain Boissy and Dominique Blache	
	Hall A	
	Chair: **Suzanne Millman**, *United Kingdom*	
	Emotions, cognition and temperament: an integrated approach to animal welfare - 113 **Alain Boissy**, *INRA (National Institute of Agronomic Research), France* **Dominique Blache**, *University of Western Australia, Australia*	
14:10-15:00	**CONCURRENT**	
	Animal Emotion and Cognition	**Free Communications**
	Hall A	Meeting Room 1 & 2
	Chair: **Suzanne Millman**, *United Kingdom*	Chair: **Cassandra B Tucker**, *Department of Animal Science, University of California, Davis, United States*
14:10	Positive and negative emotion in sheep: behavioural and physiological correlates - 114 **Nadine Reefmann**, *Centre for Proper Housing of Ruminants and Pigs, Federal Veterinary Office, Switzerland*	A novel system to automatically measure behavioural motivation for food in cattle - 117 **Drewe M Ferguson**, *CSIRO Livestock Industries, FD McMaster Laboratories, Armidale, Australia*
14:25	Do judgement biases and emotional reactivity reflect the mental state of sheep? - 115 **Rebecca E Doyle**, *CSIRO Livestock Industries, Armidale, Australia*	Consistency of flight speed and individual behavioural characteristics of dairy cattle to restraint in a crush - 118 **Jenny M Gibbons**, *SAC, United Kingdom*
14:40	Effects of sex and periconceptional ewe nutrition on offspring behavioural and physiological response to isolation - 116 **Carlos E Hernandez**, *Liggins Institute, National Research Centre for Growth and Development, University of Auckland and AgResearch Ruakura, New Zealand*	Behaviour of dairy goats in the collecting area - influence of space allowance and shape - 119 **Simone Szabo**, *University of Veterinary Medicine; Institute for Animal Husbandry and Welfare; University of Applied Life Sciences, Department, Austria*
14:55	Personality, hand preference and welfare of primates - 504 **Dianne J Gordon**, *University of New England, Australia*	Variability in responses to novelty by feral horses and donkeys in a wildlife sanctuary - 553 **Alexali S Brubaker**, *University of California, Davis, United States*

15:00-15:30	Afternoon Tea and Poster Session B		
	Hall C and D		
15:30-17:30	**CONCURRENT**		
	Discussion Forum 1: Conservation conflicts with animal welfare	Discussion Forum 2: Modern pet ownership is incompatible with the behavioural and welfare needs of animals	Discussion Forum 3: Research into the positive emotions in animals - currently vital or a potential distraction?
	Meeting Room 4	Meeting Room 1 & 2	Hall A

Wednesday, July 8

08:30-09:10	**PLENARY ADDRESS** - A Tribute to Associate Professor John Barnett given by *Paul Hemsworth*, *Animal Welfare Science Centre, University of Melbourne*	
	Hall A	
	Chair: *Donald M Broom*, *Cambridge University, United Kingdom*	
09:10-10:30	**CONCURRENT**	
	Welfare Assessment and Enhancement	**Welfare Assessment and Enhancement**
	Hall A	Meeting Room 1 & 2
	Chair: *Donald M Broom*, *Cambridge University, United Kingdom*	Chair: *Eberhard von Borell*, *Martin-Luther-University Halle-Wittenberg, Department of Animal Husbandry & Ecology, Germany*
09:10	Relationship between metabolic - related production diseases and feeding behavior characteristics of dairy cows in early lactation - 201 **Otto Kaufmann, Humboldt** - *Universität zu Berlin, Faculty of Agriculture and Horticulture, Div. of Animal Husbandry Systems and Technology, Germany*	Effects of pre- and postnatal flavour exposure on stress-related behaviour and postweaning performance in piglets - 206 **Marije Oostindjer**, *Adaptation Physiology group, Wageningen University, The Netherlands*
09:25	Automated measurement of feeding behavior to detect illness in milk-fed calves - 202 **Jeffrey P Rushen**, *Agriculture and Agri-Food Canada, Agassiz, BC, Canada*	Effects of split marketing on agonistic behaviour and carcass characteristics of entire male pigs and gilts in a restricted feeding system - 207 **Sabine Conte**, *Queens University Belfast, Belfast, United Kingdom*
09:40	Validation of a novel data logger for recording lying behaviour of dairy cows and its application on robotic milking farms - 203 **Simone Helmreich**, *Federal Veterinary Office, Centre for Proper Housing of Ruminants and Pigs, ART Tänikon, 8356 Ettenhausen, Switzerland*	Effect of age on physiology and recovery behaviour of calves transported for 10 hours in individual pens - 208 **Mariko C Lauber**, *Animal Welfare Science Centre, The University of Melbourne and the Department of Primary Industries, Australia*

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09:55	How hot is too hot? A cow's view - 204 **Lindsay R Matthews**, AgResearch, New Zealand	Different roughages to organic growing/finishing pigs - influence on activity behaviour and social interactions - 209 **Magdalena Høøk Presto**, Swedish University of Agricultural Sciences, Dept of Animal Nutrition and Management, Sweden
10:10	Dairy cows will work for access to shelter from wind and rain - 205 **Adele A Arnold**, New Zealand	Effects of alternative housing systems on dry sow well-being - 210 **Ashley E DeDecker**, University of Illinois, United States
10:25	Hunger in pregnant sows; the effect of fibre diet and free access to straw - 509 **Lene J Pedersen**, Aarhus University, Faculty of Agricultural Sciences, Institute of Animal Health, Welfare and Nutrition, Denmark	Problem solving in dingoes (Canis lupus dingo): an example using the detour task - 521 **Bradley P Smith**, University of South Australia, Australia
10:30-11:00	Morning Tea and Poster Session A	
	Hall C and D	
11:00-12:00	**CONCURRENT**	
	Welfare Assessment and Enhancement	**Welfare Assessment and Enhancement**
	Hall A	Meeting Room 1 & 2
	Chair: **Lindsay R Matthews**, Animal Behaviour and Welfare, AgResearch, Hamilton, New Zealand	Chair: **Kevin J Stafford**, Massey University, New Zealand
11:00	Social animals and philosophical ethology: on the extents of farm animals, welfare and ethics - 211 **Jes Harfeld**, Centre for Bioethics and Nanoethics, Aarhus University, Denmark	Welfare assessment of restraining traps for wild animals; can behavioural and physiological indices be incorporated into a standard? - 215 **Janet C Talling**, Central Science Laboratory, United Kingdom
11:15	Animal welfare science and policy - oil and water or sugar and spice? - 212 **Cheryl E O'Connor**, Ministry of Agriculture and Forestry, New Zealand	Welfare implications of different culling methods for shooting red deer - 216 **Michael S Cockram**, Sir James Dunn Animal Welfare Centre, Atlantic Veterinary College, University of Prince Edward Island, Canada
11:30	Enrichment programs and animal welfare: catalyst or catastrophe? - 213 **Mia L Cobb**, Guide Dogs Victoria, Monash University & Animal Welfare Science Centre, Australia	Rules, Relations and Robotics: using behavioural data for refinement, reduction and replacement of animals in research - 217 **Lucy Asher**, Veterinary College, Hatfield, United Kingdom
11:45	Effects of hide provision and regular petting on the behaviour of stray and surrendered cats in a quarantine shelter - 214 **Sally J Haynes**, Australia	How do larger enriched cages and larger group size affect juvenile mink behaviour? - 218 **Lena M Lidfors**, Department of Animal Environment and Health, Swedish University of Agricultural Sciences, Sweden
12:00	Boxed lunches to take to afternoon excursions	

Thursday, July 9

08:30-09:10	**PLENARY ADDRESS** - Bidda Jones	
	Hall A	
	Chair: ***Cheryl E O'Connor***, *Ministry of Agriculture and Forestry, New Zealand*	
	Invasion, over-abundance and animal welfare: controlling unwanted wildlife in Australia - 301 ***Bidda Jones***, *RSPCA Australia, Canberra, Australia and Faculty of Veterinary Science, University of Sydney, Australia*	
09:10-10:30	**CONCURRENT**	
	Management of Unwanted Animals	**Welfare Assessment and Enhancement**
	Hall A	Meeting Room 1 & 2
	Chair: ***Cheryl E O'Connor***, *Ministry of Agriculture and Forestry, New Zealand*	Chair: ***Tina M Widowski***, *University of Guelph, Canada*
09:10	Using animal behaviour to assess the animal welfare impacts of pest control - a review with 'real life' examples - 302 ***Kate E Littin***, *Ministry of Agriculture and Forestry, New Zealand*	How is welfare of transported turkeys affected by cage height? - 307 ***Anette Wichman***, *Department of Production Animal Medicine, Finland*
09:25	New approaches to developing humane toxins - 303 ***Charles T Eason***, *Connovation Research Ltd, New Zealand*	Effectiveness of different on-farm killing methods for cull turkeys - 308 ***Marisa A Erasmus***, *Department of Animal and Poultry Science, University of Guelph, Canada*
09:40	Development and validation of the Behavioural Assessment for Re-homing K9's (B.A.R.K.) - 304 ***Kate M Mornement***, *Animal Welfare Science Centre, Monash University, Australia*	Elevated plasma corticosterone in domesticated hens affects their offspring's behaviour and physiology both in youth and adulthood - 309 ***Rie Henriksen***, *Behavioural Biology Research Group, The Netherlands*
09:55	The effect of cat behaviour on adoption, relinquishment and retention of shelter cats - 305 ***Linda C Marston***, *Monash University, Australia*	Preferences of laying hens for different dustbathing substrates - 310 ***Britta Scholz***, *Friedrich-Loeffler-Institut, Institute of Animal Welfare and Animal Husbandry, Celle, Germany*
10:10	The control of invasive animals in Australia: development of welfare based codes of practice, standard operating procedures and a model to assess relative humaneness - 306 ***Glen R Saunders***, *Invasive Animals Cooperative Research Centre, Australia*	The use of anaesthesia and analgesia during dehorning and their effects on the welfare of Bos indicus cattle - 311 ***Stephanie Sinclair***, *Cooperative Research Centre for Beef Genetic Technologies/ Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia*
10:25	Encoding and genetic selection of psycho-acoustic markers of emotions in sheep - 520 ***Frèdèric Sëbe***, *School of Animal Biology, The University of Western Australia, Crawley, WA, Australia* ***Dominique Blache***, *School of Animal Biology, The University of Western Australia, Crawley, WA, Australia*	The buck stops here - stress of semen collection - 536 ***Aprille R Chadwick***, *Animal Biology, Univerity of Western Australia, Australia*

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10:30-11:00	Morning Tea and Poster Session B
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11:00-11:40	**PLENARY ADDRESS** - Clare Veltman
	Hall A
	Chair: **Donald C Lay**, *USDA-ARS, Livestock Behavior Research Unit, United States*
	Behavioural challenges in managing invasive mammals and native wildlife for conservation in natural environments in New Zealand - 312 **Clare J Veltman**, *Department of Conservation, New Zealand*

11:40-12:30	CONCURRENT	
	Animals in Extensive and Natural Environments	**Welfare Assessment and Enhancement**
	Hall A	Meeting Room 1 & 2
	Chair: **Donald C Lay**, *USDA-ARS, Livestock Behavior Research Unit, United States*	Chair: **Xavier Manteca**, *School of Veterinary Medicine-Universitat Autúnoma de Barcelona, Spain*
11:40	The welfare of wild animals - what does it mean? - 313 **Pete J Goddard**, *Macaulay Institute, United Kingdom*	A wireless sleep actigraph for calves - 316 **Laura Hänninen**, *Research Center for Animal Welfare, University of Helsinki, Finland*
11:55	Social attraction, social space and familiarity: how do these social factors influence movement? - 314 **Kym Patison**, *CSIRO Livestock Industries, Rockhampton, Australia*	Assessing cattle welfare at stunning - 317 **Sophie Atkinson**, *Swedish University of Agricultural Sciences, Department of Animal Environment and Health, Sweden*
12:10	Monitoring grazing patterns and habitat selection of the Scottish Blackface, a traditional hill sheep breed, compared with a crossbred, Scottish Blackface x Texel using GPS Satellite telemetry collars - 315 **Eileen P McCloskey**, *Queens University, School of biological sciences, Belfast, United Kingdom*	Introducing herd health and welfare plans on Austrian organic pig farms - 318 **Sabine Dippel**, *BOKU - University of Natural Resources and Applied Life Sciences Vienna, Austria*
12:25	Physiological response to isolation in Merino ewes of differing temperament - 508 **Kate J Lennon**, *The University of Adelaide, Australia*	Describing the ideal Australian companion dog - 528 **Tammie King**, *Monash University, Australia*

12:30-13:30	Lunch
	Hall C and D
13:30-14:10	**PLENARY ADDRESS** - Ed Charmley
	Hall A
	Chair: **Stine Christiansen**, *Denmark*
	Monitoring livestock in extensive grazing systems for environmental and production outcomes - 319 **Ed Charmley**, *CSIRO Livestock Industries, Australia*

14:10-15:00	CONCURRENT	
	Welfare Assessment and Enhancement	**Welfare Assessment and Enhancement**
	Hall A	Meeting Room 1 & 2
	Chair: **Stine Christiansen**, *Denmark*	Chair: **Natalie K Waran**, *Unitec Institute of Technology, New Zealand*
14:10	Relationship between behaviour and brain activity during the inhalation of 90% CO_2 in pigs - 320 **Pol Llonch**, *IRTA, Spain*	Insulin and prolactin secretion are boosted within a few hours after parturition in ewes selected for calm temperament - 323 **Samantha L Bickell**, *The University of Western Australia, Australia*
14:25	Evaluation of an animal-based welfare protocol for growing pigs in intensive and extensive conditions - 321 **Dèborah Temple**, *Universitat Autúnoma de Barcelona, Spain*	Measurement of feeding motivation in sheep: effects of food restriction - 324 **Else Verbeek**, *University of Waikato and Animal Behaviour and Welfare, AgResearch, Hamilton, New Zealand*
14:40	Acoustic features of trapped piglet screams and their effect on maternal reactivity - 322 **Gudrun Illmann**, *Department of Ethology, Institute of Animal Science, Prague, Czech Republic*	Maternal behaviour in ewes when their offspring experienced stress and pain - 325 **Sophie Hild**, *Norwegian School of Veterinary Science, Department of Production Animal Clinical Sciences, Oslo, Norway*
14:55	Effects of extended evening zoo opening hours on the behaviour of captive mammals - 527 **Margaret R Hawkins**, *Taronga Conservation Society Australia, Australia*	Effects of previous handling on responses of dairy calves during painful procedures - 556 **Mairi Stewart**, *AgResearch Ltd, New Zealand*
15:00-15:30	Afternoon Tea and Poster Session A	
	Hall C and D	
15:30-17:30	**AGM**	
	Hall A	
19:00	**CONGRESS DINNER**	
	Hilton Hotel	

Friday, July 10

09:00-09:40	**PLENARY ADDRESS** - Darryl Jones
	Hall A
	Chair: *James A Serpell*, *University of Pennsylvania, United States*
	The agony and the ecstacy: wildlife-human interactions in an urbanising world - 401 *Darryl N Jones*, *Australia*

09:40-10:30	**CONCURRENT**	
	Animal-Human Interactions	**Animal Emotion and Cognition**
	Hall A	Meeting Room 1 & 2
	Chair: *James A Serpell*, *University of Pennsylvania, United States*	Chair: *Grahame J Coleman*, *Animal Welfare Science Centre, Monash University, Australia*
09:40	The human-animal relationship in commercial laying hens - 402 *Lauren E Edwards*, *Animal Welfare Science Centre, Faculty of Land and Food Resources, University of Melbourne, Parkville, Australi*	On the mental life of fish: an examination of key philosophical arguments both old and new with an eye to concerns related to moral status and welfare - 405 *Raymond Anthony*, *University of Alaska Anchorage, United States*
09:55	Development of the Canine Five Factor Model of personality (CFFM) and Monash Canine Personality Questionnaire-Revised (MCPQ-R) - 403 *Jacqueline M Ley*, *Anthrozoology Research Group, Animal Welfare Science Centre, Monash University, Australia*	Side biases of feral horses: species-typical specializations - 406 *Nicole P Austin*, *Universtiy of New England, Australia*
10:10	The effect of familiarity on behaviour of kennel housed dogs during interactions with humans - 404 *Anne J Pullen*, *University of Bristol, United Kingdom*	Comparative studies will offer new opportunities for animal welfare research - 407 *Adroaldo J Zanella*, *Norwegian School of Veterinary Science, Norway*

10:30-11:00	Morning Tea and Poster Session B
	Hall C and D
11:00-11:40	**PLENARY ADDRESS** - Pauleen Bennett
	Hall A
	Chair: *Jan Ladewig, Denmark*
	The modern work of dogs: what is it and how does it influence dog behaviour and welfare? - 408 *Pauleen C Bennett*, *Anthrozoology Research Group, Animal Welfare Science Centre, Monash University, Australia*

11:40-12:30	**CONCURRENT**	
	Animal-Human Interactions	**Free Communications**
	Hall A	Meeting Room 1 & 2
	Chair: *Jan Ladewig*, *Denmark*	Chair: *Jeff Rushen*, *Pacific Agri-Food Research Centre, Agriculture and Agri-Food Canada, Canada*

11:40	Assessing dog aggressiveness: validation of a behavioural test using the c-barq questionnaire - 409 **Aantonio Di Nardo**, *Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise, Italy* **Paolo Dalla Villa**, *Italy*	Relationships between sow behaviour and piglet mortality in loose housing farrowing environments outdoors and indoors - 412 **Anna Wallenbeck**, *Department of Animal Breeding and Genetics, Swedish University of Agricultural Sciences, Sweden*
11:55	Dog aggression towards family members: unpredictability of the attacks as a risk factor - 410 **Marta Amat**, *School of Veterinary Medicine-Universitat Autúnoma de Barcelona, Spain*	Avoiding hypothermia in neonatal piglets: causes of individual differences - 413 **Trine Jensen**, *Institute of Animal Health, Welfare and Nutrition, Faculty of Agricultural Sciences, Aarhus University, Denmark, Denmark*
12:10	Are Pit Bulls different? Behavioral comparisons between Pit Bull Terriers and other common dog breeds - 411 **James A Serpell**, *University of Pennsylvania, United States*	Stalled sows demonstrate higher motivation for compost compared to straw - 414 **Monica R Elmore**, *Purdue University, United States*
12:30-13:30	Lunch	
	Hall C and D	
13:30-15:00	**CONCURRENT**	
	Welfare Assessment and Enhancement	**Welfare Assessment and Enhancement**
	Hall A	Meeting Room 1 & 2
	Chair: **Andrew D Fisher**, *Faculty of Veterinary Science and Animal Welfare Science Centre, University of Melbourne, Australia*	Chair: **Ian Colditz**, *CSIRO Livestock Industries, Armadale*
13:30	The effect of treatment for lameness on the relationship between nociceptive threshold and locomotion score - 415 **Richard A Laven**, *IVABS, Massey University, New Zealand*	Can the weaning stress of dairy calves be reduced by weaning later? - 421 **Anne Marie de Passille**, *Agriculture and Agri-Food Canada, Canada*
13:45	Post-operative behavioural change in rabbits undergoing abdominal surgery: potential indicators of pain - 416 **Mark J Farnworth**, *Unitec Institute of Technology, New Zealand*	Preference of dairy cows: indoors vs. pasture - 422 **Gemma L Charlton**, *Harper Adams University College, Newport, United Kingdom*
14:00	Short-term effects of general anaesthesia and analgesia on the suckling order and behaviour of piglets after castration - 417 **Eberhard von Borell**, *Martin-Luther-University Halle-Wittenberg, Department of Animal Husbandry & Ecology, Germany*	Voluntary use of showers: effects on behaviour and physiology of dairy cattle in summer - 423 **Amèlie L Legrand**, *United Kingdom*
14:15	Comparison of novel methods to alleviate the pain caused by castration in pigs - 418 **Mhairi A Sutherland**, *Texas Tech University, United States*	Rubber covering for pens with fully slatted floor to improve welfare in finishing cattle - 424 **Katharina L Graunke**, *Swedish University of Agricultural Sciences, Sweden*

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14:30	Development of electrical activity and responses to noxious stimuli in the chicken brain - 419 **Amanda E McIlhone**, *Institute of Veterinary, Animal and Biomedical Sciences, Massey University, Palmerston North, New Zealand*	Dairy cattle prefer shade over sprinklers in summer: effects on behaviour and physiology - 425 **Karin E Schütz**, *AgResearch Ltd, New Zealand*
14:45	Improving the welfare of calves through the use of topical anaesthesia - 420 **Sabrina H Lomax**, *The University of Sydney, Australia*	Behavioural changes associated with lameness in sows - 426 **Anna Valros**, *Research Centre for Animal Welfare, Department of Production Animal Medicine, University of Helsinki, Finland*
15:00-15:30	Afternoon Tea	
	Hall C and D	
15:30-16:15	**PRESENTATIONS AND CLOSE**	
	Hall A	
16:15	Close of Congress	
19:00	**FAREWELL PARTY**	
	Rattle 'n' Hum Bar and Grill	

General Information

Registration Desk Hours

Our registration desk will be located in the Main Foyer of the Cairns Convention Centre. The desk will be open during the following times:

Monday, 6 July 2009	15:00 – 18:00
Tuesday, 7 July 2009	08:00 – 17:00
Wednesday, 8 July 2009	08:00 – 12:30
Thursday, 9 July 2009	08:00 – 15:00
Friday, 10 July 2009	08:30 – 13:00

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Monday, 6 July 2009	17:00 – 18:00
Tuesday, 7 July 2009	10:00 – 16:00
Wednesday, 8 July 2009	10:00 – 13:00
Thursday, 9 July 2009	10:00 – 16:00
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SDR Clinical Technology – Booth 1

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Compassion In World Farming – Booth 10

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Brain and behavioural lateralization in perspective, including its relevance to animal welfare

Lesley J Rogers, University of New England, Australia

The left and right sides of the brain are specialized to process information in different ways and to control different types of behaviour. Research on a range of species has shown that the left hemisphere controls well-established patterns of behaviour performed in non-stressful situations, whereas the right hemisphere responds to unexpected stimuli and controls escape and other emergency responses. A body of evidence of lateralization in vertebrates has been established over the last three decades but only recently have domesticated species, other than the domestic chicken, been investigated. Since lateralization of the brain is often manifested as side biases in behaviour, knowledge of lateralization is likely to have particular relevance to the handling and training of domestic animals and to be important in other aspects of their welfare. For example, many species, including horses, are more reactive to novel stimuli presented on their left than on their right side and, since the left eye sends its inputs mainly to the right hemisphere, this reflects the predominant role of the right hemisphere in the expression of emotions and in controlling both flight and fight responses. Moreover, animals that are more fearful and, according to circumstances, more aggressive use their right hemisphere more than the left and often express left eye or limb preferences. Hence, knowledge of limb and eye preferences can assist in detecting individuals that are more fearful and flighty, as well as more likely to suffer high levels of physiological stress. The strength of these side preferences is also important; in dogs, weaker paw preference is associated with noise phobia and stronger bias to use the right hemisphere to process sounds, including vocalisations, is associated with increased emotional reactivity. These and other examples will be discussed to illustrate the relevance of research on lateralization to animal welfare.

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Cognition: a burden or blessing for animals in captivity?

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Cognition is considered as a brain function superior to and distinct from emotional states. There are different levels of cognition: from simple habituation, emotional learning to advanced planning and awareness. It is often assumed, that an advanced cognitive ability with indispensable neuronal complexity is required for experiencing welfare. What level of complexity is envisioned? I define welfare as a specific subjective experience with a biological function, namely optimization of behaviour. I will present a hierarchically organized brain where emotional states and cognitive abilities are positioned as two gradually different prerequisites for the optimal adaptive response. Emotional states are defined as internal signals organizing standard answers to phylogenetically old standard problems. For instance, a standard problem can be lack of food; a concerted action of various brain areas has the ability to organize efficient food intake. The signals mobilize 'higher' cognitive structures facilitating the integration of specific information (what, when and where) into a final response and are perceived as hunger and satisfaction after a successful response, respectively. The perception of the own state by "higher cognitive functions" can be conceived as the signal from the neuronal network representing: the difference between (i) the situation the animal is in and (ii) the situation which is pursued. This difference consists of sensory input representing the external world and internal input from lower limbic brain areas representing the appraisal of that sensory input in relation to actual needs. The hierarchically organized brain of vertebrates enables animal to perceive their world: this perception of the own state - pleasure stress, etc. - has an adaptive function in a changing environment. However, in a never changing world the content of cognitive perception is hopelessness.

To rely on own experience or to do what others do? – testing conflict of information in the domestic pig

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Eight test gilts, assigned to demonstrator gilts, were used to investigate whether pigs make foraging decisions based on their own experience or copy choices of conspecifics. Test gilts were trained to find food in one of four reward boxes where a blue rope was a cue indicating food location and, after learning, were subjected to two tests. Before each test, three correct choices was the success criterion for the tests to commence. In the Rope-Demonstrator (RD) test, test gilts watched a demonstrator enter and eat from a reward box while the rope indicated location of food in a different box. After removing the demonstrator, the test gilt could choose a box. In the Demonstrator (D) test the procedure was similar, but no rope was attached to any box. Test gilts were subjected to one RD test, four D tests and finally another RD test. In the first RD test, four pigs relied on their own experience, i.e. chose the box with the rope (Binomial distribution, p=0.0865), while two pigs chose the demonstrator box (p=0.311). In the second RD test significantly more pigs than would be expected by chance chose the box with the rope (p=0.00128). In none of the D tests did more test pigs than expected by chance choose the demonstrator box (p=0.311, p=0.311, p=0.058, p=0.311), but two individuals chose the demonstrator box significantly more often (p=0.0469). The test gilts had not previously experienced another pig in the arena, thus the novelty of the situation could have lead to a spontaneous random choice in the first test influencing choices made in the following tests. This experiment indicates that pigs rely less on their own experience when faced with a novel ambivalent foraging situation, and that some will copy the choice of a conspecific when their own information is lacking.

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Emotion, cognition and welfare of birds

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Welfare of avian species may be covered by general legislation but, even in welfare-conscious countries, the special requirements of birds are rarely considered, partly because of a paucity of scientific publications about the physical needs, cognitive abilities, expressions of stress, a range of emotions and pain in birds. We now know that cognitive abilities of some birds may rival those of higher primates. Pain is almost always difficult to judge in birds because its expression is suppressed (masking). In the expression of other emotions, some bird species, if not most, may be very explicit vocally or in feather position and body posture but these have not yet been well documented and they present a previously unutilised means of assessing welfare in birds. Hence, this project investigated how birds express emotions visually or vocally. My research on wild Australian magpies (Gymnorhina tibicen) recorded vocalisations and classified them according to type and context (sample size N=120; recorded vocalisations N=70 h). Their vocalisations were found to express many emotions, which will be presented, including a newly found distress call. The magpies' calls also extend to referential signalling emitted to alert and recruit group members to a specific danger. Changes in feather positions, body posture, head and beak position were recorded on video, tagged by areas of feather movement, and scored in specific contexts (conspecific/ predator etc) using tawny frogmouths (N=44, Podargus strigoides) and galahs (N=10, Cacatua roseicapilla). Eight specific areas were identified in the head region alone that carried unambiguous information about the birds' state and type of arousal (agonistic/ affiliative). Data on feather position derived from tame birds that were either hand-reared or rescued and then released again. The importance of these observations will be linked to welfare and why there is an urgent need to revise and improve welfare of birds.

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Pigs adjust their foraging preference depending on who they are foraging with

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We investigated whether pigs can learn to deceive an exploiting dominant in a competitive foraging task. Subordinate pigs were trained to forage for two differently-sized food baits hidden in two of 12 buckets in an arena. The first arena visit was a 'search visit' to locate both baits. The second visit was for 'relocation' with the same two buckets baited. Repeated search and relocation visits turned subjects into informed foragers (I-pigs) that knew in relocation visits where the baits were. One of the I-pigs' heavier pen-mates was turned into a non-informed forager ('NI-pig'): she always received only one bait, in a different location each visit. Another heavy pen-mate returned to the same baited bucket each visit (non-follower, 'NF-pig'). After training, seven I-pigs were paired with either their NI or NF-mate during relocation visits ('I-NI tests', 'I-NF tests'), or tested alone ('I-alone tests'). I-pigs completed 48-72 I-NI tests, 15 I-NF and 20 I-alone tests. Replicated-Goodness-of-Fit Tests revealed a preference for retrieving the large bait first in I-NF and I-alone, but not in I-NI tests (I-NF:Gpooled=5.81, df=1, p<0.05; I-alone:Gpooled=6.49, df=1, p<0.05; I-NI:Gpooled=0.63, df=1, p>0.01). I-pigs, then, lost their bias for retrieving the large bait first when with their exploiters, but did not clearly switch to first retrieving the small one as predicted. A possible explanation is that, against expectation, retrieving the small bait first in I-NI tests led to a foraging advantage in only two I-pigs (measured as the combined time each I-pig spent at the two baited buckets; analysis across pigs by GLM with the following factors: pig (df=6, F=1.77, p>0.05), bait located first (df=1, F=0.58, p>0.05), pig*bait located first (df=6, F=2.92, p<0.01)). In conclusion, pigs adjusted their foraging strategy to who they foraged with, but did not learn to deceive possibly because no advantage was gained from so doing.

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Responses to inequity: dominance and scrounging in egg cannibalism by laying hens

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Some laying hens learn to break eggs whereas others scrounge on the contents after egg breakage. Dominant scroungers can drive away subordinate egg breakers. If sensitive to inequity, subordinate egg breakers might counter by inhibiting egg breaking behaviour when dominants are nearby. We hypothesized that egg breaking decisions are affected by the dominance status of nearby hens. We predicted that subordinate egg breaking hens would exhibit longer latencies to break eggs when in the presence of a dominant flockmate than when alone, whereas egg breaking by dominant hens would be unaffected by presence or absence of subordinates. In groups containing egg breaking hens, we assessed dominance rank according to ratio of aggressive pecks and threats given and received. We then observed 16 pairs of familiar hens comprising one dominant and one subordinate hen, of which one was an egg breaker, during a 4-min test starting when an egg was placed in the nest. We also observed the egg breaking hens while alone with an egg, balancing for order of each condition. There was no difference in latency to break eggs when hens were alone or paired (median 36 s; Wilcoxon Matched Pairs Signed Ranks Test: W=43.5; P>0.05). Latency to break eggs when paired was unaffected by the dominance status of the egg breaker (median 30.5 s; Mann-Whitney U Test: U=39; P>0.05). We found no evidence that subordinate egg breakers (n=8) were less willing to break eggs in the presence of dominant scroungers. Scroungers rapidly approached hens pecking at eggs and both scroungers and egg breakers were able to consume some of the contents even when subordinates were deterred by aggression. The egg breakers may have been insensitive to inequity, unable to inhibit their egg breaking behaviour, and, within the confines of a furnished cage, unable to conceal this behaviour.

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Can simple visual discrimination learning be used on laying hens as on-farm assessment?

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Feather pecking and cannibalism are the key welfare problems in commercial laying hen husbandry. Both abnormal behaviours have been suggested to originate from the thwarting of highly motivated behaviours in the context of exploration, grooming, foraging and/or perching. Moreover, cannibalism was found to be associated with impaired spatial cognition, while feather pecking has been proposed to reflect some form of behavioural disinhibition. The assessment of specific learning and cognitive skills is crucial to elucidate the neuropsychological underpinnings of these impairments. The aim of the present study was, therefore, to assess the performance of commercial laying hens in a visual discrimination task that can be modified to study a wide range of learning and cognitive skills. Eleven hens, aged 34 weeks, were conditioned and tested on acquisition, reversal, extinction, and relearning of a simple visual discrimination. The experimenters randomly assigned red and blue paperboard discs as discriminative stimuli. The learning criterion was 90% pecks on the correct discs in two consecutive sessions with 20 trials each. Effects of choice latency, number of pecks, and reward delay were analysed using the GLM procedure (SPSS 16®). The hens could be habituated to the test procedure within a reasonable time. Latency in choosing decreased significantly during the procedure, choices to peck at a disc were made more rapidly (p=0.000). The time delay, i.e. the time between pecking the right disc and reinforcement, affected in a negative way this latency in choosing (p=0.011). The number of pecks at the correct disc increased in each learning session (p=0.000). The study suggest that naïve commercially deployed laying hens can be trained in simple visual discrimination tasks within a reasonable time. The assessment of learning and cognitive skills of hens will enhance the understanding of the origin and development of feather pecking and cannibalism.

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The effect of exposing chicken embryos to light during incubation on their post-hatch fear, physical asymmetry, and behavioral rhythms

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Chicken eggs are often incubated commercially in complete darkness, although in nature they would receive some light exposure. Light, like other environmental stimuli, can affect the development and behavior of chickens post-hatch. To determine the effect of exposing embryos to light on post-hatch behavioral rhythms, fear and physical asymmetry (an indicator of stress susceptibility), we incubated broiler chicken eggs (N = 664) under either 24L:0D (L), 0L:24D (D), or 12L:12D (LD); the light level was 550 lux. Post-hatch they were raised under a 12L:12D regimen. Physical asymmetry was assessed using a composite asymmetry score determined by middle toe length and metatarsal length and width. Data were analyzed using ANOVA with an LSD post-hoc test. The D chickens were more fearful than LD, as indicated by their responses to induction of tonic immobility (TI) and inversion after catching (INV). At 5 wk of age L (232 ± 24 sec) and LD (213 ± 24 sec) had shorter ($P < 0.05$) latencies to right during TI than D (306 ± 24 sec); D also wing-flapped more intensely ($P < 0.05$; 5.7 ± 0.1 flaps/sec) during INV than LD (5.0 ± 0.1 flaps/sec) or L (5.4 ± 0.2 flaps/sec). The D chickens had a higher level of composite physical asymmetry (1.87 ± 0.11mm) than LD (1.57 ± 0.09mm, $P = 0.05$); they also tended to have more composite asymmetry than L (1.62 ± 0.11mm, $P = 0.10$). There were no differences in activity rhythms but there was a difference in feed consumption rate for the first 2 h after light onset, with L and LD eating more during this time period. The results of this study indicate that light stimulation during embryogenesis results in long-term effects on fear responses and stress susceptibility as indicated by physical asymmetry.

Red junglefowl have individual body odours

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Olfaction may play an important role for regulating various aspects of bird behaviour. The uropygial gland, located at the base of the large tail feathers, produces preen oil which differs in composition of carboxylic acids in relation to age and to whether the bird is feather pecked. The aim of the present study was to investigate possible olfactory differences between individual red junglefowl, and to assess possible differences between feather pecked (P) and non-feather pecked (NP) animals. Using an automated olfactometer we assessed individual bird odours by examining the ability of four trained mice to discriminate between the odours of uropygial gland secretion. Samples were taken from six non-pecked and six severely pecked females (judged by visual inspection of plumage condition) in a group of red junglefowl (RJF; chosen because they are known to have more feather pecking than domestic hens). The animals were of the same age and were kept in separate cages during the test period to avoid further feather pecking. Two samples per animal were presented in random combinations to the mice at different occasions. Furthermore, the uropygial gland secretions of the animals were analysed by gas chromatography and mass spectrometry (GC-MS). All mice performed significantly above chance level and were clearly able to discriminate between all individual red junglefowl odours (two-tailed binomial test, $P<0.01$). The GC-MS analyses showed that the chemical profile (composition of different carboxylic acids) of uropygial gland secretions differs consistently between individuals. We conclude that red junglefowl have individual body odours based on differences in the relative abundance of carboxylic acids, as shown by the fact that trained mice are able to discriminate between the odours of individual uropygial gland secretions. However, it remains to be studied whether olfactory cues are used intra-specifically and play a role in the development of feather pecking.

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Pleiotropic QTL affecting behaviour and morphology in a large F2 intercross in the chicken (Gallus gallus)

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Domestication is one of the best models of evolution available, eliciting a range of behavioural, morphological and life history changes both in traits under selection and in other, correlated, traits. However, it remains unclear whether the same genes underpin the changes seen across different traits. Though there is some evidence for pleiotropic effects (where one gene has effects on multiple traits) from artificial selection experiments, these have yet to identify any of the loci involved. Using a large F2 intercross between White Leghorn layers and wild red junglefowl chickens in a marker-dense Quantitative Trait Loci (QTL) mapping experiment, we identified 41 significant (genome wide $P<0.05$) and 46 suggestive ($P<0.2$) QTL for a variety of behavioural (for example, fear avoidance behaviour), morphological (body weight, bone density measures, comb size) and life history (fecundity) phenotypes. The behavioural tests in this instance were specifically related to fear avoidance, and comprised of a tonic immobility test, latency to approach a novel object, a restraint test (to measure anxiety) and an open field test. Of the QTL found, 59 were found in 7 'hotspots', with 27 of these QTL statistically indistinguishable from pleiotropy (i.e. either in pleiotropy or close linkage). Therefore these regions consist of a pleiotropic or tightly linked 'core' surrounded by a set of more loosely linked loci. Evolutionarily, this indicates that genetic variation in domesticated animals may be due to linked groups of genes (potentially with a pleiotropic core), rather than a few genes that affect numerous traits. The findings offer possible explanations for how selection for a particular trait during domestication (for example, low fearfulness) can simultaneously cause cascades of phenotypical effects on unselected traits. This knowledge could also be of profound importance in breeding and selection programs, especially those trying to select specific characteristics and exclude others.

The effects of group size on nest-box use by Hy-Line Brown laying hens in furnished cages

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Brown egg-laying strains lay fewer nest-box eggs in furnished cages than white strains (e.g. 60+ vs. 90+% nest-box eggs). Two experiments investigated the effects of group size on nest-box use by Hy-Line Brown hens. Space per bird was not controlled. Hens were housed in Victorssen Trivselburen 8-bird furnished cages (Sweden) measuring 1.2 m by 0.5 m. Experiment 1 involved 56 individually-marked hens housed in 12 cages. There were three cages in each of two rooms and the experiment was replicated in time. The locations of each hen's eggs were recorded from video. Differences due to group size (2, 4 and 8 birds per cage) on the proportion of nest-box eggs were examined using ANOVA. The experimental unit was the cage of birds and analyses were blocked on room and replicate. Consistency of nest-box use, defined as the proportion of nest-box eggs each hen laid over 10 consecutive eggs, was estimated using the Pearson's goodness of fit statistic. Experiment 2 involved 96 hens housed in 40 cages, either singly (n=32) or in groups of 8 (n=8) and with equal representation of treatments between two rooms (replicates). Differences due to group size on the proportion of nest-box eggs were investigated using ANOVA. The experimental unit was the cage of birds and analyses were blocked on room and tier. In experiment 1 most hens were consistent nest-box layers by their tenth egg and there was no effect of group size/space on the proportion of nest-box eggs (e.g., 58.5, 75.6 and 70.9% nest-box eggs in 2-, 4- and 8-bird cages for eggs 11-40; P>0.05). In experiment 2 however, the proportion of nest-box eggs was higher in 1- than 8-bird cages (96.6% and 74.5%; P<0.001). Social factors rather than group size and/or space affect the overall proportion of nest-box eggs, but the mechanism(s) is unclear.

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Effects of different forms of exercise on post-inhibitory rebound and unwanted behaviour in stabled horses

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The stable provides horses with a protected environment but it restricts the opportunity for exercise. This study aimed to examine post-inhibitory increase in locomotor behaviour (termed rebound) in horses following four exercise regimes and to determine if regular exercise reduced the occurrence of unwanted behaviour compared to un-exercised control treatments. Twenty-four stabled horses were assigned to one of four exercise regimes - walker, treadmill, turn-out and riding - for one hour per day for four consecutive days. Each horse served as its own control in four corresponding (un-exercised) control treatments. Unwanted behaviour was tested by routine handling by an experienced handler, and rebound behaviour was tested by releasing them into a large (80 x 80 m) arena for a period of 15 minutes. Locomotor activities made up a large part of behaviour in the large arena but all exercise regimes were sufficient to reduce the amount of walking (1123±123 to 672±91 steps, $P<0.05$), trotting (179±24 to 66±10 steps, $P<0.01$) and cantering (231±16 to 65±13 steps, $P<0.001$) compared to control treatments. Turn-out reduced bucking (6.2±0.5 to 2.0±0.4 bouts, $P<0.01$) and rolling (1.6±0.1 to 1.0±0.2 bouts, $P<0.05$) during rebound tests compared to un-exercised controls. Exercise regimes reduced unwanted behaviour (1.1±0.2 to 0.2±0.5 events) and the number of commands (0.9±0.3 to 0.4±0.2 commands) given by the handler during weighing (both $P<0.05$) but had no effect on these behaviours during loading onto a float. We conclude that providing stabled horses with one hour per day of exercise on a walker, treadmill, turn-out or by being ridden are likely to improve handler safety. The above forms of exercise for one hour are all effective at allowing the expression of locomotor behaviour in stabled horses, and if rebound behaviour is considered an indicator of previous behavioural deprivation, can be expected to have positive effects on horse welfare.

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Emotions, cognition and temperament: an integrated approach to animal welfare

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The study of emotional states in animals is essential to our understanding of their welfare. Animals are sentient beings and experience both negative (e.g. fear, frustration) and positive (e.g. pleasure) emotions. In addition, there is large variability in emotional reactivity between animals, named temperament. A good understanding of an animal's emotions and its temperament traits will allow us to modify genetic selection and change housing practices to meet the welfare needs of animals. It is only very recently that the nature of emotions in animals and the way to assess their temperament have been under investigation. According to appraisal theories in psychology, an emotion results from the sequential evaluation of the triggering situation based on elementary characteristics (suddenness, unfamiliarity and pleasantness of the situation, individual ability to predict and to control it). For instance, an unfamiliar and unpleasant situation elicits either fear if the individual cannot control it or anger if the situation is under its control. Research in sheep has shown that animals use the same elementary characteristics as humans to evaluate their environment, allowing inference of their emotional experience. Cognitive processes are thus relevant to assess emotions in animals. In turn, repeated emotions can bias cognitive functions such as judgement and decision-making, which explain how temperament traits can be strongly expressed. Temperament in farm animals, such as sheep, cattle and quail, has a strong genetic basis. Most of the selection for temperament has been based on phenotypic parameters measured during behavioural tests. Heritability for some temperament traits is about 0.3, depending on tests and species, allowing efficient selection. Animal welfare may be thus improved by selecting animals with moderate levels of emotional reactivity to various eliciting events (human contact, novel situation, isolation). Moreover, selection for temperament has been associated with better reproductive rates and even increased meat quality.

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Positive and negative emotion in sheep: behavioural and physiological correlates

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With the aim of assessing positive and negative emotional states in animals, behavioural and physiological reactions of sheep were observed in exemplary situations. Fourteen ewes were subjected to situations likely to induce states of negative, intermediate and positive emotional valence, respectively: separation from group members, standing in the home pen, and being voluntarily groomed by a familiar human. The latter was chosen as a positive situation since sheep approached the familiar experimenter, and animals stayed close-by while being groomed. The animals' ear postures, eye aperture, and cardio-respiratory activity were recorded over a four-minute period. Data were analysed using linear mixed-effects models. Moreover, measures were correlated to test whether they could be assessed in ten-second time periods. The proportion of axial ear postures shown by sheep increased linearly from separation from group members (model estimate: 0.05) towards standing in the home pen (0.31) and being groomed (0.58; $p<0.001$). Relative eye aperture followed an inverse pattern (0.81, 0.78, 0.74; $p=0.02$). Similarly, the values of two cardiac measures, mean inter-heartbeat interval ($p<0.001$) and heart-rate variability ($p<0.001$), decreased from separation from group members towards standing in the home pen and being groomed. Measurements made over ten-second and longer time periods correlated for behavioural and cardiac variables (Spearman $rS=0.4-0.8$, $p<0.01$). In conclusion, findings indicate that ear postures, eye aperture and cardiac measurements were useful for differentiating situations likely to induce negative, intermediate and positive emotional states in sheep. Moreover, cardiac variables can be measured in ten-second periods, allowing for the rapid detection of short-term emotional reactions.

Do judgement biases and emotional reactivity reflect the mental state of sheep?

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Assessment of mental state is an important goal in animal welfare. The mental states of animals have been assessed using judgement bias but not in livestock. There is also the possibility that emotional arousal (emotional reactivity) could be indicative of mental state. This study aimed to induce differences in the mental states of sheep and then determine if this altered their judgement biases and emotional reactivity. To test for judgement biases, twenty-six ewes were trained to respond to two different bucket positions in a 3x6 m pen. One position was positively reinforced with food so the sheep approached it quickly; the other was associated with a fan-forced blower so the sheep avoided it. Following training, half the sheep were subjected to unpredictable, aversive events (2-3 per day for 3 weeks) that might modify mental state while control sheep were maintained in a standard environment. Events included restraint, mixing with unfamiliar sheep, exposure to a dog, simulated shearing, ear tattooing, foot bathing and transportation. Treated and control sheep were then tested for judgement biases by presenting the bucket in ambiguous locations between the learned positions, and responses were recorded. Following judgement bias testing, emotional reactivity was tested by measuring behavioural responses to events that were novel, sudden or unexpected. Judgement bias data were analysed by GLM and emotional reactivity behaviours by ANOVA. The unpredictable treatment induced negatively skewed judgement biases with these sheep approaching the ambiguous buckets less frequently than the controls (approach frequency: 38% and 46% respectively, S.E=2.38%, P=0.024). There were no treatment differences in emotional reactivity, with all sheep displaying similar behavioural responses to events (P>0.05). The occurrence of judgment biases suggests that exposure to unpredictable aversive events affected the mental state of sheep. This methodology may be useful in providing another component for assessing welfare states.

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Effects of sex and periconceptional ewe nutrition on offspring behavioural and physiological response to isolation

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In pastoral sheep production, conception often occurs when nutrient reserves are poor and food availability is low. The aim of this study was to assess effects of ewe periconceptional undernutrition (food restriction to achieve 10-15% weight reduction) on offspring behavioural and physiological responses to isolation at 4 (n=130) and 18 (n=79) months of age. We studied four nutritional treatments: control ewes well nourished throughout pregnancy (n=39) or undernourished (UN) from -60 to +30d from mating (n=36), -2 to +30d (n=20) or -60 to 0d (n=26). Animals were isolated in a 4x2.5m enclosure for 5min and number of vocalizations, occasions standing against enclosure walls, jumps, and activity (number of times animals crossed lines dividing the enclosure into quadrants) were recorded. Blood withdrawn from jugular catheters immediately before, 10 and 60 min after isolation was analysed for cortisol concentrations. Data were compared using Fisher's exact test or REML analysis, including nutritional group, singleton/twin, sex, year and ewe as random effects, with Tukey HSD adjustment for multiple comparisons. Data are mean±SEM. Four-month females had a higher cortisol area under the curve (AUC) than males (360.4±23.6 vs 299.2±19.1 ng.min/ml, p=0.05) and vocalized more (51.1±2.5 vs 37.8±2.3, p=0.0001). Fewer UN-2+30 animals stood against walls (17.7% vs 50% controls and 56% UN-60-0, p=0.05), and fewer UN-60-0 animals jumped (0% vs 22% controls p=0.05). Eighteen-month females had higher cortisol AUC than males (606.1±78.1 vs 294±28.6 ng.min/ml, p<0.0001), vocalized more (22.1±3.9 vs 2.2±1.4, p=0.0001) and were more active (44.7±4.6 vs 31.2±2.8 quadrants crossed, p=0.01). UN-60+30 animals had lower cortisol AUC than controls (357.8±28.4 vs 477.7±37.9 ng.min/ml, p=0.05). We conclude that females have a stronger behavioural and physiological response to isolation than males before and after puberty. Furthermore, maternal periconceptional undernutrition suppresses pre-puberty stress behavioural reactions and post-puberty cortisol secretion in response to isolation-stress in the offspring.

A novel system to automatically measure behavioural motivation for food in cattle

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We aimed to develop a simple, automated system to measure feeding motivation in cattle based on behavioural economics and using a natural (walking) operant response. A feed delivery system and feeder were constructed with two feed access bays. Presence at one bay (detected by infra red beams) activated feed delivery in the second bay. Access to the feed required the animal to walk around a fence panel extending out from the feeder. Continued access to feed required the animal to cycle back and forth between the bays, with the distance walked controlled by the length of the barrier. A software interface automatically recorded each feeding event and controlled the amount of feed delivered. The system was tested and used to examine the sensitivity of cattle to feed reward size (30 and 45 g) and walking distance up to 24 m. After a period of training and adjustment to a concentrate ration, feeding motivation of six yearling Angus steers was determined. Each animal was tested at each of five distances (costs) and the number of feed rewards over 23 h was measured. There was a 48 h recovery period between tests. Three animals received rewards of 30 g at all five distances (randomised) before being tested at the 45 g reward amount, with the other animals rewarded in reverse order. Demand function analyses of the data showed that Omax, the maximum distances walked, were 4.5 ± 0.5 and 13.2 ± 25.7 km for the 30 g and 45 g reward sizes, respectively. However, at 45 g the curve was relatively inelastic and the estimate of Omax was unreliable. An analysis of covariance revealed a significantly lower number of feed rewards ($P<0.05$) at 30 g compared to the 45 g indicating that cattle could detect the small difference in reward size.

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Consistency of flight speed and individual behavioural characteristics of dairy cattle to restraint in a crush

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Abstract

Response during routine management procedures can give an indication of an animal's underlying temperament. Flight speed (FS) is an objective measure of temperament in beef cattle. However, no work to date has investigated the relationship between FS and subjective measures of temperament in dairy cattle. The aims of this study were to: a) evaluate the reliability of the FS and crush score (CS) test by repeated measurements, b) examine the correlation of FS and CS with reactivity responses in a human approach test (HAT). The study was approved by the SAC animal ethics committee. FS and CS measurements for 55 Holstein-Friesian heifers were repeated three times at 4-week intervals. Heifers were tested at random. Flight response to a HAT was assessed in the passageway of the home-pen on a subset of 33 animals. On completion of the HAT, an assessment of six qualitative terms (at ease, friendly, bold, docile, shy, fear and nervous) were marked on a visual analogue scale according to a subjective judgement of whether a cow scored low or high for each term. Correlations between the three monthly repetitions of FS measurements were all significant (FS1,2: $rs=0.36$, $P=0.007$; FS2,3: $rs=0.31$, $P=0.002$; FS1,3: $rs=0.47$, $P<0.001$) which may indicate individual consistency. No significant correlations between the three monthly repetitions of CS measurements were found. FS was moderately correlated with HAT flight response ($rs=0.43$, $P<0.05$). Furthermore, FS positively correlated with qualitative terms at ease ($rs=0.46$, $P<0.01$), friendly ($rs=0.49$, $P<0.01$), bold ($rs=0.43$, $P<0.05$) and docile ($rs=0.48$, $P<0.01$) and negatively correlated with nervous ($rs= -0.53$, $P<0.01$), shy ($rs= -0.42$, $P<0.05$) and fear ($rs= -0.54$, $P<0.01$). However, no significant correlations existed between the HAT and the CS. In conclusion, the significant correlations between subjective HAT measures and objective FS show that either technique can be used for assessing temperament in these handling situations.

Behaviour of dairy goats in the collecting area – influence of space allowance and shape

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Areas of the barn with high animal densities (e.g. collecting areas) might be critical in terms of injuries and social stress, especially for horned goats. At present there are no studies available regarding health and behaviour. For this study, 66 goats (11 without horns, 55 horned; Bunte Deutsche Edelziege) were randomly assigned to two groups. Three experiments took place during a period of six weeks. In each experiment, treatments were applied for two weeks with a cross-over design. In experiment 1 and 2 the influence of space allowance (0.4 vs. 0.7m²/animal) offering different basic shapes (experiment 1: rectangular, experiment 2: long and narrow) was tested. The influence of different basic shapes at a space allowance of 0.4m²/animal was tested separately in experiment 3. Agonistic and socio-positive behaviour was observed by continuous behaviour sampling before (15 min) and during (1 hour) morning and evening milkings on four days of the week. The scoring of fresh skin lesions took place at the beginning and end of every week. For each experiment, behaviour was analyzed using linear mixed models. Data on skin lesions were analyzed descriptively. In both experiments 1 and 2, threatening ($p < 0.01$-0.05), head butts ($p < 0.05$) as well as total agonistic behaviours ($p < 0.01$-0.05) occurred significantly more often with lower space allowance (before as well as during milking). In experiment 2, more socio-positive behaviours were found, when more space was available ($p < 0.05$). Shape (experiment 3) significantly affected the rare behaviours clashing and kicking only; both increased with rectangular shape ($p < 0.05$). Skin lesions were rare and no clear influence of either space allowance or shape was found. The effects of shape on social behaviour were minor; therefore the most efficient way to reduce agonistic interactions is to provide more space in the collecting area.

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Relationship between metabolic – related production diseases and feeding behavior characteristics of dairy cows in early lactation

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The early postpartum period is the major risk period for metabolic disorders of high-yielding dairy cows. Relatively little is known about the relationship between feeding behavior and metabolic disorders. The objectives were to investigate differences in feeding behavior between cows with clinical metabolic disorders and healthy cows, and to determine whether feeding behavior characteristics could be used to identify sub-clinical metabolic disorders. Data on feeding behavior characteristics and feed intake of 47 German Holstein multiparous dairy cows from 7th to 105th day of lactation were collected using automatic feeders and electronic identification. Seventeen cows with diagnosed clinical metabolic disorders (milk fever, ketosis, retained placenta and displacement of the abomasum) within the first week of lactation were compared with 18 healthy cows (no metabolic disorders and other diseases) over 15 weeks of lactation. Eight cows with out of normal reference values of blood parameters: NEFA (>800 µmol/l), BHBA (>1000 µmol/l), and ASAT (> 105 U/l), but without any clinical problems were compared with 14 cows without clinical or sub-clinical metabolic disorders during the second and third week of lactation. Cows with clinical metabolic disorders had shorter meal duration (37.6 vs. 40.3 min., P<0.01). The healthy cows spent 26 min longer at total daily mealtime than cows with clinical metabolic disorders (277.1 vs. 251.2 min, P<0.01). The mean meal duration for cows with sub-clinical metabolic disorders was about 6 min shorter than that for healthy cows in the second and third week of lactation, respectively (26.1 and 29.5min vs. 32.07 and 35.46 min, respectively, P<0.01). In the same periods, cows with metabolic disorders spent about 40 min less at total daily mealtime than healthy cows (190.0 and 233.6 min vs. 217.0 and 256.4 min, respectively P<0.01). Sensor-based monitoring of feeding behavior may be useful to detect metabolic disorders of dairy cows.

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Automated measurement of feeding behavior to detect illness in milk-fed calves

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Automated monitoring of feeding behavior may help detect illness among group-housed calves. We examined whether illness in dairy calves fed with an automated milk feeder changed their feeding behavior, and whether these changes were affected by milk rations. Unweaned Holstein calves (64) were housed in groups of 3-16 animals and fed either high (12L/d or ad libitum) or low (4-6L/d) amount of milk or replacer. Thirty-two calves became spontaneously ill from gastro-intestinal and/or respiratory problems before 21d of age, with no differences between feed level ($P>0.10$). We used PROC MIXED (with a separate model for each feed level) to test differences between 22 calves that succumbed to only one bout of illness and 22 healthy calves of the same feeding level and age. During the 2d prior to illness detection, there were no differences between sick and healthy calves in any measure of feeding behavior ($P>0.10$). Following clinically identified illness, sick calves fed high levels of milk or replacer showed a decrease in milk or replacer intake (-2.59 ± 0.7 L/d), a reduced frequency of visits to the milk feeder (-2.43 ± 0.3 visits/d), and an increase in the duration of each visit to the milk feeder (1.66 ± 0.5 min/visit), as compared to the matched healthy calves ($P<0.05$). This was apparent up to 3d after illness detection. Sick calves fed low levels of milk or replacer only showed a decrease in the duration of each visit to the milk feeder (-1.35 ± 0.2 min/visit; $P<0.05$) compared to healthy calves, with no differences in intake of milk or replacer or frequency of visits to the milk feeder ($P>0.10$). Illness results in changes in feeding behavior of calves which can be monitored with automated milk feeding equipment but feeding level affects the types of changes in feeding that occur.

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Validation of a novel data logger for recording lying behaviour of dairy cows and its application on robotic milking farms

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Adequate lying times are essential to the well being of the dairy cow. Hence the assessment of lying behaviour is an important welfare indicator of cows. In robotic milking farms (RMF), restricted access to specific barn areas and night time milking may result in disturbed lying behaviour. The aim of this study was (1) to validate a new Data Logger (DL: 20 x 15 x 61 mm, 23 g, MSR Electronics GmbH, Switzerland) for recording lying bouts via acceleration, and (2) to investigate the lying behaviour of two different groups of cows on four commercial RMF in Switzerland. (1) DLs were programmed with a logging interval of 30 s and attached to the left hind legs of 19 cows. Video recordings from a two-day period were analysed. A total concordance of 99.92 % between video observations and DL readings was obtained. (2) On each farm, 20 cows were previously selected on the basis of herd management data and assigned to two groups of ten animals each. In contrast to individuals of group A, group B cows were characterised by long intervals between milkings, a low milking frequency and a high percentage of night time milking. Both groups had an equal distribution of parity and stage of lactation. Data recorded over a period of 11-14 days were analysed using multifactor ANOVA and regression analysis. Group B cows showed a longer daily lying time than individuals of group A (677 min vs. 638 min, F = 21.64, p = 0.000) and the interval between milkings correlated highly significant with total lying time (r = 0.18 - 0.48). Due to its accuracy, the DL represents an excellent alternative to direct or video observation of the lying behaviour of cows and provides a non-invasive method for assessing the welfare of dairy cows on RMF.

How hot is too hot? A cow's view

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This study aimed to quantify dairy cows' perceptions of heat (in)tolerance using a trade-off procedure: we assessed the ambient conditions at which cows would give up a highly-valued activity (resting) in order to obtain shade. Under a range of naturally varying ambient thermal conditions, one group of eight cows (Experimental) were provided with a mutually-exclusive choice of Resting or Shading areas for 75 min. Each cow was tested at each of three levels of resting deprivation (0, 12, 24 h). Individual cows in a second group of eight animals (Control) were provided with 75 min access to a lying area only, at each of the resting deprivations. Measures of ambient environmental parameters (temperature, humidity, solar radiation, wind speed, black globe and ground temperature) were recorded in the open and in the choice areas. For Experimental cows, the time spent in each area, switches between areas and total time resting were recorded, whereas for Controls total time resting was recorded. In addition, internal body temperature (Tb) and respiration rates (RR) pre-and post-testing, and external coat temperature (Tc) were recorded for all animals. The Shaded area was significantly cooler than the Resting area (t-test, $p<0.001$). The proportion of time resting increased with increasing duration of prior rest deprivation (REML, $p<0.001$), and the proportion of time in shade (in choice tests) decreased with increasing rest deprivation (REML, $p<0.05$). In the choice test, 24 h resting-deprived cows decreased time resting (REML, $P<0.05$) when ambient temperatures exceeded 29°C (when RR, Tb and Tc were 70bpm, 38.5°C and 40.0°C, respectively). Since rest is a highly-valued activity to 24 h lying deprived cows, the results indicate that shading becomes critical at temperatures approaching 30°C.

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Dairy cows will work for access to shelter from wind and rain

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Results from both observational and experimental studies suggest that cows in extensive management systems will use shelter as a behavioural response to reduce heat loss during inclement weather. However, little is known about the perceived importance of shelter for cows in an extensive environment. This study aimed to measure the motivation of cows to gain access to shelter after a 48-h period of artificially-imposed constant wind at 1.5 m/s and intermittent heavy rain (4 mm/h for 60 % of 48h exposure time), across a temperature range of 2-17 °C. Measurement of animal indicators of heat loss during this exposure period revealed significant ($P<0.01$) linear relationships between ambient temperature and heat loss, with each 1°C reduction in ambient temperature corresponding to decreases of 0.80 breaths per minute and 0.03°C body temperature. Eight cows were successfully trained to perform a lever press response to access shelter from rain and wind. Six of the eight cows were randomly selected for testing at 5 Fixed Ratio (FR) levels; 5, 10, 20, 40 and 60. Reward duration was 20 min shelter access and tests were conducted for 15h between 1700h and 0800h. Three cows failed to gain a shelter reward on FR60 and were re-tested on FR50. Normalised demand functions were fitted to the data; the mean peak response output was 769 lever presses (SEM=67.0) and the mean price at which maximum output was observed was 20.27 lever presses (SEM=2.22). These results suggest that cows' motivation to access shelter, under the prescribed weather conditions, is moderate in comparison with other valued resources such as rest (maximal output for rest has not been observed at or below FR50 in dairy cows). Measurement of motivation to access shelter across a range of heat loss values is required to determine shelter requirements under more severe weather conditions.

Effects of pre- and postnatal flavour exposure on stress-related behaviour and postweaning performance in piglets

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We aimed to study the effects of pre- and postnatal flavour exposure through the maternal diet on performance and behaviour of newly weaned piglets offered a similarly flavoured food.

Sows (n=18) were offered anise-flavoured (F) or control (C) food during late gestation for 10 days. Piglets were cross-fostered after birth, with each sow fostering five piglets from an F sow and five from a C sow. During lactation, sows were offered F or C feed, resulting in FF, CF, FC and CC piglets (n=9 groups of each treatment). Piglets were weaned, relocated and mixed with unfamiliar same-treatment pigs (4 per pen, 2 of each sex) on day 25 and were given both control and anise-flavoured food for two weeks in a choice food approach. Pen averages for body weight, feed intake, diarrhea and behaviour were analyzed using a mixed model (repeated measures when appropriate) including pre- and postnatal exposure, their interaction and batch (two) as factors. No clear effect of exposure on anise preference was found. Prenatally exposed animals (FF+FC piglets) showed a higher food intake on day 2, 3 and 5 (on average 0.30±0.03 vs. 0.27±0.04 kg/pig/day, p<0.10), a higher bodyweight during the postweaning period (on average 10.5±0.12 vs. 10.2±0.26 kg, p=0.07) and lower diarrhoea occurrence (1.9±0.25 vs. 2.8±0.41) days, p=0.04) compared to prenatally non-exposed animals (CF+CC). Prenatal exposure (FF+FC) also increased the latency to fight (29.9±4.6 vs. 19.7±2.1 minutes, p=0.02) and decreased mounting behaviour (0.65±0.13 vs. 0.83±0.15% of time, p=0.03). Pre- and postnatal exposure (FF treatment) reduced oral manipulation of pen mates (0.68±0.14 vs. 1.49±0.17% of time, p=0.06). These findings suggest that a familiar flavour from the sow's gestational diet in the postweaning diet reduces stress and possibly food neophobia, resulting in a higher performance and welfare of piglets after weaning.

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Effects of split marketing on agonistic behaviour and carcass characteristics of entire male pigs and gilts in a restricted feeding system

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This study evaluated the effects of split marketing (Sm), whereby some pigs in a group are removed for slaughter before others, on entire male pigs and gilts. Twenty-eight single sex groups of 14 pigs (75 ± 5 kg) were assigned to the following treatments: Male-Sm, Male-Control, Female-Sm and Female-Control. Pigs were fed 3 times daily. Control pigs were all slaughtered after 6 weeks on trial, whereas in Sm groups the 3 heaviest pigs were slaughtered 2 weeks earlier. The number of fights during feeding was recorded during 2 days prior to and after Sm, the day of Sm, and 2 weeks later. Observations prior to Sm were combined, as were observations post Sm. Behavioural data were analysed using repeated measures ANOVA, and carcass characteristics were recorded and analysed by ANOVA. Split marketing reduced the coefficient of variation in carcass weight (Sm: 8.6%, Control: 10.9%; s.e=0.71, p<0.05). There were no significant differences between Sm groups (just including data from 11 remaining pigs) and Control groups in carcass weight (77.6 and 78.7 kg), backfat depth (10.4 and 10.2 mm), lean meat % (58.7 and 58.9%), and kill out % (76.1 and 75.8%). There was an interaction between gender, treatment and observation period in aggressive behaviour (p<0.01). In male groups there was a reduction in fighting between observations taken prior to and at Sm (prior Sm: 24.2, day of Sm: 14.7; s.e=1.78, p<0.05), but no difference between Control and Sm groups in any period. In female groups, the proportion of fights was higher in Control than Sm groups during the post Sm period (Sm: 13.4, control: 25.7; s.e=3.51, p=0.06). Thus, without affecting carcass characteristics, Sm reduced aggression at feeding during the post Sm period in female groups. The fact that this was not shown in male groups may reflect different social regulation.

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Effect of age on physiology and recovery behaviour of calves transported for 10 hours in individual pens

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This study examined the physiological and behavioural effects of transport on young calves in a 3x2x3 factorial design comparing age, transport or no transport, and time. Eight calves at each of 3, 5 and 10 days-of-age were transported for 10 hours in individual pens. An additional 8 calves at each age were individually penned without access to food or water for 10 hours. Testing occurred over a 3-week period with 2 ages compared in each testing week. Blood sampling from indwelling catheters occurred immediately prior to loading onto the trailer or into a control pen at 0.5, 2, 4, 6 and 10h after loading, and 0.5, 12 and 24h after unloading. Lying, standing, walking and running were observed for 2h post-transport. Analysis of variance found no age, treatment, time or interaction effects. For example, time spent lying was not different between the transported (mean±sem; 108.95±4.62mins) and the control calves (101.69±4.39mins) (F(1,44)=1.296, p=0.263). Repeated measures analysis of variance showed significant age (F(2,46)=13.671, p=0.019) and time of testing (F(2,46)=4.875, p=0.027) main effects for total blood cortisol levels; 3-day-old calves had significantly higher levels (47.49±4.963nmol/L) than 10-day-old calves (18.47±4.723nmol/L) regardless of treatment. There were no significant treatment main effects, but there was a significant time x treatment interaction effect (F(8,28)=2.908, p=0.027). No main age, treatment or time of testing effects on white blood cell counts or packed cell volume were observed. Significant time (F(3,39)=3.660, p=0.020), time x treatment (F(3,39)=3.643, p=0.021) and treatment x age (F(2,41)=4.270, p= 0.021) interaction effects were found for lymphocyte counts, with lymphocyte counts increasing over time and across age although lymphocyte counts were within normal ranges at all times throughout the study. Therefore, the results suggest minimal impacts of individual transport under 'ideal' conditions on calves aged 3, 5 and 10 days.

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Different roughages to organic growing/finishing pigs - influence on activity behaviour and social interactions

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This study investigated the effect of additional roughage in the outdoor area on activity and aggressive behaviour among organic growing/finishing pigs. The study included two experiments and behaviour was studied on four occasions per experiment. In experiment 1, 377 pigs were allocated randomly to either a control treatment (C) or treatments with access to additional roughages; hay (H), grass silage (GS) or whole crop barley silage (BS). Each treatment consisted of three groups. In experiment 2, 138 pigs were randomly allocated to the C or the GS treatment with two groups per treatment. Pigs were housed indoors with straw in the lying area and with a concrete outdoor run, where H, GS and BS pigs were given roughages ad libitum in hedges. Statistical analysis was performed with group as the statistical unit in SAS Proc. Mixed. Pigs given roughage stayed outdoors more often and were more active than control pigs ($p<0.05$, for both). C pigs were rooting in straw in the lying area more often than GS and BS pigs, which suggests that additional roughage motivated the pigs to explore and forage although straw was provided. However, we did not find any difference in time spent on eating the different roughages (H, GS and BS). The frequency of aggressive behaviour in the indoor lying area was lower among roughage pigs than C pigs in experiment 1 ($p=0.009$) and was lower, though not significantly, in experiment 2 ($p=0.121$). In experiment 1, pigs stayed outdoors more often with a tendency of eating roughage more frequently later in the rearing period, which resulted in a lower aggression level with increasing age of the pigs. Our results indicate that access to additional roughage is an important resource that might influence pigs to be more active, and which can reduce aggressive behaviour among the pigs.

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Effects of alternative housing systems on dry sow well-being

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Sow housing is one of the most controversial welfare issues facing the swine industry. New housing systems are being implemented without scientifically evaluating the impact these alternative systems have on well-being. The objectives of this study were to evaluate a) the effects of 3 housing systems on sow physiology (Exp. 1) and more specifically b) the utilization of individual vs. group space in the free access stall treatment (Exp. 2). On d 30 of gestation 12 multi-parious sows were allocated to a standard crate (CRATE; control), an adjustable crate (FLEX), or free access stall-pen (FREE). On d 89 of gestation, FLEX width was adjusted to achieve 2cm space between sow and stall. Immune and endocrine status was measured on d 0, 30, 31, 89, 90 (FLEX only) and 110. For Exp. 2 live behavioral observations among sows in FREE system were registered for 60 min on d 30, 45, 60, 75, 89, and 103. Data were analyzed using Proc MIXED with repeated measures (SAS). In Exp. 1, on d110, phagocytosis was greater ($P<0.05$) among sows in FREE than sows in FLEX. Sows in FREE and FLEX stalls had less concanavalin A- ($P<0.001$) and lipopolysaccharide- ($P<0.05$) induced proliferative responses at d31 and throughout gestation. Sows in FREE had greater ($P<0.05$) cortisol on d89 than previous days of gestation. In Exp. 2, regardless of day of gestation, some sows spent a greater ($P<0.05$) amount of time in group-pen area than in individual stall. Later in gestation, fewer sows spent more time in the group-pen than on d30 ($P<0.05$). These data indicate that housing systems can affect immune function and physiology of the sow throughout gestation; while FREE can affect individual sow preference on space utilization. Thus it is important to assess the impact of housing components on sow-well being.

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Social animals and philosophical ethology: on the extents of farm animals, welfare and ethics

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In this theoretical paper I will discuss the philosophical and ethical aspects of sociobiology and social behaviour among farm animals. The purpose is to present a philosophical ethology - an animal epistemology so to speak - that gives us a better understanding of farm animal life, and thus provides us with more relevant knowledge from which we can construct theories of animal welfare and ethics. Standard definitions of farm animals often focus on genetics, physical attributes, individual behaviour and the animals' function and output in agricultural production. However, the fully defining characteristics of farm animals include and transcend these limited models and require an answer that evades reductionism and encompasses a de-atomising point of view. Such an answer, I argue, should promote the recognition of traditional farm animals as beings with extensive social capabilities and behaviours: E.g. allogrooming, "friendships" and relationships between parents and off-spring. These natural social aspects which, in intensive agricultural production, are either entirely denied or radically limited, constitute not only important welfare characteristics for the individual animal, they simultaneously lay down parts of the foundation of an additional level of existence and consideration: That the animals are integral parts of sociobiological wholes that in themselves have fitnesses and welfare to be considered. In conclusion, any attempt at constructing a convincing and workable theory of ethics and farm animal welfare must include a pluralistic - i.e. individual as well as a social/sociobiological - understanding of the animals. Thus, welfare and ethics cannot merely be based upon individual aspects (as in deontological or rights based theories), or solely on the good of the collective (as in for example utilitarian theories), but must encompass both within its framework.

Animal welfare science and policy – oil and water or sugar and spice?

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Animal welfare research is regularly promoted as providing information on practical welfare issues which assist policy-makers, but what is the reality? One of the key issues in the development of legislation, policy, and assurance programmes is how welfare can be assessed in an objective, practical and cost-effective way. Science is but one part of animal welfare policy but is the key in welfare assessment. The challenge is to develop policy standards that achieve welfare outcomes consistent with current scientific thinking, are consistent with good practice, meet societal expectations for the welfare of animals, are readily understood and accepted by those who must abide by them, and are effective tools for those who have to enforce them. Policy must strike a balance among these often conflicting scientific, social, ethical and production management considerations and must remain relevant in an environment of constant change. We have concluded that these objectives are best met by writing standards as welfare outcomes to be achieved, with each outcome accompanied by indicators by which achievement of the outcome can be measured or objectively assessed. We will illustrate how such science-based policy is being developed in New Zealand. Some of the challenges for policy makers are:

1. keeping up with the latest science;

2. being able to understand and interpret the science. How could science information be packaged to assist 'evidence-based' policy?

3. what to do when the science is not available (e.g. pain of banding dog tails) or

4. when science does not support popular views or wishes (e.g. layer hen cages vs free range)?

5. what to do when there are conflicting interpretations of scientific research?

In order to improve animal welfare, people in policy and science must better understand these differing issues and work together.

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Enrichment programs and animal welfare: catalyst or catastrophe?

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The aim in this presentation is to review available data concerning the provision of enrichment to kennelled dogs, and to illustrate some of the conceptual issues requiring resolution before composite enrichment programs should be universally recommended. This is important because growing awareness of the implications of animal use and housing on welfare have led to rising public expectations and lower levels of tolerance for conditions not perceived to be adequate. Consequently, there have been calls for improved provision for the welfare of animals housed in captivity, including the use of enrichment programs. Enrichment can be broadly understood as the provision of a more complex social, physical and sensory environment, with the goal of improving the welfare of the target animals. Various elements of enrichment have been recognised as having a significant positive effect on the behaviour, physiology and welfare of animals housed in captivity, including kennelled dogs. However, composite programs containing multiple elements of visual, auditory, olfactory and social enrichment risk overstimulating these dogs, and may increase levels of stress, reducing rather than improving, levels of canine welfare. This is potentially problematic, not only to the welfare of the animals, but also their ability to provide the desired service for humans. If too much stimulation leads to increased stress, potential working dogs may fail the training and accreditation programs for substance detection, guide or assistance work. Failing to acknowledge that a composite enrichment program's effects may not equal the sum of its parts also risks the investment of more resources than is actually required. There is clearly a need for systematic research, conducted in realistic industry conditions, to evaluate perceptions regarding the importance of enrichment for the welfare of kennelled dogs and to determine whether composite enrichment programs affect the welfare, training success and resource requirements of such dogs.

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Effects of hide provision and regular petting on the behaviour of stray and surrendered cats in a quarantine shelter

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This study examined the effects of hide provision and regular handling on the behaviour of 67 cats in a shelter. Cats were allocated to one of 4 treatments in a 2x2 factorial design: hide + petting, hide + no petting, no hide + petting or no hide + no petting. The hide consisted of a 3-sided box and petting, which involved offering the hand to be sniffed and, if allowed, gently stroking the cat's head between the ears, occurred on days 1-5 for 15 s. Postures and behaviours were observed on the first 6 days in the shelter. Two-way analysis of variance examined main effects, hide and petting, on postures and behaviours. Hides increased the proportion of time spent lying on days 1-3 (mean±s.e.m for hides vs no hides) (0.978±0.002 vs 0.875±0.002, $F(1,63) = 10.107$, $P = 0.002$; 0.930±0.002 vs 0.792±0.002, $F(1,63) = 9.055$, $P = 0.004$; 0.955±0.003 vs 0.819±0.003, $F(1,56) = 9.634$, $P = 0.003$, respectively) and lying with eyes closed on days 2-3 (0.302±0.034 vs 0.189±0.033, $F(1,62) = 5.546$, $P = 0.022$; 0.421±0.044 vs 0.281±0.043, $F(1,55) = 5.229$, $P = 0.026$, respectively). Hides decreased the proportion of time spent in or behind the litter tray on day 1 (0.022±0.037 vs 0.169±0.036, $F(1,63) = 8.191$, $P = 0.006$). When a hide was present, cats that were petted spent less time in the hide on days 2 and 4 than cats that were not petted (0.762±0.011 vs 0.969±0.009, $F(1,31) = 5.703$, $P = 0.023$; 0.67±0.018 vs 0.97±0.015, $F(1,31) = 6.186$, $P = 0.018$, respectively). The results of this study indicate that the provision of both hides and petting in a quarantine shelter may assist cats in adapting to the shelter environment.

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Welfare assessment of restraining traps for wild animals; can behavioural and physiological indices be incorporated into a standard?

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Assessment of restraining devices, according to the Agreement on International Humane Trapping Standards, for capture of wild animals, at present is reliant on injury data. This standard was developed and agreed over 10 years ago, and there was hope at that time that further developments in the area of using behaviour and physiology for welfare assessment, would allow these to be incorporated into the Standards. In this paper we review the scientific studies carried out to date in wild animals to determine if sufficient advances have been made to allow such use. Although it may seem straight-forward to transfer knowledge gained from domestic species into wild species, it is very difficult. Firstly, in contrast to many domestic animals, the normal behavioural repertoire and physiological profile, of many of the species under investigation is unknown. Secondly, the presence of the human observer and experimental set up has a profound impact on the species under investigation, impacting on the behaviour and physiology to a much greater degree than with domestic animals. Thirdly, the logistics of obtaining statistically robust data from the field to enable an assessment to be carried out. An insurmountable problem with the Agreement on International Humane Trapping Standards is that it encompasses a diverse range of species, from large predatory mammals e.g. wolf, to small herbivorous mammals e.g. muskrat. For the purposes of an International Standard, injury data, that can be compared across species may be the only option to judge humaneness, however this does not mean that behaviour and physiology should not be used for comparison of control methods within a particular species.

Welfare implications of different culling methods for shooting red deer

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Methods for culling wild red deer in Scotland were compared by observing behaviour and collecting 164 post-mortem samples from wild deer shot: using a helicopter for deployment of stalkers and carcase removal (WH); by more than one stalker (WS+); by one stalker during the day (WSday); by one stalker at night (WSnight), and from farmed red deer shot in the field (FF) or killed at a slaughterhouse (FS). Deer were active before the first shot only in WH (27%) and WS+ (21%) (Fisher's exact test P<0.001). Forty-eight percent of deer culled by WH and 43% of WSnight deer moved away after the first shot without collapsing (Fisher's exact test P<0.01). Plasma cortisol concentrations in deer shot in WH (log10 mean 1.79 nmol/l SEM 0.059) were similar to those in FS (log10 mean 1.93 nmol/l SEM 0.032), but higher than WSnight (log10 mean 1.25 nmol/l SEM 0.046), WSday (log10 mean 1.42 nmol/l SEM 0.077) and FF deer (log10 mean 1.42 nmol/l SEM 0.070) (GLM P<0.001). WS+ culled deer (log10 mean 1.70 nmol/l SEM 0.101) had a greater plasma cortisol concentration than WSnight. WSnight deer (log10 mean 2.91 nmol/l SEM 0.049) had a greater muscle glycogen concentration than those culled via WH (log10 mean 2.56 nmol/l SEM 0.048), WS+ (log10 mean 2.64 nmol/l SEM 0.070), and WSday (log10 mean 2.65 nmol/l SEM 0.046); and FF (log10 mean 2.86 nmol/l SEM 0.076) had a greater concentration than WH (GLM P<0.001). Culling by WSday and FF were the most accurate and WSnight the least in achieving shot placement likely to have quickly killed the deer. There were no significant differences between methods in the numbers of wild deer that appeared to have died immediately after the first shot or were wounded. Wild deer were more disturbed by either WH or WS+ than with WSday.

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Rules, Relations and Robotics: using behavioural data for refinement, reduction and replacement of animals in research

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The analysis of behavioural organisation can improve the lives' of animals used in research through study of the Rules that determine behaviour, the Relations between animals and the use of Robotics to study behaviour using simulations. The National Centre for the Refinement, Replacement and Reduction (NC3Rs) is a UK initiative to improve the welfare of research animals. Here we show how our three analytical Rs map onto the NC3Rs, using examples from our research. Firstly, we demonstrate how rules-based approaches can refine research by improving understanding of animal welfare and research validity. This is illustrated by research conducted on the repetitive behaviour of caged European starlings (Sturnus vulgaris) using Markovian and semi- Markovian methods. We found that a semi- Markovian method correlated with counts of stereotypic somersaulting behaviour (Kendall's $t = 0.635$, $p= 0.043$). Secondly, we demonstrate analysis of social relations, using an example in laying hens. Hens kept in small groups were found to become more clustered over a six week period, spending more time in patches which contained other hens (GLMM: $F_{1, 28} = 154.66$, $p = 0.029$). Consideration of social behaviour can provide refinement by encouraging appropriate group-housing for animals. It can also offer statistical treatment that maximizes use of behavioural data in group-housed animals, resulting in a need for fewer animals. Finally, we demonstrate how robotics in the form of computational modelling can accelerate experimental findings. The model we present distinguishes between the contributions of social and resource attraction in determining the movements of laying hens. To some degree models can replace the use of live animals and can reduce the number of animals required. Continued application of simulations to the field of animal welfare will also contribute to refinements in the way animals are housed.

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How do larger enriched cages and larger group size affect juvenile mink behaviour?

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The aim of this study was to evaluate if behaviour of juvenile mink was different when being kept in pairs or groups of three or four in larger enriched cages compared to being kept in pairs in traditional cages. Farmed mink of the colour type "demi buff" (n=165) and "silver blue" (n=165) were housed after weaning at 10 weeks in traditional cages (2 550 cm2) where ¾ had a top cage added (1 700 cm2). All cages had a netting shelf, plastic cylinder and nest box with straw, and top cages had a netting shelf. Each group consisted of half females and half males except for groups of three where two were females. Behaviour was recorded with scan sampling 6 times per individual and observation period over 5 days, two hours after sunrise and two hours before sunset, which was repeated in six periods. Statistical analysis used Generalized Linear Models (GLIMMIX, SAS). Mink in larger cages had a higher number of recordings being inactive outside the nest box (p<0.0001), however there were no differences for the other behaviours. Larger groups had a higher number of recordings being active (p<0.01), a lower number of recordings in the nest box (p<0.0001) and fewer recordings interacting with shelves and cylinders (p<0.05). Stereotyped behaviour was very low, and was not affected by cage type or group size. Compared with males, females performed more stereotypies (p<0.0001), were more active (p<0.0001), spent more recordings in the nest box (p<0.01) and were less inactive outside the nest box (p<0.0001), but did not differ in the number of interactions with the shelves and cylinders (n.s.). It is concluded that larger groups of juvenile mink were more active and used enrichments less, whereas pairs of juvenile mink only were resting outside the nest box more in a larger cage.

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Invasion, over-abundance and animal welfare: controlling unwanted wildlife in Australia

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Australia is home to a unique and diverse ecology: its wildlife is a key attraction to overseas visitors and it is recognised internationally for its iconic marsupials and monotremes. But uniqueness is a source of ecological vulnerability and Australia now has the second highest ranking of threatened animal species in the world. European settlement and the subsequent destruction of habitat through land-clearing and agricultural practices dramatically altered the environment for many Australian animals, promoting numerous extinctions. Introduced animals quickly became established in most of the Australian landscape with devastating consequences. There are now at least 73 species of introduced (invasive) vertebrates living wild in Australia, including 25 mammal, 20 bird and 23 freshwater fish species. Some native species (eg kangaroos and parrots), have also increased in range and abundance and are now regarded as 'pests' or 'unwanted animals'. Controlling the impacts of unwanted animals is a significant activity for land managers. A wide range of physical, biological, chemical, lethal and non-lethal methods are used which vary greatly in their humaneness. Animal welfare must compete with other factors such as cost, efficacy, target specificity and practicality in formulating management plans. Ensuring that control is both justified and humane requires a new, long-term perspective. It involves changing attitudes towards invasive or overabundant animals as well as improving the humaneness of control techniques This review paper examines recent approaches to improving the strategic and humane control of unwanted wildlife in the Australian context. This includes the development of a framework for the integration of animal welfare considerations into the management of unwanted wildlife, reviews of the humaneness of specific control methods, research to find potential alternative techniques, and measures to assess the relative humaneness of control methods and to improve the application of control methods by identifying best practice.

Using animal behaviour to assess the animal welfare impacts of pest control – a review with 'real life' examples

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Animal behaviour is an integral part of any assessment of animal welfare– including the impacts of pest control. However, there are specific challenges. For instance, animal welfare assessments of pest control often must use captive, wild-caught animals to allow the necessary close observation. Practical challenges arise from the lack of background data and the need to observe rare behaviours and to allow for extreme peaks in frequency. All of these make it difficult to know how to design a sampling regime and what behaviours to expect. Rare behaviours may be significant for animal welfare (eg seizures) but may not be seen in normal situations– they occur irregularly and infrequently, may not be recognised or expected, and may not be identified as significant (eg postural adjustments, twitching).

Interpretation can be difficult: often, there is not much known about the species– can it suffer in particular ways? Does it normally express pain-related behaviour? Their previous and current environments can have unexpected effects (eg reactions to chronic stress) and time needs to be taken ensure they acclimate. How does the behaviour of a wild-caught, captive animal relate to its free-living counterparts?

Ethical realities also make the research a challenge. Some behaviours are not pleasant to observe, but the 'look' must separated from the 'real effect'. Also, how do we abide by the 'Three Rs' when we must document extremes of suffering and observe sufficient animals to get robust data from infrequent and irregular behaviours? Researchers often struggle to get ethical approval, despite the fact that millions of animals are subjected to the same treatment outside of the laboratory in our forests and fields.

Based on our own work, we review these and other challenges in the application of animal behaviour to assessing the animal welfare impacts of pest control methods.

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New approaches to developing humane toxins

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Vertebrate pests control still relies on the use of poisons that are linked with secondary poisoning or are considered inhumane. Stoat (Mustela erminea) control is conducted in New Zealand to protect kiwi chicks from predation. Para-aminopropiophenone (PAPP) is being investigated for more humane culling. Research to test the humaneness was undertaken in cage experiments followed by field efficacy trials. Fifteen individually housed stoats were presented with 5-10 grams of meat with PAPP (12.8 mg) added in the form a 40% PAPP paste. The PAPP paste was added prior to presenting the meat "bait" to the stoats. PAPP impregnated meat was palatable and eaten by stoats. All 15 stoats died after eating bait. Onset of symptoms occurred on average 17 minutes after eating the meat containing PAPP. Death occurred after a short period of lethargy and unconsciousness in an average time of 44 minutes, and symptoms demonstrated PAPP to be humane and effective. Subsequently field trials over two 1,500 hectare blocks of native bush PAPP paste produced 90% reductions in stoat populations. PAPP represents the first new active ingredient to be developed as a vertebrate pesticide for 30 years and the only one with humaneness as the primary consideration. The dose is optimised to reduce oxygen supply to the brain such that stoats become lethargic, sleepy and unconscious prior to death within 1 hour.

These pen and field studies were conducted with the approval of the Lincoln University Animal Ethics Committee. AEC approval numbers were 145 and 190 respectively.

Development and validation of the Behavioural Assessment for Re-homing K9's (B.A.R.K.)

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Behavioural assessments used by shelters to determine adoption suitability of dogs should ideally provide an efficient and accurate profile of each dog's behavioural characteristics. However, a scientific review of assessments currently used in Australia revealed a lack of standardisation and validation. To address this issue the B.A.R.K. protocol was developed; incorporating the best features of existing protocols into 12 subtests which aim to assess how a dog might behave in real life situations. Five behavioural attributes (anxious, non-compliant, fearful, non-friendly and active) were scored on a scale from 0 (behaviour absent) to 10 (behaviour extreme) for all subtests. To assess the reliability of the B.A.R.K. protocol, 48 dogs in a Victorian animal shelter were assessed on two consecutive days. The first assessment was scored independently by two observers. Pearson correlation analyses revealed that most measures of inter-rater reliability were statistically significant (p<.01) but ranged from weak to strong (r=.38 to .99). A second assessment was conducted 24 hours later and scored by one of the original observers. Again, Pearson correlation analyses revealed that measures of test-retest reliability were typically significant (p<.01) but ranged from weak to strong (r = 0.32 to 1.00). Measures of Compliance and Friendliness were most reliable (r = 1.00, n = 31, p<.001), with a perfect correlation for the 'resource guarding wet food' subtest. Findings that some correlations were not significant, and that many were weak to moderate in strength, raise concerns about whether some canine behavioural traits can be reliably measured in the shelter environment. This issue is critical having implications for both public safety and dog welfare; behavioural assessments, whether valid or not, are currently used to determine which dogs are suitable as pets, and which should be euthanased rather than rehomed. Further research is underway to investigate the validity of the B.A.R.K. protocol.

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The effect of cat behaviour on adoption, relinquishment and retention of shelter cats

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Data indicate that pet cats who display undesirable behaviour, such as inappropriate toileting, are at greater risk of relinquishment to shelters. To determine if this applies to cats adopted from a shelter, 212 people who adopted a shelter cat were surveyed by telephone. Variables collected included factors affecting the selection of a cat, the perceived presence and frequency of certain feline behaviours and ownership practices. Chi-square and correlational analyses explored the relationships between owner satisfaction, cat behaviour and relinquishment. Positive human-cat interactions influenced almost 70% of adoptive decisions. The failure rate of adoptions was low (6.5%), resulting primarily from owner-related factors, such as allergies and lifestyle changes. However, the effort required by an owner to care for their cat increased with the reported frequency of certain behaviours. These included excessive vocalisation ($x^2=83.905$, df=20, p< 0.001), timidity to visitors ($x^2=82.226$, df=20, p< 0.001), destructiveness ($x^2=76.345$, df=20, p< 0.001), aggression to people ($x^2=74.194$, df=20, p< 0.001), general fearfulness ($x^2=51.905$, df=20, p< 0.001), hyperactivity ($x^2=51.278$, df=20, p< 0.001),clawing property ($x^2=51.277$, df=20, p< 0.001), aggression to animals ($x^2=49.357$, df=20, p< 0.001), starting fights with another animal ($x^2=48.415$, df=20, p< 0.001) and housetraining problems ($x^2=38.154$, df=20, p= .008). While most cats displayed some of these behaviours (mean 3.54), cats that displayed greater numbers of them were over-represented amongst those who were relinquished ($x^2=18.44$, df=4, p= .001) and whose owners had unfulfilled expectations of cat ownership ($x^2=72.978$, df=16, p< .000). The presence of certain feline behaviours significantly and adversely affected the ownership experience and increased the risk of relinquishment. Identifying which cats display these behaviours could enable shelters to determine which cats are best suited for adoption, potentially increasing adopter satisfaction and reducing subsequent relinquishment. This research was performed in accord with Monash University Human ethics requirements.

The control of invasive animals in Australia: development of welfare based codes of practice, standard operating procedures and a model to assess relative humaneness

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Invasive animals such as rabbits, feral pigs, foxes, wild dogs and feral cats cause significant environmental damage and agricultural losses in Australia. The control of invasive animals is a complex issue and the traditional approach to addressing animal welfare concerns was to justify the harm done to these animals by espousing the economic benefits of control programs. This approach overlooked animal suffering and hindered attempts by animal welfare advocates to engage with the pest animal control community to change or ban unacceptable practices.

Over the last decade the promotion of best practice control strategies that aim to minimise negative impacts on both target and non-target species have seen changes to traditional approaches. Nationally applicable standard operating procedures and codes of practice have been developed and published for a range of invasive animal species. These documents openly and transparently identify negative and unacceptable welfare impacts and promote strategies to reduce these impacts.

A model has also been developed to assess the overall humaneness of invasive animal control methods. This model utilises published scientific information and informed judgement to examine the negative impacts that a method has on an animal's welfare and, if a lethal method, how the animal is killed. A score is generated so that the relative humaneness of different methods can be compared. Although it cannot achieve a purely objective assessment, this model provides a systematic, comprehensive and transparent process that helps to generate consensus among diverse stakeholders regarding the welfare impact of control methods.

This paper examines the development of these processes and the impact they have had on improving the humaneness of invasive animal management in Australia.

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How is welfare of transported turkeys affected by cage height?

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According to EU legislation sufficient height should be provided to animals during transport. The aim of this study was to investigate effects of different cage heights on turkey welfare. Male turkeys (N=36) weighing between 12.6 and 19.4 kg were confined singly and filmed for six hours in stationary cages (52W x 70L cm) which were either 40, 55 or 90 cm high. A blood-sample was taken after confinement for analyses of creatine kinase (CK), aspartate aminotransferase (ASAT), lactate and heterophil/lymphocyte (H:L) ratio. In addition, four commercial slaughter transports were followed using both 40 (N=504) and 55 cm (N=480) high cages (70W x 115L cm) where birds were kept in groups of four (slaughter weight 12.2±1.2kg (mean±SD)). Observations of behaviour during lairage (standing, lying and panting) and carcase damage (bruises on wings and rump and scratches on the back) were carried out. Birds confined singly in stationary 40 cm cages could not stand up and spent more time lying (Wilcoxon Signed Rank test; P<0.001), turned (P<0.001) and preened (P<0.001) less than birds confined in 55 and 90 cm height. There was no difference in CK, ASAT or H/L ratio between heights but CK increased with increased body weight (P=0.008). Lactate concentrations were significantly lower in 55 cm cage than in the 40 cm cage (Mann-Whitney; P=0.001) but no difference was found between 40 and 90 cm. After commercial transports the turkeys performed more panting (Mann-Whitney; P=0.001), and lying (P<0.001) during lairage in the 40 cm cage. Birds transported in 55 cm cages had more scratches on their backs than birds from 40 cm cages (GLM; F=27.6, P=0.013). While behavioural signs indicated more discomfort in the low cages, scratches during transport could have caused more pain to the birds in the higher cages.

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Effectiveness of different on-farm killing methods for cull turkeys

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Cervical dislocation and blunt trauma are accepted euthanasia methods for poultry. For large birds, it is sometimes recommended to use a tool for cervical dislocation (Saif et. al., 2003, Diseases of Poultry 11ed.). The effectiveness of a non-penetrating captive bolt (Zephyr) was evaluated for euthanasia of turkeys, and compared to mechanical cervical dislocation and blunt trauma. Two experiments were conducted to determine the effects of these killing methods on loss of sensibility, time to cessation of convulsions, and brain trauma. Presence of the nictitating membrane reflex was assessed at 15-second intervals to determine when insensibility occurred. In experiment 1, data were collected at a facility where mechanical cervical dislocation is routinely used. Turkey hens (11.4 ± 0.9kg) were killed with mechanical cervical dislocation using a burdizzo (n=26) or the Zephyr (n=46). Reflexes were present and gasping occurred in 100% of hens killed with mechanical cervical dislocation, versus gasping in 7% ($\chi2=48.8,P<0.0001$) and reflexes present in 17% ($\chi2=45.5,P<0.0001$) of hens killed with the Zephyr. Convulsions ceased sooner with mechanical cervical dislocation (mean±SEM, 114.1 ± 10.0s) than with the Zephyr (202.8 ± 8.0s, t=-6.14, P<0.0001). In experiment 2, turkey toms (13.1 ± 2.0kg) on commercial farms were killed with blunt trauma (n=32) or the Zephyr (n=46), and post-mortem examinations were conducted to score the severity of skull fractures and hemorrhage. Reflexes were similarly present in 2% of toms killed with the Zephyr and 6% of toms killed with blunt trauma. Although skull fracture scores were higher for the Zephyr (mean±SEM, Zephyr=3.1 ± 0.1, Blunt trauma=1.69 ± 0.14, t=-7.98, P<0.0001), hemorrhage scores did not differ. Time to cessation of convulsions did not differ (mean±SEM, Zephyr=199.5 ± 6.7s, Blunt trauma=217.9 ± 11.8s). Based on the absence of reflexes, blunt trauma and the Zephyr produce immediate insensibility by directly disrupting brain function, whereas the mechanical cervical dislocation method results in cervical crushing and anoxia, and fails to produce immediate insensibility.

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Elevated plasma corticosterone in domesticated hens affects their offspring's behaviour and physiology both in youth and adulthood

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Poultry production systems show variable production results despite standardization of both the genetic material and the birds' environment. Research on avian endocrinology has highlighted the influence of maternally derived yolk hormones on offspring phenotype. Artificial administration of corticosterone into eggs triggers behavioural and physiological changes in the chicks. However, the presence of elevated levels of corticosterone in bird eggs is disputed and egg injections may not result in physiological levels and distribution patterns. We artificially elevated plasma corticosterone concentrations in laying hens via subcutaneous implantation of corticosterone pellets (Ncorticosterone = 20, Nplacebo = 20). Hens were housed in outdoor aviaries (1,5x3m) in groups of four with one cockerel. Eggs were hatched or analysed for steroid hormone content. The presence of corticosterone was proven both in albumin and yolk in the eggs of the corticosterone implanted females via HPLC analyses. When compared to placebo-offspring (hierarchical models in MLwiN), the corticosterone implanted females' offspring grew slower the first 10 days of life (p = 0,015), they stole and ate less mealworms in a mealworm competition test (psteals mealworm = 0,001; peats mealworm = 0,023) on day 9, they were less right eyed lateralized (p = 0,011) on day 11. 11 weeks old they showed a lower antibody response to an immune challenge (p = 0,057), had higher baseline testosterone levels (corticosterone-offspring = 0,34±0,06 ng/ml, placebo-offspring = 0,1645±0,02 ng/ml; p = 0,022), and in adulthood performed shorter duration of tonic immobility (corticosterone-offspring = 75,80±11,49 sec., placebo-offspring = 180,37±12,50 sec.; p = 0,024). The results demonstrate that embryonic corticosterone exposure affects behaviour and physiology in chickens. Studying the effects of elevated prenatal hormone exposure in chicken may help to understand their behavioural ontogeny and explain the variability in behavioural problems in the poultry industry. The Dutch Animal Experiment Committee approved this experiment (project 5124A).

Preferences of laying hens for different dustbathing substrates

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Within the EU, adequate dustbathing material to enable scratching, pecking and dustbathing in cage-kept laying hens will be a legal demand after 2012. Presently, hens are mainly provided with food particles, which are dropped on Astroturf mats, due to a coupling of food chain and supply pipe of dustbaths. This study investigates the use of different substrates for selected behavioural traits in laying hens in order to particularily verify whether hens would choose food particles for dustbathing when different non-nutritive types of substrates were simultaneously offered. In 2 identical trials, 72 hens (LSL, LB) were kept in 12 compartments (6 hens each) equipped with wire floor and additionally containing 4 different dustbathing areas ($1000cm^2$/hen). Dustbaths contained wood shavings (WS), Lignocellulose (L, soft wood fibre, pelleted), Astroturf mat without substrate (A) and food particles (F). Hens were transferred to the experimental pens at the age of 18 weeks. After habituation, 3 video observations (week 21, 24, 27) were conducted. The number of hens dustbathing, scratching and pecking in the different dustbaths and dustbath lengths were recorded over 2 days in each week. A significant effect of substrate was found for dustbathing frequency (Kruskal-Wallis-Test, Chi-Quadrat 21.6, DF=3, p<0.001) with less dustbathing in F (26 dustbaths during observation period) compared to L (321, p<0.001) and WS (109, p=0.06) and least dustbaths on A (12). Lengths of dustbaths, however, tended to be longer in F compared to L. No effect of age or layer line was detected. Hens significantly preferred F to L (p<0.01), WS (p<0.05) and A (p<0.001) for scratching and also for pecking (L, WS, A: p<0.001). In conclusion, F was preferred for pecking and scratching but less attractive for dustbathing. This might be due to its nutritive character or fat content, which might have inhibited the lipid removal from hens' plumage.

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The use of anaesthesia and analgesia during dehorning and their effects on the welfare of Bos indicus cattle

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In northern Australia, cattle genotypes are predominantly Bos indicus-derived and the extensive nature of the production systems mean they are commonly dehorned at 5-9 months of age. Dehorning at this age is permitted without the use of anaesthetics or analgesics. To adopt pain relief management, producers must be convinced it is effective and practical. We examined the effects on welfare of the administration of a local anaesthetic and/or a non-steroidal anti-inflammatory drug (NSAID) during the dehorning of Brahman heifers (animal ethics approval RH245/08). Weaners, 5-7 months-old, were allocated to four treatments (n=15/group): Sham dehorn (S); Dehorn only (D); Dehorn + local anaesthetic (cornual block) + NSAID (LA/NSAID); and Dehorn + NSAID (NSAID). Blood samples were taken, via jugular venipuncture, 20min before treatment then 0.5, 1, 1.5, 2, 3, 5, 7, 9, 24, 48 and 72 hours and 2, 4 and 6 weeks post-dehorning. Liveweights were recorded fortnightly for 8 weeks. Counts of behaviour during dehorning showed LA/NSAID vocalised (mean±s.e; 1.6±0.9) and struggled (1.9±0.9) less (GLM, P<0.05) than D (12.1±2.3 and 6.3±1.5, respectively) or NSAID (14.5±2.5 and 8.3±1.7). Repeated measures ANOVA of plasma cortisol concentrations showed that after 30 min, NSAID were higher (74.5 nmol/L) compared to S (56.4 nmol/L), while D (66.8nmol/L) and LA/NSAID (68.0nmol/L) were intermediate, not differing from either (P<0.05; s.e. = 4.41). All samples taken after 7 hours post-dehorning were not different from control. LA/NSAID lost (P<0.001, s.e. = 1.4) more liveweight post-dehorning (13.9kg) than the NSAID (9.0kg) and D (8.3kg) groups, both of which lost more than S (4.1kg). We conclude that, although local anaesthetic reduced behavioural responses to dehorning, other indicators of stress and pain (plasma cortisol and weight loss) indicated that local anaesthetic and/or analgesic treatments did not improve welfare, which contrasts with findings for Bos taurus calves.

Behavioural challenges in managing invasive mammals and native wildlife for conservation in natural environments in New Zealand

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Many populations of New Zealand plants and animals exhibit low densities, poor recruitment, fragmentation and high extinction risk caused by invasive mammals that established widespread dense populations after they were introduced. Conservation organizations invest in pest control to reduce levels of herbivory and predation on native biota, and use captive rearing and translocation to help the most endangered cases. Behavioural studies of brushtail possums, ship rats, house mice, stoats, ferrets, cats, goats, pigs, tahr and deer help to improve poison, trapping, hunting and fencing operations. Trained dogs are increasingly used to find pest animals that have survived control operations, and recreational hunters are required to train their dogs to avoid birds before they are granted access to some areas. Behavioural studies of rare birds, bats, lizards and invertebrates are done to identify the agents of decline, reduce the risks of pest control for their protection and increase the success in re-establishment of extirpated populations. Conservation work in terrestrial ecosystems is characterized by pragmatic problem-solving which means behavioural research tends to follow rather than lead innovations by wildlife managers. Behavioural studies of freshwater organisms have had a more theoretical orientation and have shown how introduced predatory fish can change the behaviour of native invertebrates. In marine ecosystems, researchers have quantified changes in cetacean behaviour caused by tourist encounters and by aquaculture. The challenges of studying animal behaviour in natural environments in New Zealand include: predator-prey interactions have not arisen over evolutionary time scales and no level of coexistence may be possible; breeding by some threatened or endangered taxa is not annual and may require episodic increases in food supply; mutualisms and interactions amongst native organisms were not described before they were disrupted by agents of decline; and some invasive mammals are valued hunting resources.

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The welfare of wild animals – what does it mean?

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Animal welfare considerations are commonly applied to farmed, pet and competition species but there is increasing public concern for animals in the wild. Distinct from conservation issues, is it appropriate to consider the welfare of wild animals? Most animals are affected by human activity, even if their immediate environment is not directly disturbed. I suggest that as the impact of man increases, our responsibility for animals affected should increase. But are current frameworks used for welfare assessment (such as the "five freedoms") adequate or relevant for wild species? If not, what approaches can be used to make meaningful assessments? Would it be more valuable to evaluate pain, suffering, distress or lasting harm as for scientific studies using animals? While subjective and coping aspects of welfare are likely to be important, as for farmed species, I suggest that aspects of naturalness should be more prominent. In the same way that the "five freedoms" have evolved, a welfare assessment tool for wild animals could include aspects of ranging behaviour, disturbance, breeding choice, lifespan, foraging ability and health - assessed, for example, through measures of population dynamics, resource utilization or morbidity. This approach accords with the current shift in ethical thinking towards valuing the presence of positive welfare indicators rather than the absence of negative indicators and the desire to describe a "whole life" profile, thus taking a long-term view. Using an example of a managed but essentially wild population of red deer, I will consider aspects of nutrition, exclusion from habitats and the incidence of disease to explore whether such a framework could be applied generically. I will also consider the ethical dilemma of whether humans should intervene to address perceived welfare problems and return to question whether the term welfare can mean anything to a wild animal population.

Social attraction, social space and familiarity: how do these social factors influence movement?

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The spatial proximity of a grazing herbivore in relation to its group members is dependant on many factors, in particular, social attraction to peers, familiarity to group members and maintenance of personal space. In this study, a novel approach was used to investigate the social interactions between pairs of steers. The directed response of each individual towards the other animal was evaluated using vector methods. Nine pairs of familiar steers and nine pairs of unfamiliar steers were observed over a three week period. Each pair were enclosed in a 3 ha sub plot of Rhodes grass (Chloris gayana) dominant pastures and supplied with ad lib access to water. Contact between other pairs was restricted by a minimum 20 m buffer zone between sub plots. The distance between individuals and their movement vectors were quantified using visual observations. Vectors were assigned to the movement between pairs of steers and assessed for the quality of their relationship based on the distance maintained between pairs, the response in movement to each other and the familiarity of the pair. It was expected that unfamiliar pairs would maintain greater distances apart and be more responsive to the movement of their partner. Unfamiliar pairs kept greater distances apart (Familiar: (mean±s.e.) 11.1±1.79 m, Unfamiliar: 19.6±3.45 m, $P<0.05$) and showed greater levels of both moving towards each other (Familiar: 3.8±0.67%, Unfamiliar: 6.2±0.68%, $P<0.05$) and away from each other (Familiar: 6.0±1.24%, Unfamiliar: 11.3±2.00%, $P<0.05$). The average proximity between unfamiliar pairs decreased over time and was comparable with familiar pairs after four days (Day 2: Familiar: 8.4±2.82 m, Unfamiliar: 26.3±6.97 m, $P<0.05$; Day 3: Familiar: 7.9±1.36 m, Unfamiliar: 16.6±4.19 m, $P<0.10$). These results provide evidence that familiarity affects proximity between pairs of steers and influences their movement patterns, with familiarity being established four days post-introduction of unfamiliar animals.

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Monitoring grazing patterns and habitat selection of the Scottish Blackface, a traditional hill sheep breed, compared with a crossbred, Scottish Blackface x Texel using GPS Satellite telemetry collars

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Environmentally sustainable grazing regimes are an important aspect of domestic livestock farming in upland hill areas. The aim of this study was to investigate grazing patterns, habitat selection and spatial distribution of the Scottish Blackface, a traditional hill sheep breed, compared with a crossbred, Scottish Blackface x Texel in a natural, free ranging environment. Animals involved in this study were two-year-old females, reared on the hill, grazing 163 hectares. GPS collars were programmed to record GPS locations at 30-minute intervals between 06:00 hr-22:00 hr (day) and 60 minute intervals between 22:00 hr-06:00 hr (night). Monitoring took place during May to October 2008. Four GPS collars were available. Collars were placed on two ewes from each breed, ewes were returned to the flock and grazed as normal. Collars were changed to different ewes approximately every 4 weeks. Results from eighteen ewes, nine per breed were suitable for analysis. Habitat mapping was carried out; aerial photos were used as a base, followed by ground mapping. Information was entered into ArcView GIS.3.2. Habitat maps were created and combined with collar data. Results were recorded for percentage occurrence on habitats, altitude and distance moved. Data were analysed by Analysis of Variance using Genstat, analysing day time, night time and 24-hr period movements separately. Scottish Blackface occurred more often in heather habitats than the Scottish Blackface x Texel, both day and night ($P>0.05$). Scottish Blackface x Texel occurred more often in Juncus habitats both day and night ($P>0.05$). Scottish Blackface grazed at higher altitudes ($P>0.01$). Distance moved and area covered also showed significant differences between breeds. Results indicate that Scottish Blackface ewes display better characteristics for grazing and managing vegetation on hill environments. Better knowledge of breed habitat selection, foraging behaviour and grazing patterns could be used as an indicator for grazing management.

A wireless sleep actigraph for calves

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Sufficient sleep is important for calf welfare, but so far the only possibilities measuring sleep in production systems are either using ambulatory EEG or validated sleeping behaviour. We aimed at developing a wireless actigraph for measuring sleep in calves. We attached lightweight, wireless 3-dimensional accelerometers to collars of six under 6 week-old calves, kept in a straw-bedded group pen. The device registered movement and inclination in three axes at 25 Hz with sensitivity of 2g. We filmed calves behaviour simultaneously for 48 hours, and estimated the daily duration for sleep (S), rapid-eye-movement sleep (REMS) and non-REM sleep (NREMS) based on resting posture (Hänninen et al. Appl. Anim. Behav. Sci. 111, 2008). A model for predicting sleep based on the accelerometer data was developed with the data from 3 calves, and the accuracy of the model was tested with the other 3 calves. The model used the mean, variance and the wavelet variance of the data to predict sleep with a Support Vector Machine classifier. The daily time spent in S, NREMS and REMS was calculated from the observed and predicted behaviours, and compared with a t-test.

The model was able to distinguish (mean ± S.E) 93 ± 3% of total S time, 89 ± 9% of total NREMS and 83 ± 2% of total REMS. There were no statistically significant

differences (p>0.05) in daily S, REMS or NREMS between the observed and predicted behaviour for the 3 calves used in validation (621 vs. 602 min, 351 vs. 339 min, 316 vs. 351 min, respectively). We were able to record calves´ sleep using a wireless accelerometer together with a model for classifying the behavior with a good accuracy. The device provides a method to continuously measure sleep in calves in production environment without disturbing the animals.

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Assessing cattle welfare at stunning

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When animals are inadequately stunned before slaughter there are serious implications for animal welfare. The most common mechanism for cattle stunning is induced concussion by a captive-fired or pneumatic-fired bolt into the forehead. Careful observation of behavioral symptoms is required to determine if animals are adequately stunned. The aim of this study was to develop a standardized protocol for assessing stun quality in abattoirs. This included a list of behavioral symptoms that cattle display at stunning which classified adequate or inadequate stunning. Inadequate stun behaviors included display of corneal reflex, blinking, breathing, any combination of eyeball rotations, eyeball twitching, nostril flaring, groaning or severe righting reflex. Two-thousand-eight-hundred-and-two cattle (1250 bulls, 1330 cows, 124 steers, and 98 calves) in 5 abattoirs in Sweden were assessed. Stun quality was recorded as a binary outcome (inadequate; adequate). The effect of weapon type (captive bolt or pneumatic) and of cattle sex on stun quality in individual animals was assessed separately using z-test and Chi-square-test, without accounting for clustering by abattoir. The percentage of animals poorly stunned varied significantly between sexes (Chi2=159; 3 df; P<0.0001), with the highest percentage in bulls (13%). Percentages for cows, steers and calves were 1.4, 2.4 and 4.1%, respectively. Captive bolt gun was used in 2306 cases and pneumatic gun in 496 cases. The percentage of inadequate stun was greater with captive bolt (8.0%) than with pneumatic gun (0.81%) and the difference was statistically significant (z=5.8; P<0.0001). Reasons for poor stunning were attributed to use of worn out weapons, damp ammunition and weapons with insufficient power for stunning bulls. In one abattoir, 15% of the bulls showed poor stun quality even though they were shot accurately. The assessments provided abattoirs with valuable information on stun quality status and highlighted the need for better weapons to ensure adequate stunning in bulls.

Introducing herd health and welfare plans on Austrian organic pig farms

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Herd health and welfare plans are obligatory in organic and several conventional assurance schemes in the UK. Aim of this study was to introduce this management tool on Austrian organic pig farms based on health and welfare assessments. We visited 35 farms with a median number of 21 sows (12-500), 70 weaners (9-995) and 113 finishers (12-669).

The initial, one-day farm assessment includes an interview regarding management and feeding, qualitative and quantitative behavioural observations, animal based parameters (e.g. lesions, body condition), measurements of housing and treatment and production records. Results are summarised in a written plan including benchmarking of animal based parameters. This document is discussed with the farmer, who decides on areas to improve during the following year in cooperation with the researcher, his vet and/or organic advisor. Farms will be re-assessed after one year and a new plan will be made.

Best quintiles (Q1) for fight lesions were 0-0.3% and 0-4% for weaners and fatteners, respectively, while worst quintiles (Q5) were >20-67 and >20-90. In Q1 (Q5) for dry sows animals had on average 0-0.3 (>3-6) lesions per sow on shoulder/side. Prevalence of deformed vulva in sows ranged from 0% (Q1) to >17-50% (Q5). Tail injuries were absent in Q1 for weaners and fatteners, yet in Q5 >2-13% (weaners) and >3-63% (fatteners) of animals did have tail injuries. Until now 35 farms decided on 2-3 areas, including health and welfare strategies (36%), feeding (24%), management (23%) and housing (17%).

To conclude, our findings demonstrate a potential for health and welfare planning in Austria. In addition, the concept of is well received by farmers and many farm individual targets are related to animal health and welfare. However, farm visits are still on-going and the effectiveness of the planning process can only be evaluated after the final visit.

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Monitoring livestock in extensive grazing systems for environmental and production outcomes

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Australia supports 25 million cattle and 87 million sheep, of which over 90% are managed under extensive grazing systems in the lower rainfall wheat-sheep and pastoral zones of the country. Stocking rates vary from 5 to 50 ha/adult equivalent (AE = 450 kg bovine). Over the past 20 years advances in electronics and information technology have increased our ability to monitor livestock under extensive grazing conditions. Today, the goal is to determine the mechanisms behind behavioural strategies exhibited by livestock in extensive environments and to understand how livestock interact with their environment. Controlled experimental methods provide one way to study animal behaviour, however studying animals in extensive systems requires a more holistic approach, recording many aspects of behaviour in the natural environment. Monitoring techniques such as global positioning system tracking of livestock integrated with remote sensing of the environment are integral in understanding livestock behaviour. These systems provide information on where and what an animal is doing thereby allowing researchers to determine grazing motivation and social interactions. The increasing variety and sophistication of these technologies, particularly when combined in integrated networks, is allowing a shift from passive animal management, such as fencing and watering points, to active remote management. This paper uses examples to demonstrate how technological advances are helping behavioural-based studies in extensive grazing systems typical of northern Australia. These include terrestrial sensor networks that monitor soil moisture and pasture biomass, satellite sensors that estimate ground cover and pasture species and on-animal sensors that can determine animal position and differentiate between activities, such as grazing, walking and resting. On-animal controllers can also manage the distribution of livestock across the landscape. This information can be used to maximise livestock productivity, minimise environmental impact and ensure the highest welfare standards are met.

Relationship between behaviour and brain activity during the inhalation of 90% CO2 in pigs

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Exposure to a high concentration of carbon dioxide (CO_2) is a widely used method to stun pigs. During inhalation, loss of consciousness is not immediate and there is a period of time when the animals can suffer from suffocation or distress. The aim of this study was to assess the brain activity of pigs with an index of consciousness (IoC) given by the electroencephalogram (EEG) during the exposure to $90\%CO_2$ and to know how this is related to different behaviours (gasping, vocalisations, muscular excitation) and reflexes (loss of posture). IoC view®(Morpheus Medical) is a device that assesses the consciousness by an algorithm that analyzes the EEG and gives an index from 0 (unconscious) to 100 (conscious). Ten pigs of 93±1.8kg weight were individually exposed to an atmosphere of $90\%CO_2$ during 2 min by descending into a crate of 3m depth. The IoC of each pig was recorded during 5 min before the exposure to assess the basal values, during the 2min of exposure to assess the loss of consciousness and during 5 min after the exposure to assess the recovery. The data were analyzed using Mixed models of SAS. The IoC value (56) was significantly lower ($p<0.05$) than basal level at 87s from the beginning of the exposure to the gas. During the induction, 90% of the animals showed gasping at 22.1±0.82s and all the animals lost balance at 23.8±1.53s; 90% of pigs showed muscular excitation at 24.3±1.50s, 50% vocalised at 33.0±2.41s and all of them showed gagging at 38.3±0.87s. IoC values did not reach the basal level during the five min after exposure. According to the results, loss of balance could not be taken as an indicator of loss of consciousness in pigs and the beginning of vocalisations and muscular excitation could occur when the animal is still conscious.

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Evaluation of an animal-based welfare protocol for growing pigs in intensive and extensive conditions

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These results are part of the validation study of the Welfare Quality® protocol on growing pig farms. The feasibility and variability of several animal-based welfare parameters were assessed on 30 intensive and 11 extensive Spanish farms. A total of 64496 and 5821 pigs, respectively were evaluated based on 11 criteria related to the 4 welfare principles of good feeding, housing, health and appropriate behaviour. Good feeding, good housing and health parameters were scored at pen or individual level according to a three-point scale ranging from 0 (good welfare) to 2 (poor or unacceptable). Appropriate behaviour was assessed by means of scan sampling of social and exploratory behaviour, qualitative behaviour assessment and human-animal relationship test. Results were expressed as percentage of animals or pens affected and as occurrence of certain behaviours. Differences between farms within the same production system were evaluated by means of logistic models and the significance of the farm effect was fixed at $P<0.05$. In intensive conditions, the variability of the following parameters allowed the differentiation between farms: moderate (mean±sd=45.5±21.04%) and severe bursitis (4.4±5.66%), manure on less and more than 50% of the body (16.5±13.43%, 3.7±6.37%, respectively), tail biting (0.9±2.02%), scouring (12±18.7%), localised and widespread skin discolouration/inflammation (2.8±4.63%, 3.6±5.97%, respectively), expression of social positive (12.2±5.12%) and negative behaviours (5.4±2.66%), exploratory behaviours (31.3±8.00%), and fearful behaviour (13±19.1%). In extensive conditions, the variability of the following parameters allowed the differentiation between farms: poor body condition (0.7±1.59%), wounds (0.4±0.86%), localised skin discolouration (1.1±1.75%), exploratory behaviour (41.3±23.83%) and fearful behaviour (33±43.2%). Therefore, variability within certain parameters is sufficiently high to allow detection of farms with a particular welfare problem. However, the prevalence and occurrence of animal-based parameters should be carefully considered along with environmental and management conditions in order to avoid misinterpretations.

Acoustic features of trapped piglet screams and their effect on maternal reactivity

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Many deaths of live-born piglets are caused by the sow crushing piglets when she changes posture. When a piglet gets trapped it starts screaming immediately. However, the responsiveness of the sows toward screams was found to be variable which could be caused by differences in the scream characteristic. We predicted (i) that screams of heavy piglets should differ from light piglets in their acoustic structure and (ii) that sows should have higher responsiveness towards screams of heavy piglets .The two lightest and two heaviest piglets were chosen in 15 litters. The piglets' screams were recorded on Day 1 after birth during a simulated crushing situation lasting 30 sec. Experimental procedures were approved by the Institutional Animal Care Committee. 1431 calls (n=59 piglets) were individually sampled and analyzed in their time and frequency domain. None of the frequency structure of the calls showed any significant differences between heavy and light piglets. However, light piglets had a shorter call duration compared to heavy piglets (GLMM, $F_{1,17}$ =13.7, p < 0.002). On Day 2 a playback with screams of the lightest crushed piglet and a playback of the heaviest crushed piglet in the litter were presented during a lying down event to 12 sows. The sows did not differ in their reaction to the screams of the heavies and lightest piglet (GENMOD; $?^2(1)$= 0.33, NS). In conclusion, piglet weight did not significantly influence the vocal structure of screams during a crushing event. This suggests that all piglets vocalize at maximum during this life threatening situation and the sow's responsiveness towards crushing screams is influenced by other factors than the piglet weight.

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Insulin and prolactin secretion are boosted within a few hours after parturition in ewes selected for calm temperament

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Lambs born from ewes selected for calm temperament have higher rates of survival than lambs born from nervous ewes. The differences in survival rates may be because calm ewes produce better quality colostrum than nervous ewes. As the production of colostrum depends on hormonal factors, a possibility is that the differences reported in colostrum between the two lines is due to some differences in the hormones required for colostrum production. Therefore, we investigated whether temperament affects the hormones involved in the production of colostrum. Calm (n = 10) and nervous (n = 12) temperament ewes were housed indoor in individual pens. Blood was sampled (9 ml) by jugular vein venipuncture daily from 4 days before parturition and every 6 hours through to 24 hours after parturition. Plasma insulin, insulin-like growth factor 1 (IGF-I), prolactin and leptin levels were measured by radio immunoassay and analysed by a repeated measures ANOVA. Insulin concentrations increased directly after birth and were higher (F = 2.69, df = 7,137, p = 0.046) 2-8 hours after parturition in calm ewes (2 hr = 31.8 ± 9.9; 8 hr = 27.02 ± 9.5) than nervous ewes (2 hr = 17.9 ± 2.6; 8 hr = 9.5 ± 1.75). Calm ewes also tended (F = 2.2, df = 7,137, p= 0.079) to have higher concentrations of prolactin directly after parturition than the nervous ewes (Calm = 663.7 ± 69; Nervous = 528.5 ± 49.5). No differences were detected between temperament lines in the concentration of leptin or IGF-I at any time point. Both prolactin and insulin play a role in the production of colostrum, and our data suggests that the increased levels of insulin and prolactin in the calm ewes may contribute to the calm ewes producing better quality colostrum than the nervous ewes.

Measurement of feeding motivation in sheep: effects of food restriction

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Many animals are exposed to periods of limited food availability at some stage of their life cycle, which could potentially lead to a feeling of hunger. To understand the animal's perception of hunger, it is essential to objectively measure subjective feelings such as hunger. This study therefore aimed to evaluate the effects of food restriction on feeding motivation in ewes. An additional aim was to develop a quantitative method for the measurement of feeding motivation as an indicator of hunger. Sixteen ewes were tested in a long, narrow race in which they could work (by walking a certain distance) to gain access to a food reward. All ewes were exposed to five different cost levels (2, 6.6, 12.1, 22, and 40 meters) and two feeding levels (24-hour restriction and an unrestricted control) for a period of 22:50 hrs per test. Data was analysed using REML and the demand function was calculated as $Ln \ (Q) = ln(L) + b[ln(P)] - a(P)$ with L as initial level of the demand curve, b as the initial slope and a as the acceleration of the slope with increasing cost. The results showed that 24-hour restriction significantly increased the number of rewards consumed ($P<0.001$) and total distance walked ($P<0.001$). In addition, all ewes significantly reduced the number of rewards consumed when cost was increased ($P<0.001$). The demand function showed that there was only a small difference in Pmax (point on the demand curve where elasticity of demand takes the value -1). However, the maximum work output at Pmax (Omax) was almost twice as large in restricted compared to unrestricted control ewes. It is concluded that 24-hour food restriction increased feeding motivation in ewes. The behavioural demand approach is therefore a suitable and sensitive measure of feeding motivation and a potential indicator of hunger in sheep.

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Maternal behaviour in ewes when their offspring experienced stress and pain

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Good mothers provide comfort and protection to their offspring. We hypothesized that ewes with twin lambs would show changes in attention and grooming behaviours according to their offspring's stress and pain experience. The experiment was carried out under UK Home Office License. On day two after birth (D2) maternal behaviours (e.g. sniffing, licking and glancing) were recorded after 10 minutes of handling, in 31 pairs of lambs. This was used as a baseline comparison to behavioural data collected following adverse treatments on D3 and D4. For each day of treatment, we analysed pairs where one sibling was treated and the other remained as a control (handled only). Twenty-four pairs were used on D3 and 21 pairs were used on D4. On D3, the treated twin was stressed by either LPS injection (17/24) or 10 minutes of social isolation (7/24). On D4, the treated twin experienced pain. Nine out of 21 treated lambs and 7/21 controls on D4 had experienced stress on D3. The remaining lambs had experienced just handling on D3. Pain was induced by tail docking and castration in males (16/21) and tail-docking in females (5/21). LPS and social isolation data were pooled together for D3 analysis, as were tail-docking and castration data for D4. Using Wilcoxon rank sum test in JMP® (version 7.0.1, SAS Institute), we observed a higher frequency of "sniffing" (p=0.0032) and "glancing" (p=0.0001) by ewes towards treated lambs on pain day, compared to matched baseline measures recorded on the same animal, while no effect was found for other behaviours during either stress or pain treatments. In conclusion, ewes showed increased attention towards their offspring experiencing pain. Further studies will determine the effect of increased ewe attention on the

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The agony and the ecstacy: wildlife-human interactions in an urbanising world

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For the first time in human history, most people on earth now live in cities. Among the many profound implications of this process has been a radical alteration in the relationship between humans and nature. Increasingly, human life appears remote and independent of natural processes, and is often accompanied by historically novel interactions with and perceptions of wild species. Deprived of the usual intimacy between people and wildlife, contemporary urban humans are now subject to what has been termed "the extinction of experience". While most wild species do not survive urbanisation, those that do often thrive in the new anthropogenic environments. Such synanthropic species typically develop or evolve a range of behavioural traits including tolerance or habituation to the presence of humans. These traits are often correlated with species known for serious wildlife-human conflicts, as well those that are welcomed into our private spaces. This plenary address will explore some of the more important wildlife-human interactions that occur in suburban environments, including attacks on humans by Australian magpies, the invasion of mound-building birds into cities and the dilemma of urban flying fox roosts. I will also outline recent work on the most universal of suburban wildlife-human interactions, wildlife feeding, a ubiquitous past-time that is remarkably controversial in Australia.

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The human-animal relationship in commercial laying hens

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The impact of the human-animal relationship on hen welfare was examined at 29 laying sheds in Australia and the USA. Fear of humans was assessed by counting the number of birds that remained at the front of the home cage, or had their head out of the home cage, during a human approach test. A principal components analysis identified two components from these data, labelled the 'Forward Score' and the 'Heads Out Score'. A high value for either score indicates low fear of humans. Stockperson behaviour in each shed was studied over 2 days by recording the following behaviours (frequency of behaviours/m of aisle length, with frequency of behaviour recorded using a 5 s bout interval): Visual presence in the aisle (Visual); approaching the cages (Approach); physical contact with the cage (Contact); hands inside the cage (Entry), touching the birds (Handle), and human-made noise (Noise). A composite variable (Near Cage) was created by summing 'Approach', 'Contact', 'Entry' and 'Handle'. Stockperson speed of movement (SOM, m/s) and the time spent stationary (Time Stationary, s) were also recorded. A partial correlation analysis was conducted with country partialled out due to the large differences in bird and stockperson behaviour between Australia and the USA. The 'Heads Out Score' was positively correlated with the stockperson behaviours 'Near Cage' ($r = 0.48$, $P < 0.05$); 'Contact' ($r = 0.40$, $P < 0.05$), and 'Time Stationary' ($r = 0.38$, $P < 0.05$), whilst 'Noise' was correlated negatively with both the 'Forward Score' ($r = -0.65$, $P < 0.01$) and 'Heads Out Score' ($r = -0.59$, $P < 0.01$). These results indicate that bird welfare could be improved by increasing the number of human-animal interactions that occur in close proximity to the cages, and by reducing the amount of noise that stockpeople make in the laying shed.

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Development of the Canine Five Factor Model of personality (CFFM) and Monash Canine Personality Questionnaire-Revised (MCPQ-R)

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Dogs are a valued part of our society. Canine behaviour is a major factor in the success or failure of the human-dog partnership. Understanding and being able to predict behaviour in individual dogs would aid in the effective selection of dogs for roles within our communities. Several animal species have been found to have stable behavioural tendencies or behavioural individual differences (BIDs) which show remarkable similarity to the construct of personality in people. An overview of animal studies found that while personality factors can be reliably identified in animals there has been a tendency for researchers to rely on human personality descriptors. Few attempts have been made to ascertain if dog personalities fall into the same dimensions as human personalities. A model of canine personality and a questionnaire for assessing individuals was developed using the methodology used to develop the Big Five Model of human personality. People knowledgeable about dogs created a list of personality adjectives applicable to dogs. Three independent groups of dog owners (n=92, n=1016, n=455) were instructed to rate how well each word described their dog using a 6-point scale Factor analysis and structural equation modeling identified five dimensions labeled: Extraversion, Motivation, Training Focus, Amicability and Neuroticism. Validation studies with 455 dogs revealed no effect of dog factors, for example breed and sex, or owner factors, for example gender, education or dog ownership, on the ratings. An inter-rater reliability study with 65 dogs each with two owners showed the dimensions to have significant Intra-class correlations between 0.73 (Training Focus) and 0.86 (Extraversion). A test-retest reliability study with 50 dogs showed significant Intra-class correlations between 0.93 (Motivation) and 0.79 (Neuroticism). These two studies show the MCPQ-R to be a valid and reliable instrument for describing canine personality using the CFFM.

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The effect of familiarity on behaviour of kennel housed dogs during interactions with humans

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Human contact can positively alter kennelled dog behaviour. Dogs often instigate social contact with people, but it is unclear what type of human contact is preferred. This study assessed the effect of familiarity of the human on interaction by kennelled dogs. Two populations were studied: dogs in long stay enriched (LSE) kennels (N=23; three breeds), born on site or brought in at ~9 weeks old; dogs in rehoming (RH) kennels (N=25; three breed size groups) entering the kennel as adults. Volunteers (classed as unfamiliar or familiar to each dog) entered the pen and sat for 10 minutes. If the dog was 'next to' (within arms' reach) they petted and spoke to the dog, otherwise they ignored the dog. The two most behaviourally distinct time periods, 0-2min and 8-10min, were analysed. LSE dogs spent more time 'next to, facing' the unfamiliar (mean=42.7±4.2s) than the familiar person (33.7±4.0s) at 0-2min (Wilcoxon Z=2.345, P=0.019), whilst spending longer 'far away' from the familiar (29.8±7.1s) than the unfamiliar person (12.6±4.0s) at 8-10min (Z=2.199, P=0.028). Breed differences were only evident at 8-10min and when the person was familiar. RH dogs spent longer 'next to, facing' familiar (50.5±4.5s) than unfamiliar people (40.3±5.1s) at 0-2min (Z=2.354, P=0.019) whilst showing a tendency towards longer 'next to, away' unfamiliar (34.0±5.3s) than familiar people (23.2±3.5s) at 0-2min (Z=1.843, P=0.065). No breed group differences were observed. Findings for LSE dogs suggest preferences for unfamiliar people in dogs that receive high daily levels of human contact. RH dogs appear to value familiar and unfamiliar contact equally, but with unfamiliar people are more alert to their surroundings. Overall, preference for familiar or unfamiliar human contact appeared to be affected more by environment and past experience than breed. Therefore, the benefit of different forms of human contact is likely to differ between facilities.

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On the mental life of fish: an examination of key philosophical arguments both old and new with an eye to concerns related to moral status and welfare

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Our view of nonhuman animals has been influenced by a priori claims about the capacities of animals. Animals such as fish are excluded from the moral community because they lack intentionality as a basic capability. Here, animals like fish do not have intentional mental states, that is, their mental states lack content or 'aboutness'. The upshot is that animals like fish cannot be conscious. In recent decades, animal ethologists and philosophers alike have appealed to a posteriori arguments that attempt to debunk the view that intentionality and thus, conscious states, are exclusively human capabilities. Appeals to the evolution of complex cognitive skills per fitness, in conjunction with evidence of their social and environmental intelligence, serve to motivate the belief that animals, too, lead intentional lives. A central premise here is that conscious intentional states are a precondition of learning. This paper argues that 'aboutness' or mental content vis a vis mental representations can also be discovered in fish. Representational content can be ascribed in fish when we consider how beliefs and desires, from the fish's point of view, influence behaviour. As will be argued, the relationship between beliefs, desires and mental representations as they relate to learning and manifested through competition over access to mates, cooperation for hunting, information gathering, symbiotic cleaning, and foraging in teleost fish, will be discussed. After a discussion of the influential arguments' of philosophers Descartes and Donald Davidson, this paper will consider the merits of an a posteriori way of thinking about mind in animals. Building on Dennett's 'intentional stance' towards the behaviour of animals, it will be argued that inferring the presence of intentionality or 'aboutness' is the most plausible explanation behind learning in certain fish. The implications for the moral status and welfare of fish will be discussed briefly thereafter.

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Side biases of feral horses: species-typical specializations

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Visual side biases and limb preferences have been shown recently in domestic horses. In order to determine whether these asymmetries are species-typical or generated by human handling we conducted observational field studies of feral horses in two locations: Mona Mona Aboriginal Mission (N=19), Queensland and Oxley Wild Rivers National Park (N=34), NSW, Australia. Agonistic interactions of 7 stallions were scored from video-taped stallion fights. A significant left-eye preference to view the conspecific was found in bouts containing intense aggressive responses (Wilcoxon, Z=-2.03, p=.042; medianleft=34; medianright=18), compared to no significant eye preference for bouts with only threats. This left-eye bias for aggression, which reflects use of the right hemisphere, has also been found in a number of other species and has implications for the side of handling horses. We also recorded the forelimb placed in front of the other forelimb during grazing in 53 feral horses (77-133 scores per horse) and found no significant population bias (mean %preferenceleft=50.9, SE=1.0). However, the strength of limb preference differed significantly between 13 young horses (age<2year), 20 mares and 20 stallions, F(2,50)=10.53, p<.001. The young horses had stronger limb preferences (mean %preferenceabsolute=60.20, SE=1.49) than mares (mean %preferenceabsolute=54.13, SE=0.86; p=.001) and stallions (mean %preferenceabsolute=53.79, SE=0.77; p<.001). In fact, 6 of the 13 young horses displayed significant individual limb preferences compared to only 4 of the 40 adults. Our findings demonstrate that, as in domestic horses, perceptual and motor laterality is present in feral horses. However, whereas limb preference develops with age in domestic horses, it disappears with age in feral horses. Hence, experience may change limb preference in horses. In the natural environment, the change is toward ambidexterity, which would allow greater versatility in rapid movements during flight. Domestic horses may lack this requirement for ambidexterity or conventional left-side handling could entrain left-limb preferences.

Comparative studies will offer new opportunities for animal welfare research

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Comparative studies in animal welfare optimize the access and the use of resources and foster unique interdisciplinary research environments. We started comparative studies applying our welfare assessment "toolbox" to measure stress biomarkers in pregnant women and troubled youth. Blunted morning cortisol levels, found in our human subjects at risk of premature births, were comparable to the blunted morning cortisol levels which we reported in chronically stressed sows. We studied aggression, spatial memory and brain gene expression in early-weaned pigs. Premature maternal separation increased aggression, likely, as a result of memory impairment due to stress related damage in the hippocampus and frontal cortex of prematurely weaned pigs. We proposed that the early-weaned pig was a model to study "post-traumatic" stress disorders. We are currently studying two animal models that we, arbitrarily, considered likely candidates to explain some aspects of dysfunctional affective disorders in humans. Dysfunctional affective disorders are the cause of debilitating conditions that compromise human and animal welfare on a global scale. Common to humans and animals are some of the dysfunctional affective disorders such as excessive fear, chronic pain, and anxiety disorders. All of these conditions are life threatening pathologies often associated with changes in the brain in response to traumatic, stressful situations. Our studies of tail-biting in pigs and excessive fear in sheep are in collaboration with our Nordic network and with a psychiatric research team, in Oslo. In our current studies, we are conducting a comprehensive battery of behavioural and physiological tests, brain gene expression studies, gene polymorphism studies in addition to pilot brain imaging measurements. Our ability to understand brain processes using non-invasive techniques, such as magnetic resonance imaging, in healthy and diseased animals will be extremely beneficial to address this very important comparative research area.

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The modern work of dogs: what is it and how does it influence dog behaviour and welfare?

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Relationships between dogs and humans are unique in their diversity across time and place, a testament to the incredible flexibility of the canine genome. Rarely, however, has any animal species been elevated in status to the extent observed for dogs in some contemporary societies. Modern human-dog relationships are unique in evolutionary terms and remain poorly understood. In this paper it will be proposed that modern dogs fulfil roles different from, but equally important to, those played by their ancestors when they gathered our sheep and protected our prized possessions. These roles might best be conceptualised as satisfying the otherwise unmet psychological needs of human owners for, among other things, companionship and social support, a parental attachment figure, a dependent child figure, a therapist, spouse and witness to our existence. Once the work of dogs is defined in this way, questions about their ability to adequately perform these roles can legitimately be asked, as can questions about whether our current demands on dogs have influenced canine behaviour and welfare. This is clearly the case and the outcomes are not always positive. Canines with overt behavioural disorders, perhaps indicative of underlying psychopathology, now occupy a range of professionals with job descriptions that did not exist several decades ago. Welfare shelters overflow with dogs discarded by owners whose expectations, often unrealistic to begin with, are not met. Genetic diseases and morphological traits that adversely affect canine health, welfare and behaviour are increasing in prevalence. To ensure that both humans and dogs benefit to the fullest extent possible from our shared activities, applied scientists need to work more closely with theoretical scientists to develop a multidisciplinary approach to describing, explaining and promoting optimal human-dog relationships.

Assessing dog aggressiveness: validation of a behavioural test using the c-barq questionnaire

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The goal of the current study was to determine the validity of a test for the direct assessment of aggressive behavior in domestic dogs using a previously validated questionnaire for indirect (by owners) dog behavioral assessment.

A convenience sample of ninety-eight owner-dog pairs were enrolled in the study. A modified C-BARQ questionnaire (Hsu & Serpell, JAVMA 223: 1293, 2003) for the evaluation of canine fearful and aggressive behavior was administered to owners. Subsequently, their dogs were evaluated directly for aggressiveness using the standardized SAB test (Planta & De Meester, Vlaams Diergeneeskundig Tijdschrift 76: 359, 2007). Scores for 8 distinct C-BARQ subscales were recorded: Stranger Directed Aggression (SDA), Owner Directed Aggression (ODA), Dog Directed Aggression/Fear (DDAF), Familiar Dog Aggression (FDA), Trainability (T), Stranger Directed Fear (SDF), Touch Sensitivity (TS) and Attachment/Attention Seeking (AAS). Based on their SAB test results, dogs were divided into either aggressive or non-aggressive groups according to established guidelines (Van der Berg et al., Behav. Genet. 33: 469, 2003).

Analysis of the results of the two methods of assessment indicated that dogs that were categorized as aggressive on the SAB test obtained significantly higher (more aggressive) scores on the CBARQ subscales SDA (one-way ANOVA, $p < 0,001$), FDA ($p = 0,006$) and ODA ($p = 0,025$) than the dogs in the non-aggressive group. Using the information from this study the authors believe that several components of the SAB test could be used as a valid tool to provide decision-makers with objective evidence for the evaluation and management of aggression in dogs.

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Dog aggression towards family members: unpredictability of the attacks as a risk factor

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A proper knowledge of risks factors related to aggression may help to develop preventive measures. One of the aspects that increase the risk of living together with an aggressive dog is the impulsiveness of the attacks. Previous studies conducted by the Animal Behaviour Service - Barcelona School of Veterinary Medicine (ABS) concluded that English Cocker Spaniel (ECS) showed a higher percentage of owner directed aggression and a higher rate of impulsiveness (lack of warning signals before an attack) than aggressive dogs of other breeds. The objective of this study was to gather further information on impulsive aggressive dogs to understand the factors that underlie impulsiveness as a risk factor. One hundred nineteen ECS presented for owner directed aggression at the ABS were evaluated. The clinical history obtained through a questionnaire to the owner provided general information and a detailed description of the aggressive episodes. The study group was compared with 155 dogs of other breeds that showed owner directed aggression. All comparisons were done through chi-square tests using the SPSS 15.0 for windows. The ECS group showed owner directed aggression with impulsiveness more frequently than dogs of other breeds (43.7% and 31 % respectively; $x^2 = 4.7$; p<0.03). Impulsive ECS were purchased more frequently from a pet shop than non impulsive ECS (58.3% and 38.6 % respectively; $x^2 = 4.06$; p<0.05). No differences were found between non impulsive ECS and non impulsive dogs of other breeds in their origin. Regarding the context in which aggression occurred, impulsive ECSs reacted more frequently when being petted than non impulsive ECSs (48.1% and 27 % respectively; $x^2 = 5.7$; p<0.02). In relation to other factors such as the age of adoption, the age of the dog, sex, neutering status, posture of non impulsive dogs and coat colour, no differences were found between groups.

Are Pit Bulls different? Behavioral comparisons between Pit Bull Terriers and other common dog breeds

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The Pit Bull Terrier (a.k.a. American Pit Bull Terrier or Pit Bull) has acquired a universal reputation for aggressiveness, prompting breed bans in countries, regions, and municipalities throughout the world. Despite adverse public perceptions and policies, there is a lack of reliable scientific evidence that Pit Bull Terriers are behaviourally different from other common breeds of dog. To investigate possible behavioural differences between Pit Bull Terriers and other breeds, the present study used behavioural data collected from a convenience sample of dog owners via the online Canine Behavioral Assessment & Research Questionnaire (C-BARQ: http://www.cbarq.org). The C-BARQ is a validated survey instrument with adequate reliability characteristics that is designed to measure the prevalence and severity of 13 major categories of behavior problem in dogs (Hsu & Serpell, JAVMA, 223: 1293, 2003). Although potentially subject to self-selection bias, the findings showed that Pit Bull Terriers (N=139) obtained significantly higher (worse) scores for the C-BARQ factor "aggression toward other dogs" (Mean = 1.301, SE = 0.0956) than a combined sample (N=7384) of other breeds (Mean = 0.871, SE = 0.011; Mann-Whitney U = 395142.00, $P < 0.0001$), although two other breeds-the Akita and Dachshund-were equally aggressive in this context. Contrary to expectations, Pit Bull Terriers did not obtain significantly higher scores for either "owner-directed aggression" or "stranger-directed aggression" compared with the other breeds surveyed, although they were more likely to bite unfamiliar persons ($c^2 = 5.392$, $P < 0.05$). This last effect disappeared, however, when certain background factors (e.g. source of acquisition) were taken into account. Possible reasons for the apparent mismatch between public perceptions and the present findings are discussed.

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Relationships between sow behaviour and piglet mortality in loose housing farrowing environments outdoors and indoors

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Loose housing farrowing environments for sows are common in conventional production in most Scandinavian countries and in organic production across Europe in order to fulfil the sows´ behavioural needs. However, the most common cause of piglet mortality in loose housed farrowing environments is crushing by the sow. This study compared the relationship between sow behaviour and piglet mortality for loose housed sows in two farrowing environments: outdoors in huts on pasture and indoors in farrowing pens. Forty Yorkshire x Swedish Landrace sows were videotaped inside the hut (3.9m2, parity 1 and 3) or in the pen (8.2m2, parity 2 and 4) from 12 hours before farrowing until 2 hours after the last piglet was born. The statistical analyses included LSM and regression analysis. Farrowing duration was shorter (3.5 vs. 5.2 hours, $p<0.001$, N=90) and the probability of stillborn piglets was lower (0.11 vs. 0.34, $p<0.01$, N=132) when sows farrowed in huts compared with pens. The regression coefficient for piglet mortality (until day 4 after birth) on sow behaviour during farrowing differed between farrowing environments (percent active: b=2.26 vs. -0.45, $p<0.001$; number of posture changes: b=1.46 vs. -0.82, $p<0.01$ in huts and pens respectively) indicating that restless sow behaviour leads to high piglet mortality when sows farrowed in huts, but to low piglet mortality when sows farrowed in pens. There was no significant effect of parity (nested within environment) for the investigated parameters. We conclude that parturition progress is more rapid and stillbirth frequency lower when sows farrow outdoors in huts compared to when they farrow indoors in pens. Moreover, restless sow behaviour (long activity duration and high frequency of posture changes) during farrowing is associated with high piglet mortality when sows farrow loose housed outdoors in huts but to low piglet mortality when sows farrow loose housed indoors in pens.

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Avoiding hypothermia in neonatal piglets: causes of individual differences

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Hypothermia is one of the major causes of mortality in neonatal piglets. Piglets must therefore rapidly adapt to post uterine life and achieve thermal homeostasis by starting thermogenesis and heat preservation. Rectal temperature 2 hours after birth is a strong indicator of their success. The aim of the study was to identify the causes of individual differences in successfully achieving thermal homeostasis. Behavioural and physiological data were collected on 635 liveborn piglets from 45 farrowings in either crates or pens. The data included: birth weight, hypoxia at birth (viability score and lactate in umbilical cord blood), latency to first udder contact and first suckle, scans of individual piglet position during the first 2 hours after birth, rectal temperature at birth and 2 hours post partum. A graphical chain model was used to analyse data. Bayesian-Information-Criteria (BIC) was used for model selection. BIC relates to maximum likelihood but introduces an additional penalty term for the number of parameters. Strength of the association between two variables is reported as an increase in BIC (BICinc) by removal of the link. Three variables had direct links to rectal temperature 2 hours after birth. There was a positive relation to birth weight (BICinc=25.7), and to being observed more often by the udder as opposed to alone during both the first (BICinc=7.6) and second hour (BICinc=18.7) after birth. Lighter piglets and piglets that had experienced hypoxia took longer to achieve first suckle, which in turn affected behavioural thermoregulation. In conclusion, high birth weights and staying close to the udder during the first two hours of life were critical for piglets' success in achieving thermal homeostasis. The birth process and hypoxia affected piglet behaviour during the first two hours after birth. The results of this study can help identify means of preventing hypothermia and decrease piglet mortality.

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Stalled sows demonstrate higher motivation for compost compared to straw

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Sows are often housed in barren stalls during breeding/gestation. Providing enrichments for which sows are highly motivated should improve welfare. The aim of this study was to compare the motivation of Yorkshire x Landrace gestating sows (32, n=8/reward) housed in standard stalls for access to 1 of 4 rewards. Environmental enrichments: spent mushroom compost (C, 2.27 kg) or straw (S, 0.45 kg). Food (F, 0.91 kg) and an empty trough (T) acted as positive and negative controls, respectively. We predicted enrichments for which sows were highly motivated would resemble F and/or be significantly different from T, while low motivation enrichments would resemble T. While in visual and olfactory contact with rewards, sows were trained to press an operant panel on an increasing schedule. The highest schedule pressed indicated motivational strength. Sows were given 1 h to press the panel and 23 h to interact with the reward. Data were analyzed using GLM and post-hoc Tukey tests. The C sows showed higher motivation (number of presses) for the reward (196.88 +/- 46.38, LS means +/- S.E.) than T (55.85 +/- 46.75; P=0.017), S and T did not differ (P>0.05). The F sows pressed more than all other treatments (462.87 +/- 46.38; all P<0.01). The C sows pressed the panel sooner (sec; 5.00 +/- 156.40) than S (332.88 +/- 156.40) and T (271.43 +/- 157.70; P=0.069 and P=0.011, respectively), while F pressed sooner (11.25 +/- 156.40) than T (P=0.046); all other latencies did not differ (P>0.05). Gestating sows housed in stalls were highly motivated for C and F, but showed low motivation for S and T. The C and F sows pressed the panel sooner, which may indicate increased motivation. The provision of compost is important to sows housed in barren stalls and should be considered as a method to improve welfare.

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The effect of treatment for lameness on the relationship between nociceptive threshold and locomotion score

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In dairy cattle locomotion score (LS), based on gait and posture, is related to allodynia, as measured using nociceptive threshold (NT). The effect of lameness treatment on this relationship has not been properly evaluated. As part of a study evaluating lameness treatment protocols, longitudinal measurements of NT and LS were made to allow such an evaluation. Data were collected from 149 dairy cattle with claw horn lesions from nine farms. On presentation, LS was recorded (1 to 5 scale) and NT measured with a pneumatically-activated pin. After corrective paring, cows were randomly allocated to one of six treatment groups. NT and LS were recorded 3, 8, 28 and 100 days after treatment. A PROC MIXED model was developed with square root transformed NT as the outcome variable. Without time in the model, NT and LS had a significant inverse relationship ($r2=0.26$). Treatment had no significant effect on this relationship. For example mean NT for cattle with a LS of 1 was 39.8 (0.54) KPa, 28.0 (0.86) for a LS of 3, and 21.5 (1.99) for one of 5. Inclusion of time altered the relationship. For cows with LS of £3, earlier visits were associated with a lower NT than later ones. Example on Day 0, the mean NT of cattle with a LS of 2 was 28.5, whereas on Day 100 it was 41.3 KPa. For cows where LS remained ³4 this was not so; mean NT was 23.5 on day 0 and 28.7 on Day 100. Progress in LS was not necessarily related to improvement in NT and vice-versa. As NT is a more objective measure of lameness-associated pain, with less inter and intra-observer variation than LS, it is probably a better measure of treatment response.

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Post-operative behavioural change in rabbits undergoing abdominal surgery: potential indicators of pain

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Behavioural data were collected on 10 New Zealand White rabbits to assess the efficacy of a post-operative analgesic regime. Rabbits were subjected to an ethically approved medical experiment requiring abdominal surgery and implantation of a telemetry device. Prior to surgery rabbits were anaesthetised using an oxygen isoflurane mix and given carprofen (2mg/kg) as a peri-operative analgesic. Rabbits were housed individually in standard laboratory cages throughout. Data were collected for 24-21h prior to surgery (T1) as a behavioural control, 0-3h immediately post-surgery (T2) as the period of maximum anaesthetic recovery and analgesic activity, 3-6h (T3) as anaesthesia declined whilst analgesia remained active. Data were analysed using ObserverXT to identify behavioural changes, the significance of which was assessed using a Friedman's test for several related samples. Those behaviours absent or of low occurrence in T1, elevated in T2 and persistent into T3 were considered useful pain indicators. Behaviours which began to decline between T2 and T3 were considered to indicate withdrawal from anaesthesia. A number of behaviours were also found to be expressed in T1 but extinguished in periods T2 and T3 suggesting that absence of behaviours may also be associated with pain. Given these criteria, significant behavioural changes that we conclude are indicative of pain include reduced "grooming" (p=0.001), "eating" (p=0.004), "stretching" (p=0.001), "hopping" (p=0.004) and "rearing" (p<0.0001) and an increase in "full-body-flexing" (p=0.001), "tight-huddling" (p=0.024), "hind-leg-shuffling" (p=0.019) and "postural change frequency" (p=0.037). Those behaviours which are significantly associated with anaesthesia recovery are increased "ventral lying" (p=0.002), "drawing-back" (p=0.001), "staggering" (p=0.002) and "closed eyes" (p=0.001). We postulate that peri-operative pain management used in this study does not entirely ameliorate the pain effects of abdominal surgery. Additionally, for the effective application of best-practice post-operative care, the above behaviours can provide routes by which carers may identify any requirement for additional post-operative analgesia.

Short-term effects of general anaesthesia and analgesia on the suckling order and behaviour of piglets after castration

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The influence of injection anaesthesia with ketamine/azaperone (Ursotamin®, 25mg/kg; Stresnil®, 2mg/kg) and analgesia (Metacam®, 0.4mg/kg) on the behaviour of 5-7 day old piglets after castration was studied (anaesthesia + analgesia: *Comb*[n= 29], analgesia: *Met* n= 24], control: *Cont* [n= 29]). To protect anaesthetised piglets from being crushed, all treatment groups were separated from sow and female siblings for 3 h following castration. The aim of this study was to test if this separation would affect suckling order stability (SOS) and behaviour after reunion. The highest proportion of piglets changing their preferred teat position (TP) in a 3 h period after reunion occurred in the *Comb*treatment (27.5%), though not statistically significant (*Met*: 16%; *Cont*: 17.2%). The change to a lower ranked TP almost reached significance (logistic ANOVA, ?2=5.3, p=0.07) with none of the *Met*piglets changing to a lower TP (*Comb*: 10.3%, *Cont*: 13.8%), indicating that they might have a better chance of defending their teat. A higher number of teats used by *Comb* piglets after separation (Wilcoxon test, p=0.004) suggests a significant decrease in SOS in this treatment (*Met*: p=0.054; *Cont*: p=0.068). This instability could lead to a reduced milk intake due to fighting over TP, indicating a certain degree of post- surgery stress. Considerable treatment effects appeared in the suckling duration (ANOVA, F=13.3, df=2, p<0.001), with an increase in *Met* piglets (+68.9±16.5%), but a decrease in *Comb* animals (-27.6±11%; *Cont*: +5.9±8.3%). Taken together, the results suggest that *Met* analgesia has an effect on suckling behaviour of piglets, perhaps due to less post-castration pain. This advantage is not apparent for animals receiving additional anaesthesia, probably because of impaired coordination, which seems to persist a minimum of six hours after castration. Thus, post-castration behaviour must be taken into account when evaluating alternative castration methods.

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Comparison of novel methods to alleviate the pain caused by castration in pigs

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Castration of piglets is a routine procedure on farms in some countries to prevent aggressive behavior and the occurrence of boar taint, however castration causes an acute stress response. The objective of this research was to examine novel methods (needle-free injection system or topical application) to potentially alleviate the pain associated with castration in piglets. At 3 days of age, piglets were castrated without anesthetic (CAS; n = 10), with local anesthetic injected 10 minutes prior to castration using a needle (LA-Ned10; n = 10), with local anesthetic injected immediately prior to castration using a needle (LA-Ned0; n = 10), with local anesthetic injected immediately prior to castration using a needle-free injection system (LA-NF; n = 10), with a short acting topical anesthetic (S-TOP; n = 10) or a long acting topical anesthetic (L-TOP; n = 10) applied to the castration wound, or piglets were sham castrated (CON; n = 10). Behavior was continuously recorded during castration to measure vocalizations (squealing and grunting) and pain related behaviors (struggling and flinching). Blood samples were taken prior to castration and at 30, 60, 120, and 180 min after castration to measure cortisol concentrations. Data were analyzed using the MIXED and NPAR1WAY procedures of SAS. Piglets injected with local anesthetic 10 minutes prior to castration tended (p = 0.067) to squeal less during the scrotal incision and struggled less (p < 0.05) during the removal and severing of the testes than piglets castrated using other pain alleviation methods. Cortisol was greater (p < 0.01) in all castrated treatments compared with CON piglets 30 minutes after castration, except LA-Ned10 piglets. Piglets injected with local anesthetic 10 minutes prior to castration showed fewer behavioral signs of distress and had lower cortisol concentrations 30 minutes after castration than piglets castrated using other pain alleviation methods.

Development of electrical activity and responses to noxious stimuli in the chicken brain

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Brain electrical activity can provide an indication of the presence or absence of consciousness, which in turn determines whether or not the animal has the capacity to suffer. The brain activity of chickens before and after hatching was monitored using an electroencephalogram (EEG). The EEGs indicated that brain activity was first apparent from day 13 of a 21-day incubation. Spectral analysis of the EEGs showed an increasing level of high frequency activity up to day 17. This activity diminished around the time of hatching before re-emerging in the newly-hatched chick (spectral analysis parameters: median frequency, 95% spectral edge frequency and total power fitted cubic regressions with $F=46.77$ $p<0.01$, $F=62.48$ $p<0.01$ and $F=48.91$ $p<0.01$ respectively). The decrease in activity may be related to neuroinhibitory effects of an oxygen shortage in the chick towards the end of incubation.

Previous studies in anaesthetised mammals have used the EEG to record responses to noxious events, which can provide further information on neurological functioning. Consciousness is needed to perceive the negative emotional component of pain. Therefore, an EEG response to noxious stimulation could indicate that the animal has the neural capacity for consciousness. Two studies were conducted to look for EEG responses to noxious stimulation in anaesthetised chickens. The results suggest that the chicken's EEG may be less responsive to noxious events than the mammalian EEG. While a noxious electrical stimulus caused a 1.5Hz increase in median frequency 5-10 seconds after the stimulus (ANOVA and Dunnett's test t=4.19, p<0.01), EEG parameters following the other noxious events were not significantly different from baseline (thermal, mechanical and feather-pull stimuli, ANOVA, time effect p>0.05). This discrepancy between birds and mammals may relate to differences in brain anatomy and suggests that another method may be needed to investigate the processing of noxious sensory inputs in birds.

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Improving the welfare of calves through the use of topical anaesthesia

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Castration and dehorning are husbandry procedures routinely performed without analgesia or anaesthesia in Australian cattle herds. These procedures cause considerable pain and suffering to the calves but are considered necessary for economic, safety and quality-control reasons. With the increasing shift toward welfare conscious markets, we can no longer ignore the strong ethical and commercial imperatives to explore methods for pain alleviation during routine husbandry procedures. Following the success of our previous studies into the use of topical anaesthesia (TA) for mulesing, castration and tail-docking in lambs (references), our group has been researching the application of a topical anaesthetic gel formulation for castration and dehorning purposes in cattle. Twenty-seven Angus bull calves (mean initial body weight 135.8kg +/- 5.7kg) were randomly allocated to one of treatment groups for either surgical castration (n = 9), surgical castration in combination with TA (n=9), or sham castrated controls (n=9). Calves were placed in a crush, where skin sensitivity of wound and peri-wound surfaces was assessed using an electronic von Frey anaesthesiometer (IITC Life Sciences) over a 2 to 24 hour period after surgical castration with a sterile, sharpened knife. Results were measured as pressure (g) exerted to invoke animal withdrawal and/or reflex, and were analysed using repeated measures analysis (REML) and linear regression. TA treated calves exhibited overall significant ($p < 0.001$) primary wound analgesia (mean pressure exerted 559.2 ± 14.26g) as compared to untreated calves (612.96 ± 12.17g). TA calves also displayed less secondary wound hyperalgesia (602.82 ± 16.5g) than untreated calves (515.2 ± 20.3g). In these studies topical anaesthesia successfully reduced the post-operative wound sensitivity of castration in calves. Topical anaesthesia may present a cost-effective and management-friendly approach to on-farm pain alleviation and is proposed as a useful tool to reduce the welfare impact on the animal during routine husbandry procedures.

Can the weaning stress of dairy calves be reduced by weaning later?

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Dairy calves are increasingly being fed large volumes of milk (8-12L/d), which reduces feeding motivation and improves weight gain. However, they often lose weight when weaned off milk, even if weaning is gradual, due to low grain intake. We examined whether delaying the age at weaning would reduce the growth check at weaning. Calves were raised in groups of 9 and fed milk and grain with automated feeders. In each group 3 calves were randomly assigned to one of 3 treatments: 1. low-milk early-weaned: fed 6l/d of milk and weaned at 42 days; 2. high-milk early-weaned: fed 12l/d of milk and weaned at 42 days: 3. high-milk late-weaned: fed 12l/d of milk and weaned at 84 days. Milk and grain intakes and feeder visits were recorded daily and body weight weekly. Animals were weaned gradually over a 10 day period. The high-milk late-weaned calves continued to drink 10-12L/d up to the day of weaning. During the 10d weaning period, the low-milk early-weaned calves made many more visits (PROC MIXED: $P<0.001$) to the milk feeder (23.9 ± 0.9/d) than the high-fed early weaned (15.8 ± 0.9/d) and high-fed late weaned calves (17.1 ± 0.9/d), which did not differ ($P>0.10$). Grain intake during the weaning period was highest for high-milk late-weaned calves (1.10 ± 0.08kg/d), intermediate for low-milk early-weaned calves (0.77 ± 0.08kg/d) and lowest for high-milk early-weaned calves (0.36 ± 0.08kg/d) ($P<0.01$). Weight gain during weaning followed the same direction (8.8kg vs 5.1kg vs 3.8kg ±0.2kg) ($P<0.01$). At 15weeks of age, high-milk late-weaned calves were heavier (155.0 ± 1.4kg) ($P<0.01$) than high-milk early-weaned calves (145.7 ± 1.4kg) and low-milk early-weaned calves (142.8 ± 1.4kg), which did not differ ($P>0.10$). Delaying the age at which calves are weaned off milk keeps the advantages of feeding them more milk by increasing their ability to eat grain. However, it does not reduce their motivation to drink milk while being weaned.

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Preference of dairy cows: indoors vs. pasture

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Although grazing at pasture is assumed to be welfare friendly, it may not allow high yielding cows to fulfil their nutritional requirements. An exploratory study was conducted to determine whether high genetic merit Holstein dairy cows (n = 32) in mid to late lactation had a preference to be indoors or on pasture. Twice a day after milking, cows were given the choice of going out to pasture (0.56 ha) or in to a cubicle house. They were then free to move between the two until the next milking. Indoors, a total mixed ration was available ad libitum and at pasture, sward dry matter (DM) was maintained between 1800 and 3000 kg DM/ha. The study had four experimental periods, during each of which eight cows received an eight day training period followed by an eight day study period. Cows had at least two weeks prior experience of each location. Two measures of choice were recorded: the decision taken at the choice point and then the time spent indoors and at pasture. Weather data were recorded but are not presented here. One sample t-tests were used to analyse decision from the choice point and time spent. From the choice point cows chose to go indoors almost twice as often as to pasture ($66.2\% \pm 5.02$ choice for indoors) which differed from 100% (P<0.001), 0% (P<0.001) (i.e. total preference to be either indoors or at pasture respectively) and 50% (P=0.004) (i.e. random choice), and spent more time indoors compared to time spent at pasture ($91.9\% \pm 2.33$ time spent indoors) which differed from 100% (P=0.001), 0% (P<0.001) and 50% (P<0.001). The results indicate that cows have a partial preference to be indoors. Further studies will investigate the factors influencing this partial preference and the implications for the welfare of dairy cows.

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Voluntary use of showers: effects on behaviour and physiology of dairy cattle in summer

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The objective of this study was to understand how and when dairy cattle will voluntarily use a water source that is located away from other resources, such as shaded feeding and lying areas, and how this use would affect behavioural and physiological indicators of heat stress. Twenty-four Holstein Friesian, non-lactating, dairy cows were used, with four animals tested simultaneously, half of which had access to a cow shower (n=12 with shower, n=12 control). Internal body temperature and behaviour, including shower use, were recorded 24h/d for five days during summer (mean temperature=25.3°C), whereas respiration rate and skin temperature were recorded between 10:00-18:00h. Dependent variables were compared with t-tests. Cattle spent 3.0±2.1h/d in the shower, and there was considerable variability between animals (range: 0.0-5.8h/d). Cows preferentially used the shower during the daytime, with 89%±12% of the time spent in the shower between 10:00-19:00h. Shower use increased with warmer weather by 0.3h for every 1°C increase in ambient temperature. Respiration rate and skin temperature did not differ between treatments (53±3.7 vs. 61±4.3 breaths/min and 35.0±0.3°C vs. 35.4±0.4°C in shower and control cows, respectively, P≥0.16). In contrast, cows provided with a shower had lower (0.2±0.1°C) body temperature than control cows in the evening (18:00-21:00h; P£0.05), which is around the time when daily peak of body temperature occurred. Weather affected cattle time budgets and physiological responses in both treatments. Cows spent less time lying when heat load index (HLI) increased (P<0.001), but the total time spent lying, standing, and feeding did not differ between treatments (P=0.500, P=0.316, P=0.500, respectively). Cows also had higher respiration rate, skin temperature and body temperature as HLI increased (P<0.001), regardless of treatment. These data suggest that cattle, when given the opportunity, will make considerable use of a shower, thus alleviating some of the effects of heat load in summer.

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Rubber covering for pens with fully slatted floor to improve welfare in finishing cattle

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The aim of this study was to compare the effect of slatted concrete floor and two different rubber covers for fully slatted floor pens on lying behaviour, joint swellings and cleanliness of finishing cattle. Eighty Swedish Holstein bulls of initially 250 kg were randomly divided into 16 boxes (10.4 m²) with three floor types (6 boxes slatted concrete, 5 boxes slatted rubber, 5 boxes rubber mats). At 400 kg the lightest bull in each box was taken out. In blind tests, cleanliness was recorded once a month and joint swellings were assessed at 650 kg, all according to a graded scale. Lying behaviour was continuously recorded for 12 h from video film at 250, 450 and 650 kg. Data were analysed with a mixed GLM model (cleanliness, reference slatted rubber), a logistic regression (joint swellings) and the Mann-Whitney-test (lying behaviour). Preliminary results for lying behaviour include recordings at 250 and 450 kg. The Ethical Committee on Animal Experiments Gothenburg approved the study. The appearance of joint swellings was influenced by floor type (Odds Ratio slatted concrete=39.4, Odds Ratio rubber mat=0.1, p<0.001). Animals on rubber mats were dirtier than on slatted concrete or slatted rubber (F=13.9, p<0.001). On both rubber floors there were more lying bouts than on slatted concrete at 250 kg (slatted rubber W=22.5, p=0.018; rubber mat W=21.5, p=0.012); there was no difference between the rubber floors. Furthermore, on both rubber floors there were less interrupted lying-down attempts than on slatted concrete at 450 kg (slatted rubber W=49, p=0.023; rubber mat W=48, p=0.036), with no difference between the rubber floors.

The results suggest that rubber covering improves welfare by diminishing the occurrence of joint swellings and decreasing the number of interrupted lying-down attempts. However, the use of rubber mats with less gap surface area results in dirtier bulls.

Dairy cattle prefer shade over sprinklers in summer: effects on behaviour and physiology

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Cattle will readily use shade in warm weather, but less is known about voluntarily use of sprinklers. We investigated whether 96 Holstein-Friesian dairy cows prefer sprinklers, shade or ambient conditions after walking 2km or 0.3km in the afternoon (n=48 cows/distance). Each cow was individually tested on 3 consecutive days with a different paired choice/day: 1) shade vs. sprinklers, 2) shade vs. ambient, 3) sprinklers vs. ambient. The test order was balanced between cows. The change in both respiration rate and body surface temperature was recorded after the 10-min exposure to the chosen treatment. In addition, insect avoidance behaviours were recorded during this 10-min period. Data were analysed using REML and linear regression. Average air temperature during testing was 22°C (range:15-28°C). Sixty-two percent of the cows chose shade over sprinklers (se:5.0%, p=0.032) and 65% chose shade over ambient conditions (se:5.1%, p=0.010). No preference was found for sprinklers over ambient conditions (44% of the cows chose sprinklers, se:5.3%, p=0.358). The preference for shade over sprinklers and ambient conditions increased with air temperature (p=0.038), solar radiation (p=0.030) and wind speed (p=0.026). Walking distance did not influence the preference for any treatment (p=0.426). Body surface temperature was reduced most by sprinklers (11% decrease), compared to shade (0.3% decrease) or ambient conditions (2% increase; sed:1.53%, p<0.001). Similarly, respiration rate was reduced most by sprinklers (39% decrease) but also declined in shade and ambient conditions (15% and 14% decrease, respectively, sed:5.10%, p<0.001). Furthermore, sprinklers reduced insect avoidance behaviours, including number of tail flicks (32, 37 and 36 flicks/30s for sprinklers, shade and ambient, respectively, sed:1.23, p<0.001) and hoof stamps (4.9, 7.1 and 6.3 stamps/30s for sprinklers, shade and ambient, respectively, sed:0.47, p<0.001). In conclusion, dairy cattle preferred to use shade in summer despite sprinklers being more efficient in reducing heat load and insect avoidance behaviours.

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Behavioural changes associated with lameness in sows

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Lameness is common in sows, causing production losses and reduced welfare. We studied how lameness affects behaviour in gestating sows and how treatment with oral ketoprofen affects the behaviour of lame sows. Sows were group-housed in partly slatted pens. On day 0, sow lameness was clinically evaluated using a scale from 0 to 4 (no to severe lameness). Sows with non-infectious lameness (L, score 2-3, n = 13) and control sows (C, score 0, n = 13), 1-3 L:C pairs per pen, were followed in their home pens. L sows were given a placebo (P, n = 4), or ketoprofen (K) 2 mg/kg (n = 5) or 4 mg/kg (n = 4) orally once a day for 5 days. Behaviour was observed for 2 h by direct scan sampling on days 0 and 5, starting 10 min after feeding (2:40 pm). Data were analysed with Mann-Whitney U-tests. The two K levels were pooled as there was no difference in their clinical effect. L sows lay down more (p = 0.02) and stood (p = 0.05) and explored pen features (p = 0.005) less than C sows on day 0. The behaviour of L sows showing an improvement in their lameness score (n = 7, 1 P sow and 6 K sows) after the treatment did not differ from C sows on day 5 (p > 0.05). However, sows showing no improvement (n = 6, 3 P sows and 3 K sows) laid down more (p = 0.01), while moving (p = 0.02) and standing (p = 0.04) less than C sows. Lameness reduced activity in group-housed gestating sows, indicating discomfort or pain. Improvement in the lameness score is connected to normalisation of the behaviour. As ketoprofen improves the success of recovery, treatment of lame animals is recommended.

Poster Group A

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On-farm assessment and genetic improvement of calf temperament

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Improving animal's temperament defined as "the animal's reaction to handling by human" could be a way to improve animal welfare. This study aimed at finding a simple measure for calf temperament discrimination which can be useful as a European selection criterion for on-farm beef cattle breeding schemes. Calves' reactions to human in the scale have been shown to be consistent across time, observer and with the docility test used to evaluate Limousin bulls in the French test stations. Therefore, we chose to test these measures on-farm for the purpose of this study. In order to ensure good family structure and connectedness across farms, 12 bulls were chosen among the Limousin bulls selected for artificial insemination use and their semen was diffused in 24 farms (56±23 weaned calves per sire). Behavioural records were registered at, on average, age of 218 ± 60 days for 1441 calves, offspring of 128 sires. For every calf, the quantity of rush movements (RM) and the total number of movements (TM) were scored using a continuous scale successively during weighing (P1), then when exposed to a stationary human situated in front of the scale for 10s (P2). The calf's reaction during the overall period was also assessed using the Australian crush test score on a 5-point scale ranging from 1 (docile) to 5 (aggressive). Mixed linear models were fitted to the data and variance components were estimated using Restricted Maximum Likelihood methods applied to linear animal models. Heritabilities were estimated at 0.28±0.09, 0.31±0.1, 0.19±0.07, 0.17±0.07 and 0.18±0.08 respectively for RM and TM scores measured during P1, RM and TM scores measured during P2 and the Australian score. All traits were highly genetically correlated (from 0.73±0.16 to 0.99±0.06). These results open the door to on-farm selection on docility in European conditions.

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Exploring choice and control opportunities applied in enrichment and training

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Providing animals with choices and control over the environment they inhabit is one of the many tasks we have as professional caretakers to ensure the animals have what they want and their wellbeing is high. Many studies have looked into how much, and for what, animals are willing to work as well as using observational data to see where animals prefer to spend their time, with whom and their preferred food, bedding and enrichment opportunities. On the basis of these observations, care staff can then decide what they consider to be best for the animals, and often attempt to provide variation in location, time of day, frequency, duration of exposure, and type of enrichment activity (e.g. scent, tactile, food, visual or social) to allow animals to make choices. However, it is still the human caretakers and not the animals themselves who usually decide what the animals get. Even with positive reinforcement training, where the animals' participation is voluntary and they can choose to take part, the only real choice is whether to participate with the trainer or not. Given that animals can readily learn to respond to a large variety of signals and learn to associate and discriminate different circumstances with specific stimuli, we should aim to use this to communicate to the animals the choices available to them for enrichment and training. This paper offers and explores some of the possibilities and practical ideas of providing this level of choice and control. By discriminating between signals animals can tell us, for example, when they want to start a training session and what reward they want for doing the requested behaviour, or they can choose where, when and what they want to do. I shall describe potential methods of providing choice and control, and the benefits for the animals.

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Alleviation of pain and discomfort through common dental procedures for horses

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Dental abnormalities develop commonly in horses as a result of modern feeds and feeding practices. These abnormalities, including sharp enamel points, are commonly associated with ulceration and mastication problems and results in pain, discomfort as well as interference with chewing function. A range of treatment procedures, involving removal and modification of the dental structures, have been developed. The effects of these on alleviating pain and discomfort and improving jaw function have not been previously evaluated. The jaw motions of 15 thoroughbred horses (5 geldings, 7 fillies and one colt, two years of age, in medium work and fed typical rations of oats, chaff and hay, and typical sharp enamel points and ulceration) were recorded using an optical motion capture camera system. The recordings occurred during 20 minute periods of chewing oats and hay. They were done before, immediately after, and one week after dental treatment. The data obtained were transformed into a 3D Cartesian co-ordinate system to calculate jaw displacement relative to the head. The displacements during the phases of mastication were compared using two-tailed paired samples t-tests. Horses chewing oats increased their opening stroke (dropping the jaw and placing food) (from 9 mm to 16 mm, S.E. = 5, P<0.001) before and immediately after treatment, and chewing hay it decreased from 19 mm to 11 mm (S.E. = 3, P<0.026). The closing stroke (bringing the teeth together) decreased one week after treatment from 26 mm to 22 mm (S.E. = 3, P<0.026). Total average speed (mm/s) of chewing increased from 39 mm/s (S.E> = 2) to 63 mm/s (S.E. = 9) for oats immediately after treatment. These findings are consistent with alleviation of pain and discomfort through the application of the dental procedures.

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Personality, hand preference and welfare of primates

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Proactive and reactive personality traits have been documented in many species and refer to collections of broadly assigned characteristics. Proactive individuals are described as being bold and active explorers. Reactive individuals are wary of novelty and cautious of change. Since there is evidence that these personality types are susceptible to different stress-related health problems, it would be of value to have a means of detecting each type easily. In primates, hand preference might provide such a measure since it is associated with personality type: right-handed primates approach, touch and explore novel objects, environments and foods more readily than left-handed primates. We have investigated social behaviour associated with hand preference in common marmosets. Left- and right-handed marmosets were presented with live crickets, an unfamiliar food item, both when alone and with their social companion. In right-handed marmosets the latency to begin capturing crickets was shorter when the companion was present than when the marmoset was tested alone: latency 67 ± 23 seconds (mean and standard error) with companion present and $410\pm141s$ when alone (Wilcoxon, Z=-2.43, P=0.02). Left-handed marmosets were unaffected by the presence of a companion: latency $289\pm124s$ when with companion and $476\pm190s$ when alone (Wilcoxon, Z=-0.73, P=0.46). Right-handed marmosets also performed more mobbing responses directed at a model predator than did left-handed marmosets, which is another example of a relationship between hand preference and social behaviour (e.g. mean number of 'tsik' mobbing calls by right- and left-handed marmosets were 185 ± 23 and 119 ± 19, respectively; Man Whitney U-Test, 2-Tailed, U=133.5, P=0.03). These findings may be useful in providing the best captive care for the two personality types.

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Variability in neonatal behaviour in single and twin lambs

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The effect of litter size (LS) on the variability in neonatal behaviour in the context of lamb survival was investigated. Merino ewes (n=270) were oestrus synchronised in three mating groups (MG) 10 days apart and naturally mated. Eighteen ewes from each MG were selected, balanced for LS (singles and twins) following pregnancy scanning at day 60. Ewes were maintained on pasture until day 100 of pregnancy before being fed a concentrate ration in group pens. Ewes were housed five days prior to lambing, in individual pens. Video records from birth until three hours post partum were taken and times to stand, reach the udder, unsuccessfully and successfully suckle determined. At 10-15 minutes post partum, lambs were removed for blood sampling and morphometric and temperature measurement. MG3 lambs also had an infrared thermal image taken and consequently, were separated from their dams 1 minute longer (P<0.05) than MG1 and 2 lambs. Data were analysed using Proc GLM (SAS) with LS and MG plus their interaction included as terms in the model. MG was added as it was a potential source of variance. There was a significant interaction (P<0.05) between LS and MG for times to stand and reach the udder. Twins were quicker to stand than singletons in MG1 (15.4 and 31.0 min) and MG2 (18.8 and 29.3 min) but this was reversed in MG3 (42.4 and 20.6 min). Similar trends were observed for time to reach the udder (MG1 20.4 and 42.4 min; MG2 31.0 and 39.7 min; MG3 57.1 and 38.5 min). Singletons did not differ in times to perform these behaviours between MG. The reasons for this MG effect in twins are unclear. The additional time away from the ewe or more exposure to high quality Spring pasture for MG3 compared to the other groups could have contributed.

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Effect of alternative methods for increasing stocking density short-term on lying and ruminating behavior of lactating Holstein dairy cows.

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Understanding the effects of overcrowding on the behavior of lactating dairy cows is critical for formulating housing standards that ensure welfare and profitability; however, previous research has relied on the denial of resting or feeding space to simulate on-farm overcrowding without establishing the validity of this method. The objective of this study was to determine the differences in lying and rumination of Holstein dairy cows housed at stocking densities of 100 (1 cow per stall and headlock) or 142% imposed by the 1) denial of freestalls and headlocks, 2) denial of freestalls, headlocks, and 26.6 m2 of alley space, or 3) addition of 14 cows. Cows (n = 136) were assigned to 1 of 4 pens and treatments imposed using a 4 × 4 Latin square for 14 d. Data were collected from focal cows (n = 12) within each pen. Lying time and bouts were determined at 1-min intervals for 5 d using dataloggers. Feeding and rumination time was determined by direct observation at 10-min intervals on d 11. Data were analyzed using MIXED procedure of SAS. Lying time was greater (13.0 ± 0.1 h/d; P < 0.002) at 100% than any 142% treatment, which did not differ (11.8 h/d ± 0.1; P > 0.10). Cows spent more time ruminating in the alleys when housed at 142% compared with 100% (1.1 ± 0.2 h/d vs. 0.6 ± 0.2 h/d; P = 0.01), regardless of stocking density method used. Lying bouts (12.3 per d; P > 0.10) and feeding time (4.2 ± 0.2 h/d; P = 0.25) did not differ among treatments. Overcrowding reduced lying time and increased ruminating in the alleys; however, the response did not differ by stocking density method. This suggests the three methods are equally valid for evaluating lying and ruminating behavior during short-term overcrowding.

The use of heart rate variability as a novel method to differentiate between affective states

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The major goal of animal welfare scientists is to determine when animals are experiencing a state of good welfare or poor welfare. The goal of this research (Animal Care Approval: 07-020) was to determine if measures of heart rate variability can be used to differentiate whether animals are experiencing 'unpleasant' versus 'pleasant' conditions. Nine, 4-month-old pigs were implanted with telemetric devices to collect electrocardiogram data. Data were collected while pigs were: 1) isolated for 1 hour, or 2) 'playing' under a water hose. Series of 512 successive inter-beat intervals (IBI) were subjected to time and frequency domain analysis. Data were analyzed using the Kruskal-Wallis test to compare data for active pigs during isolation (Active), inactive pigs during isolation (Inactive) and pigs during play (Play). Pigs were Active when they were walking, rooting, and jumping. Pigs were inactive when they remained motionless. Data for Active pigs were collected during the first 15 minutes of isolation while data for Inactive pigs were collected during the last 15 minutes of isolation. Pigs were playing when a water hose was sprayed into their pen and they exhibited animated movements and actively sought to be under the water spray. There was no difference in the ratio of low to high frequency power (power spectral density, $P = 0.46$) when comparing Active, Inactive and Play (0.18, 0.11, 0.16 ± 0.04 respectively). However, the mean IBI was less ($P < 0.001$) for Active pigs compared to Inactive; but not Play pigs (366.4, 499.1, 429.8 ± 11.4 ms respectively). However, the standard deviation of the IBI interval showed a different pattern with Active and Inactive pigs having a greater deviation than Play pigs (23.7, 28.4, 14.1 ± 4.1 ms respectively). These data indicate that measures of heart rate variability may prove useful to differentiate between affective states.

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Physiological response to isolation in Merino ewes of differing temperament

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This study was conducted to determine whether physiological responses to stress differed between ewes of calm and nervous temperament. Merino ewes were selected for temperament based on agitation score. This score involved placing the ewe inside a 1.5 x 0.7 x 1.5m isolation box for 30 seconds whilst objectively recording movement and sound. Ewes classified as calm had an average agitation score of 18.1 ± 4.8 (n = 15) whilst those deemed as nervous averaged 81.3 ± 4.3 (n = 15). Prior to sampling, ewes were group housed within a yard, fed at the same time and run through a race daily to accustom them to handling. After the acclimatisation period, ewes were quietly restrained and a 9ml venous blood sample was collected. At the same time the following day, ewes were placed inside a replica isolation box for two minutes after which time a 9ml venous blood sample was collected once more. Blood samples were analysed for glucose, lactate, cortisol and differential blood cell counts. Analysis of data was performed using SAS software (version 8.1) with temperament, treatment and the interaction between the two fitted as fixed effects. There was no effect of temperament on blood glucose, lactate or cortisol levels, however after the application of the isolation box test ewes displayed a 27% increase in plasma glucose (4.1 ± 0.18nmol/L prior to isolation and 5.24 ± 0.18nmol/L post isolation; $P < 0.001$) and a 70% increase in plasma cortisol (47.14 ± 8.4nmol/L prior to isolation and 80.2 ± 8.4nmol/L post isolation; $P < 0.001$). Plasma glucose and cortisol concentrations were related (r= 0.6, $P < 0.05$). Differential blood cell counts were not affected by temperament or isolation box test. It is concluded that a ewe's temperament cannot be predicted by the blood measures investigated in this study.

Hunger in pregnant sows; the effect of fibre diet and free access to straw

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Fibrous diets have not proven effective in reducing hunger in pregnant sows except just after feeding. We therefore tested if free access to straw alone, or in combination with a fibrous diet, reduced hunger. Two blocks of 15 pregnant sows housed in groups of 3 were allocated to limited amounts of chopped straw or free access to long straw. The experimental period (week 1 to 9 of pregnancy) were divided into two 4-week-periods. During one period sows within a group were fed a control diet (wheat/barley; 17.5 % fibre) while during the other period they were fed a fibrous diet containing 35 % fibre from sugar beat pulp. Both diets were offered restrictively at 21.62MJ net energy/day. Sows were fed twice daily at 0800 and 1500. Towards the end of each period hunger was assessed using operant conditioning. The operant response was lever pressing for a food reward (27 g per reward) on a progressive ratio that increased 5 presses for every second reward. Sows were tested in a balanced design at 0700, 0900, 1200 and 1900 hours. The data was analysed using variance component analysis. There was no effect of free access to long straw compared to control straw (maximum level of responding: 76 vs. 78 (SE 5.0)). The level of responding was significantly higher during tests at 0700 compared to tests at 0900, 1200 and 1900 (P=0.03). The level of responding at 0900 was higher during control fed periods compared to fibre fed periods (79 vs. 67 (5.6), P=0.03) and tended to be higher at 1200 for control fed periods compared to fibre fed periods (80 vs. 69 (5.6), P=0.06). In conclusion, free access to straw did not improve satiety neither in control nor in fibre fed sows. The fibrous diet reduced hunger just after feeding.

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Comparison between blood and salivary cortisol levels in horses (Equus caballus) using an ACTH challenge

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In horses, serum cortisol concentration is considered by searchers as an indirect measurement of stress. However, it includes the free and the transcortin-bounded fractions, and the sampling method is invasive. This is not the case for saliva cortisol, which represents a part of the free cortisol fraction, the biologically active form. The aim of this study was to compare salivary and serum cortisol assays in horses, on a large scale of concentrations using an ACTH stimulation test. In five horses, blood samples were drawn using intravenous catheter. Saliva sampling was made using swab. In saliva, cortisol was assayed by a direct radioimmunoassay (RIA). In serum, dilutions were necessary. Minimum detection limits were 0.2 nM and 8 nM respectively in saliva and serum. Precision and reproducibility of both RIAs were acceptable (CV<10%). Variables normality was assessed using the Shapiro-Wilk test. Transformation for variable normalisation was applied when necessary. Methods for pooling multiple subject data for linear analysis were applied (Chin-Sang Poon). At rest, cortisol concentrations were 188.81 ± 51.46 nM (mean ± sd) in serum and 1.19 ± 0.54 nM in saliva. Peaks were reached after 96 ± 16.7 min in serum (356.98 ± 55.29 nM) and after 124 ± 8.9 min in saliva (21.79 ± 7.74 nM) (Student t test, p<0.05). Percents of discharge were also different (225% in serum and 2150% in saliva, Student t test, p<0.05). The Pearson correlation coefficient between serum and saliva cortisol concentrations was 0.90 (adjusted R-squared=0.80) (p<0.001). The strong link existing between serum and saliva cortisol levels has been estimated by a regression analysis: $F_{serum} = 159 + 56.7 \log_e (F_{saliva})$. Reliability of both RIAs and regression founded between serum and salivary cortisol levels permit the validation of saliva sampling as a non invasive technique for cortisol level assessment in horses.

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Piglet preference for temperature and flooring, and the use of creep space at different temperatures

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Newborn piglets are attracted to heat and soft materials. Three experiments questioned whether newborn piglets show clear preferences between different infrared temperatures, types of bedding in the creep area, and determined space occupation at different infrared temperatures. In the first experiment, 10 piglets from each of 18 litters were distributed between three temperature treatments (6 litters in each): 26°C vs. 34°C, 26°C vs. 42°C or 34°C vs. 42°C. Another 18 litters were tested in an identical setup with temperatures of 30°C vs. 34°C, 30°C vs. 38°C and 34°C vs. 38°C. In a second experiment, an equivalent set-up with 18 new litters was used to test the choice between foam-mattress vs. sawdust, foam-mattress vs. water-mattress, and sawdust vs. water-mattress. During testing, we placed the piglets in a neutral arena to provide a choice between the two test chambers. The piglets were videotaped for 60 minutes, and the location of piglets were scored every second minute. In the third experiment, 10 piglets from each of eight litters were placed in an experimental creep area with three different temperatures: recommended (34°C) cool (4°C below recommended) or warm (4°C above recommended) at week 1. This procedure was repeated with recommended temperatures of 27°C and 25°C in week 2 and 3 respectively. Space occupation was then calculated based on digital photographs. The piglets preferred 42°C to 34°C and 42°C to 26°C (pair-wise t-test; P<0.01), but the piglets showed no other significant preferences. The piglets preferred sawdust to plastic foam-mattress (pair-wise t-test; P<0.05), and water-mattress was least preferred. A mixed model analysis of variance showed that space occupation increased with increasing infrared temperature in week 1 (P<0.01), week 2 (P<0.001) and week 3 (P<0.01). Area occupied by 10 piglets at the recommended temperature was 0.6, 0.7, and 0.9 m2 in week 1, 2 and 3, respectively.

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The attitudes of UK sheep farmers towards fostering methods: a national survey

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Fostering is a process used by sheep farmers for rearing abandoned lambs onto non-natal ewes and in the case of triplets, providing the surplus lamb a surrogate ewe. Over the years UK farmers have used a variety of techniques which all have been shown to affect the behaviour and welfare of the ewe. Previous research has debated the varying success rates of these methods; however, no empirical comparison between the methods exists. The aim of the survey was to identify which fostering methods are currently in use in the UK and to gain an insight of farmer's attitudes towards them, in relation to lamb production and ewe behaviour and welfare. Data were collected using paper and online questionnaires and were distributed with the help of the English Beef and Lamb Executive (EBLEX). Seventy five farmers responded and results showed that they used birth fluids ($c2 = 12.973$, $p<0.01$), restraint ($c2 = 31.60$, $p<0.001$) and a combination of birth fluids and cervical stimulations ($c2 = 36.419$, $p<0.001$) more often than the other methods. Farmers felt that different fostering methods can have negative welfare implications ($c2 = 47.63$, $p<0.001$) which was determined by the ewe's behaviour. They also felt that the birth fluid method was preferred by the animals compared to all of the other methods ($c2 = 113.27$, $p<0.001$) as it was less disruptive to the ewes involved. Overall, farmers acknowledged that the selection of the 'correct' foster method is a means to increase lamb productivity which can influence the farmers return. However, they also recognised that the display of positive or negative ewe behaviours play a vital role in the selection process of the fostering technique. Subsequent research will investigate the welfare implications to the ewe by means of behavioural and physiological measures.

Sizes and shapes of gaps large enough for masked palm civets (Paguma larvata) to enter

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In recent years, agricultural fields and houses have been damaged by invasion by masked palm civets (Paguma larvata) in Japan. We investigated the size and shape of gaps large enough for them to enter (4 adult masked palm civets weighing 2.8-4.0 kg) and their approach behavior by trial-and-error testing in experiment 1. The gaps were rectangular (20 cmx2.5-10 cm at 2.5 cm intervals), square (2.5x2.5 cm-10x10 cm at 2.5 cm intervals), square (8x8 cm-11x11 cm at 1 cm intervals), and circular (8-11 cm at 1 cm intervals). In experiment 2, we investigated the relationship between the size and shape of the gaps large enough to enter and body part sizes (6 subadults and 6 adults weighing 2.2-3.4 kg). Gap sizes were changed to 1 cm intervals. In experiment 1, masked palm civets could enter by 7.5x20 cm rectangular, 8 cm square, and 10 cm diameter circular gaps. Exploration of gaps included not only olfactory and optical contacts, but also insertion of the muzzle into gaps that were obviously too small to go through. When a masked palm civet entered a gap, they moved their joints limber. In experiment 2, individuals could enter by 6x20 cm rectangular, 8 cm square, and 9 cm diameter circular gaps. There is no significant difference in body part sizes between individuals that went through the 6x20 cm rectangular gap and individuals that did not. By contrast, differences in sizes of body parts, such as shoulder and hip width, affected the minimum size of square and circular gaps that civets could go through. Japanese-style houses have many gaps to adjust to humid climate. It is necessary to cover these gaps with heavy fine-mesh materials to prevent invasion by civets.

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Managing western grey kangaroo (Macropus fuilginosus ocydromus) populations with deslorelin

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Perimeter fencing prevents dispersal of kangaroos from golf courses and some nature reserves around Perth, Western Australia, leading to overpopulation and culling. We investigated efficacy and behavioural effects of chemical fertility control with deslorelin as a more attractive option. In October 2007, we sedated 12/23 female western grey kangaroos (Macropus fuilginosus ocydromus) on Melville Glades Golf Course, in the Perth suburb of Leeming, 14 km south-south east of Perth city centre, with Zoletil® (8 mg/kg) and injected a 4.7 mg depot formulation of the gonadotrophin releasing hormone super-agonist, deslorelin (Suprelorin®), subcutaneously between the shoulder blades (DEC Licence to Take Fauna for Scientific Purposes SF006081, University of Western Australia Animal Ethics approval RA/3/100/592). All 23 kangaroos had young-at-foot and pouch young at the time of treatment. We then recorded the location of all kangaroos on the golf course and the composition of their group, scored their activity when first seen (resting = 0, standing = 1, feeding, travelling, courting, or mating = 2) and presence of obvious pouch young, twice weekly until December 2008. Diurnal home ranges, estimated by minimum convex polygon (mean/SD treated 30.3/10.25 ha, untreated 27.1/8.46 ha) and modified minimum area (mean/SD treated 15.52/3.97 ha, untreated 13.88/5.2 ha) methods showed no significant difference. Treated and untreated kangaroos continued to associate and showed no significant difference in activity (mean/SD treated 0.92/0.14, untreated 0.90/0.15). One treated female disappeared in November 2007 and a new untreated female appeared in February 2008. All 23 carried their pouch young normally through to pouch emergence in summer 2007/8. 3/11 treated kangaroos were seen to mate during the observation period but none produced a new pouch young in 2008, whereas all 12 untreated females did. We conclude that Suprelorin® can be used to manage isolated populations of western grey kangaroos with no serious behavioural effects.

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Whole house culling of hens for disease purposes using carbon dioxide: behaviour, gas levels and temperature

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Disease outbreaks can require the rapid, humane culling of large numbers of animals, preferably with minimal human health risk in the case of zoonoses. One technique for poultry is to kill them in situ, by injecting liquid carbon dioxide into the house. However, because of the low temperature (-78 oC) of liquid CO_2, birds might suffer from hypothermia prior to unconsciousness. This study investigated the behaviour of hens during liquid CO_2 injection while monitoring CO_2 levels and house temperature. A 3-tier conventional cage unit housing approximately 28,000 hens was fitted with a lance injection system that injected liquid CO_2 from a tanker into the deep pit. Seven cages were fitted with temperature loggers, three cages with CO_2 sampling tubes (fitted to a CO_2 analyser), and four infrared CCTV cameras (to monitor behaviour) were mounted above top tiers of cages. Side inlet vents and the deep-pit were sealed with plastic prior to gassing. The ambient temperature rose to 27 oC just prior to CO_2 injection. Approximately 1.22 kg/m3 of CO_2 was injected into the house over 27.5 min, to reach a concentration of 60%. Respiratory distress (gasping) began 147±22 (mean±SD) sec after CO_2 application (mean CO_2=0.7±0.8%). Loss of balance and convulsions, indicative of birds losing consciousness, were observed at 215±18 and 276±14 sec (respectively) after CO_2 application, when corresponding CO_2 levels were 3.5±3.0% and 6.0±4.6% and when the house temperature was still above 25 oC. Visible birds ceased moving 731±47 sec (i.e.~12 min) after CO_2 application, which was before the temperature had fallen below 20 oC and mean CO_2 levels were 27.3±6.8%. Data indicate that birds die before they suffer from hypothermia. Although CO_2 can cause respiratory distress, birds begin to lose consciousness in ~4 min, which is quicker than catching and culling, and safer for human operators.

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Domestication effects on fearfulness in chickens

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Understanding behavioral modifications due to domestication is of interest from many perspectives. It may be hypothesised that reduced fearfulness has been a major target of selection during domestication. We tested 20 domesticated White Leghorn chickens and their ancestors, red junglefowl, raised in identical conditions in four different fear tests (Open Field, Novel Object, Aerial Predator, and Fear for Humans). The tests were designed to measure reactions to different types of potentially fearful stimuli. The correlations between durations of the same four variables from each of the tests (Stand/sit alert, Locomotion, Fly/jump and Vocalisation) were analysed with principal components analysis (PCA). In the PCA, 33.5% of the variation in responses was explained by a single factor with high loadings (>0.5) for Stand/sit alert (indicating high fear) in all tests, and low (<-0.5) for Vocalisations in two tests (also indicating high fear). This was therefore interpreted as a general fear factor, and birds scoring high on it were interpreted as showing higher fearfulness. Red junglefowl scored significantly higher than White Leghorns on this factor (0.52 ±0.09 vs -0.54 ±0.1; GLM: F 1,36=14.05, P<0.001), and also had a longer latency to feed in the Fear of Humans-test (575 ±28 s vs 440 ±19 s; GLM: F 1,35=7.7, P<0.01), which was used as an independent measure of fear in the same tests. The results suggest that selection for low fearfulness has been an important element of domestication.

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The effect of anxiety on memory and learning performance in sheep

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It is widely reported that high levels of anxiety can impair memory and learning. This study examined the effect of anxiety on the memory and learning performance of sheep in a maze. Merino ewes (22 months, n=128) were randomly assigned to one of the following treatments (n=3 per treatment): 1)Saline (control), 2)Anxiogenic (m-CPP, methyl-chlorophenylpiperazine, 2mg/kg), 3)Scopolamine (impairs memory, 100ug/kg), and 4) m-CPP+Scopolamine. Firstly, treatments were administered I.M. to each animal 30 min prior to placing them in an isolation box with a meter attached to measure the number of movements made for 30s (agitation score). On days 1, 2 and 3, treatments were administered to each animal 30 min before maze testing to assess their learning performance. On day 63, 64 and 65 animals were retested in the maze test without receiving treatments to examine memory retention. Maze data were analysed by survival analysis and agitation score by ANOVA. Agitation scores ranged from 1 to 153. Administration of m-CPP increased agitation score (62) compared to the control (41; P=0.03). Agitation scores were lower in scopolamine (24) and scopolamine + m-CPP (25) animals than controls (P<0.001). Animals receiving scopolamine alone were slower to complete the maze on day 3 (160s±22.2) than controls (108±17.3s; P=0.0006), and were slower on day 63 (135s±13.9) than controls (70s±12; P<0.0001). Animals receiving m-CPP alone did not differ from the control in maze performance on any of the days of testing (P>0.05). Total time to complete the maze did not differ between treatments on days 1, 2, 64 and 65 (P>0.05). Learning performance in the maze was reduced in animals receiving scopolamine. Treatment with m-CPP appeared to increase anxiety in the sheep as shown by the increased agitation scores, however this did not impair the ability of sheep to learn or retain the memory of the maze.

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The effect of screen flicker rate on hens' discrimination of visual stimuli

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When studying animal perception and assessing welfare, researchers often use artificial stimuli (e.g., pictures, slides, videos and computer images) as substitutes for real animals or objects, as they are non-invasive and allow greater control over stimulus presentation. In the past, most studies have used cathode ray tube (CRT) screens; however, there is some evidence that these give different results to non-flickering thin film transistor (TFT) screens. Our previous research found domestic hens' critical flicker fusion frequency ranges between 80-90Hz, well above CRT screens which generally have a flicker rate of around 60Hz. Thus, stimuli presented on CRT screens may appear distorted to hens. This study aimed to investigate whether changing the flicker rate of CRT screens altered hens' discrimination. Six domestic hens were trained to discriminate between a black circle and a black cross presented on a TFT (flicker-less) screen using a forced-choice discrimination procedure (i.e., peck left key if shown circle, peck right key if shown cross) until they reached 85% correct over 5 sessions. Sessions were terminated after 40 minutes had elapsed or after 30 reinforcers had been obtained, whichever occurred first. The stimuli were then presented in test sessions on a CRT screen set at four different flicker rates (60, 75, 85, and 100Hz). The hens accuracy on the TFT screen and the CRT flickering at 100Hz was not different (Wilcoxon Signed Ranks test, $z=-1.753$, $p>0.05$), however, accuracy decreased systematically and significantly as the refresh rate of the CRT screen was decreased (Friedman's test, $\chi^2(4)=14.6$, $p<0.05$). These results imply that the change in flicker rate changed the appearance of the stimuli enough to affect the hens' discrimination and stimulus control breaks down for hens when stimuli appear to be flickering.

The influence of breed on canine ageing

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The longevity of different dog breeds generally declines with size. This has led to the assumption that larger breeds age prematurely. If valid, this represents a significant challenge in canine ethology. The current study used a cognito-behavioural survey of older dog (>8 years) owners to explore five broad domains: ingestion; locomotion; owner interaction; housesoiling; and aggression. Questions (n=84) were designed to capture the frequency of behavioural responses and also any change in frequency over the previous 6 months. After dogs with neurological or cognitive disorders were excluded, scaled survey responses from normally ageing dogs (N= 623. representing 100 breeds, from 11 countries) were dichotomised and analysed using binary logistic regression to correct for age. When split into three breed longevity categories, the percentage of longer-lived breeds showed a high frequency of: post-prandial hunger; hypodipsia; aggression; and avoidance of their owners was 13.8, 13.4, 17.2 and 6.8% higher (p<0.05) respectively than short-lived breeds. When split into three breed size categories, dogs in the large-breed group showed aggression or fearfulness 7.7 and 10.6% less frequently (p<0.05) respectively than those in the small-breed group. Reported increases in aggression or time spent eating were also 7.3 and 2% less likely respectively. Conversely, the percentage of larger breeds showing: polydipsia; minimal activity; walking into walls; grooming conspecifics; and reported declines in obedience was 49.9, 7.3, 3.8, 7.6 and 13.9% higher (p<0.05) than small breeds. Interestingly, despite some increases in disease (reported elsewhere), aged short-lived and large breeds (i.e. those assumed to age prematurely) had fewer reported unwelcome behaviours. Overall the high percentage of unaffected behaviours in both analyses (92% and 87% respectively) suggests that cognito-behavioural ageing does not affect dog breeds at different rates. The apparent absence of variability between size and longevity groups should facilitate the study of canine senescence in the community.

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Encoding and genetic selection of psycho-acoustic markers of emotions in sheep

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The need for objective assessment of animal welfare in livestock production increases. The measurement of psycho-acoustic markers could offer a practical alternative to the current subjective 'measures' of animals mental well-being. The mother-offspring sheep relationship offers a good model to investigate emotions in animals because ewes show strong behavioural responses when separated from their lambs. The aim of the present work was to identify the psycho-acoustic markers of positive and negative emotions in sheep. We analysed the acoustic characteristics of bleats emitted by the mother when its lambs were kept 1m away and without contact with their mother (distressing situation), in ewes selected for their high (nervous, n=15) or low (calm, n=12) reactivity to social isolation. Sound recordings were conducted at 48hr after lambing. The modality and complexity of stress-encoding parameters were analysed using ANOVA and discriminant function analysis (DFA). Lamb withdrawal induced changes in the mother voice characteristics. Frequency parameters (e.g. Fundamental frequency (F0), 120.2±3.9 vs 133.3±3.5Hz) increased, as did temporal and amplitude parameters (e.g. total duration: 829±32 vs 984±34ms; RMS: 45.7±3.5 vs 66.9±4.2mv/unit; ANOVA, p<0.05). Six major acoustic markers differed from the calm to nervous selected ewes: F0 (+16%), max. F0 time (+16.5%), Root Mean Square (+28.7%) were higher for the nervous than the calm ewes and the depth of Amplitude-Modulation (+58.7%), Shimmer (+23%) and Jitter (+36%) were greater for calm than for nervous ones (ANOVA, p<0.05). Using DFA, almost 90% of the animals could be correctly assigned to one of the two lines using only these 6 major acoustic parameters (only 11% misclassified in each line when we inject new data). Our results suggest that some ewe bleat characteristics could be used as psycho-acoustic markers of emotions. This study also shows that acoustic sensory modality could provide an objective basis for assessing animal emotion.

Problem solving in dingoes (Canis lupus dingo): an example using the detour task

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We investigated the problem solving ability of 20 sanctuary raised dingoes using the 'detour task', which required them to find their way to a food reward placed behind a transparent V-shaped fence. Dingoes were randomly allocated to one of four experimental conditions (inward detour, outward detour, inward detour with option of using one of two doors in the fence, or inward detour after witnessing a human demonstrator). Four trials were given for each condition, with the fifth trial reversed (i.e., inward detour became outward detour, open doors were closed, or no demonstration was provided). Recent studies have found that domestic dogs generally perform poorly on the 'detour task', with 28-42% unable to solve the inward detour task within 60 seconds on the first trial, and the remaining dogs taking 20-40 seconds to reach the reward. Dogs do not significantly improve performance, even after six trials, and find it difficult to generalise problem solving strategies when the condition is reversed. Dingoes however, were highly successful at this task, averaging 10.25 seconds (±SE 1.96) and making minimal errors (Mean±SE = 0.63±0.26) on the first trial of the inward detour condition (N=8). Dingo performance significantly improved within the four trials (Friedman Test: P=.010). Further, they adapted their problem solving strategies when the condition was reversed, with no significant difference in latency between trials 1 (Mean±SE = 10.25±1.96) and 5 (Mean±SE = 8.88±1.32; Wilcoxon Signed Rank Test: z = -1.400, P=.161, two tailed). Similar results were obtained for the other three conditions. This study is the first to test a wild canid on the V-shaped version of the 'detour task'. Overall, the results are in line with previous findings which suggest that wild canids (Canis lupus) are more adept at non-social problem solving than domestic dogs.

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Comparison of two motor laterality tests in the domestic dog (Canis familiaris)

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Associations between motor laterality and noise sensitivity have been reported in the literature. Fearfulness, including noise sensitivity, is one reason for failure of guide dogs during training. Furthermore, convention dictates that dogs work to the left of their handlers, even though this may disadvantage some perfectly useful dogs. So, knowing a given animal's laterality may be predictive of its fearfulness and usefulness as a guide. Motor laterality in potential guide dogs (n=88) was determined using two methods: the KongTM Test (the current benchmark test) and our innovation, the First-stepping Test. KongTM studies record 50 paw-uses during foraging from a rubber cylinder, which can take up to 4 hours per dog. First-stepping bypasses hunger and simply records the first foot advanced after standing with both forelegs level. Unlike the KongTM Test, 50 observations can be obtained in 20 minutes. First-stepping exposed more significant paw preferences (71.6%; $p<0.001$) than the KongTM (40.9%; $p=0.21$). Using a one sample t-test, it showed a marginally non-significant tendency for a right population bias ($p=0.065$) whereas the KongTM Test indicated an ambidextrous population ($p=0.40$). Slightly over half the dogs (55.7%) showed a significant paw preference in one test but not the other. Of the 28.4% of dogs showing a consistent paw preference in both tests, only 44.0% had a significant bias. Direction ($p=0.98$) and strength ($p=0.77$) of lateralisation were not correlated between the two tests. These results concur with previous laterality studies by showing that motor bias changes with task complexity. The difference in population biases observed is likely to reflect different motivation and action patterns between the two tests; foraging in the KongTM, and locomotory in First-stepping. Compared with the KongTM, the First-stepping Test is quicker and more discriminating as demonstrated by its exposure of a significant left or right paw preference in more dogs.

Dung avoidance behaviour of Dartmoor ponies (Equus caballus)

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Herbivores grazing in fenced areas risk high parasite-loads when forced to graze near their own dung. We investigated during a 4-month period (July, August, September and October) the influence of parasite-infected dung on grazing behaviour, patch selection and parasite-load of horses. A natural group of eleven (one stallion, 5 mares and 5 foals) free-ranging, naturally parasite-infected Dartmoor ponies of varying age, sex and parasite-load were observed in an area of 4.3 hectares of grassland. Behaviour (including grazing, etc) and distance to nearby dung (7 distance categories: 0-1m, 1-2m, 2-3m, 3-4m, 4-5m, 5-10m, 10+m) were recorded. Faecal Egg Counts (FEC) of 4 dung samples (2 in August and 2 in October) of all individuals were collected and analysed. During October dung densities were experimentally manipulated; in areas selected for low dung densities, white spots were painted. After 4 days fresh dung was placed on the spots in half of these areas. Behaviour and distance from spots (4 days) and dung (4 days) were registered using scan sampling (5-min interval). Data were analysed with Chi-square and GLM tests. The horses grazed significantly less than expected (Chi-square=123.48, df=1, P<0.001) within a short distance (0-1m) from dung, and significantly more than expected (Chi-square=239.06, df=1, P<0.001) four or more metres away from dung. FEC scores for Strongylus spp. (blood worm) showed a positive and significant correlation with individual grazing activity (in %) at 0-1m distance from dung piles (Rs=0.76, P=0.011, N=11). After addition of faeces to low density dung areas, the grazing activity decreased from 45% to 29% (F=13.34, df=1,7, P=0.008). Dartmoor ponies avoid grazing near dung piles and avoid also areas with high dung densities. The avoidance is not complete, and individuals that graze more in areas 0-1m from dung piles have a higher parasite-load and hence may run more health and welfare risks.

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Behaviour patterns in captive Iberian Lynx (Lynx pardinus) females during parturition and lactation

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The Iberian lynx (Lynx pardinus) has been catalogued as the most endangered felid species in the world (IUCN, 2002). Lynxes are solitary and territorial animals that show seasonal reproduction, and mate between mid January-February. Pregnancy oscillates between 62-65 days and the typical litter size is 2-3 cubs. However, little is known about lynx behaviour during parturition and lactation. Our study aimed at analyzing the behaviour patterns of females in the pre- and post-partum period, the frequency of specific maternal behaviours such as allogrooming and nursing and the effect of husbandry and age-related factors in stereotypies such as pacing and the possible pacing motivations. Seven captive females, among them three pregnant (Sali, Espe and Aura), were observed by scan sampling every 10 minutes during 10 weeks in 3 different day periods (morning, afternoon and night), and following 4 different orders. Eleven Day/Night EV1223CD4 Colour Domo infra-red (IR) cameras and 21 IR fixed cameras distributed in the range area, delivery rooms, and delivery dens allowed the live observation. Two different ethograms were developed and for data registration, an Excel macro table was created. For statistical analysis, Chi-squared tests were used using SPSS.14.0. Results showed females who gave birth spent 25% of their time displaying maternal behaviours, whereas they decreased the time for sleeping (16%), exploring (4.21%) and pacing (6.4%). Among mothers, Sali (3 previous litters) spent more time grooming her cubs than the others (10.51%), Espe (hand-reared, 1 previous litter) spent more time nursing (22.5%); and Aura (primiparous) spent more time resting (44%), exploring (16.37%) and pacing (1.41%). Wild animals incorporated at the breeding centre at an age of 7 months or captive-born animals paced and explored more (p<0.0001). A positive correlation was detected between pacing and feeding (p<0.05). Husbandry had an effect on the time spent pacing and exploring (p<0.007).

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Measurement of corticosterone in chicken eggs is confounded by cross-reacting gestagens

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Identifying potential stressing factors and improving husbandry conditions of domestic animals is a major welfare issue. Plasma glucocorticoid concentrations are widely used to assess stress in an animal but the blood sampling procedure itself is not feedback-free. Quantification of stress hormones in the egg has been suggested as a non-invasive method to measure stress in laying hens and thus evaluate animal welfare. However, when using a new method, one important aspect is to prove its biological relevance and thus its ability to detect increased levels of stress hormones in the analysed material. As a sound biological validation for egg yolk is still lacking, we analysed chicken egg yolk for the presence of corticosterone. We performed HPLC separations and determined concentrations of immunoreactive corticosterone via enzyme immunoassay (EIA). In eggs of untreated chickens, we did not detect any immunoreactive corticosterone at the elution position of corticosterone, but found that the corticosterone antibody cross-reacts with progesterone and several other gestagens, which are present in the yolk in abundant concentrations. When eggs from laying hens with corticosterone implants and thus elevated plasma corticosterone concentrations were analysed, we found immunoreactive corticosterone as well as high amounts of cross-reacting gestagens, hampering quantification of corticosterone in yolk without previous clean-up. This study demonstrates that the high concentrations of gestagens present in the yolk cause a signal in a corticosterone immunoassay. Our findings therefore strongly suggest that measured concentrations of corticosterone in homogenised yolk may actually reflect to a large extend those of gestagens. They also illustrate possible confounding factors when measuring a certain steroid hormone out of a mixture of various unknown and potentially cross-reacting steroids. The study demonstrates the necessity of evaluating the biological relevance of a method whenever animal welfare is assessed via physiological parameters.

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A multimedia-based cognitive-behavioural intervention programme improves the attitude of stockpeople to handling pigs

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Multimedia-based training packages (Quality Handling®) for livestock handlers to improve human-animal interactions are currently being developed in Europe (within Welfare Quality®) for beef and dairy cattle farmers, pig farmers and laying hen farmers. Each training package comprises a computerized cognitive-behavioural intervention programme, using voice-overs, images and videos. Such programmes have shown, in Australia, to be appropriate for people with limited formal education and to be the preferred method of learning for stockpeople. Most importantly, such a training method has been shown to improve stockperson animal handling, farm animal production and farm animal welfare. The effectiveness of the pig stockperson training package was tested in a field test with Dutch pig farmers. Two groups of stockpeople were used. In one group the stockpeople were trained, and their farms were visited twice (treatment group: 6 farms, 6 stockpeople): one visit shortly before and one visit 6 to 8 weeks after the training. Farms of the other group of stockpeople were visited twice, and these stockpeople were not trained (control group: 9 farms, 12 stockpeople). Part of a farm visit was the use of a questionnaire to determine the stockperson's beliefs about pigs in general, and on attitudes towards interacting with pigs. Relative to control stockpeople, trained stockpeople showed no change in general attitudes towards pigs, but showed a greater improvement in attitude to handling pigs (GLM; p<.05). The findings therefore confirm that a cognitive-behavioural intervention programme is a promising tool to improve human-farm animal relationships. We will also discuss the implications of the programme for actual behaviour of stockpeople towards pigs and the pigs' level of fear of humans.

Effects of extended evening zoo opening hours on the behaviour of captive mammals

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Changes in animal management affect the behaviour of zoo animals. A decision to extend Taronga Park zoo (Sydney, Australia) opening hours at night for a month in spring caused staff to predict the likely effects on the animals. Predictions varied between species but included increased stereotypy, aggression and handling difficulties. Two data collection methods were used with nine focal species or groups selected using the staff predictions: dingoes; large macropods; mixed African ungulates; elephant; snow leopard; clouded leopard; Kodiak bear; chimpanzee; and orang-utan. For method 1, activity data were collected for 5hr/night either directly or from video footage using an instantaneous scan sampling method, with ad-lib recording of predicted behaviours, before and during the period of evening opening. Method 2 was a survey completed at exhibits recording animal visibility, activity and vocalisations, and visitor numbers before and during evening opening. T-tests were used to test differences in single attributes and G-tests to compare focal activity budgets between the pre- and extended opening periods. Data presented are means±standard deviation. Evening mean focal activity budgets did not differ significantly pre- and during opening, and mean frequency of predicted responses differed only for snow leopard, where % pacing increased (pre: 4±5, during:15±12% time; $p<0.05$). Predicted responses observed initially for focal animals moderated as animals appeared to become used to the changed conditions. Survey results confirmed the focal species observations and provided data on other affected species. When data from all exhibits were combined, the animal visibility index increased (pre: 36±31, during: 53±32% time; $p<0.01$) and time spent active increased (pre: 24±18, during: 35±28%; $p<0.02$) in lit exhibits during extended opening. The study addressed staff concerns and we concluded that there were few signs of continued stress, with animals rapidly adapting to the presence of visitors and changed management conditions of extended opening.

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Describing the ideal Australian companion dog

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Dogs vary considerably in physical and behavioural characteristics, due to selective breeding aimed at creating dogs suitable for various working roles. Nowadays, few dogs undertake this work. Instead, most are kept as human companions. Not all dogs are equally suited to this role, with thousands being admitted to shelters because they display behaviour deemed inappropriate by owners. To identify traits considered important in companion dogs, 877 volunteers (79.8% female) aged 18 to 82 years (mean = 34.3, SD = 14.5) completed a survey about their 'ideal' dog. Characteristics identified as important included the dog being medium sized, short haired, desexed, safe with children, housetrained, healthy, obedient, friendly and affectionate. Desirable behaviours were grouped using Principal Component Analysis into five factors; calm/compliant (CC), sociable/healthy (SH), energetic/faithful/protective (EFP), socially acceptable (SA), and non-aggressive (NA), which explained 45.7% of the total variance. Pearson's correlation coefficients indicated that scores on the CC scale were moderately positively associated with participants' age (r = 0.28, n = 874, P<0.01). EFP scores were weakly negatively associated with participants' age (r = - 0.12, n = 874, P<0.01) and education level (r = - 0.18, n = 877, P<0.01). Women preferred a dog who is CC [t(870) = -2.33, P = 0.02], SH [t(870) = -2.57, P = 0.01] and NA [t(870) = -2.67, P = 0.008] while men preferred one which is EFP [t(870) = 3.09, P = 0.002]. Non-dog owners rated the EFP factor [t(874) = 2.65, P = 0.008] as more important than did dog owners. Overall, there was a preference for dogs that might be described as amicable. This is important because it means that breeders and trainers can make more informed selection and management decisions, potentially increasing owner satisfaction, reducing the incidence of problem behaviours exhibited by dogs and improving dog welfare.

Effects of extended lactation on cow activity

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Dairy herds in Australia calve in spring of each year, however extended lactation beyond 300 days is practiced by some dairy farmers. This study examined the impact of extended lactation on cow activity, using remote data sensors (Icetag) fitted to individual cows for 24hr. Observations were taken on 25 'Extended Lactation' cows (EL) and 25 'Control' cows (C) in autumn and the subsequent spring. In autumn the main difference between the two treatments was that the C cows but not the EL cows were in calf, while in spring the C cows were in peak lactation after having recently calved while the EL cows were producing considerably less milk, and both were back in calf. After appropriate transformation, data were analysed using REML mixed models. Results are presented as predicted medians and predicted inter-quartile ranges (IQR) on the original scale. There were no differences between the medians of the two treatments (P>0.05) in either autumn or spring between C and EL cows in number of steps/24hr (4510 vs 4580 and 4500 vs 4860 resp), %active/24hr (7.0% vs 7.5% and 7.7% vs 7.6%), %standing/24hr (53.6% vs 53.9% and 50.2% and 49.4%) and %lying/24hr (39.4% vs 37.4% and 42.1% vs 42.9%). However, in autumn there where large differences in variation in behaviour, when the IQR of C and EL cows of 'step number' was 910 vs 3010, 'active' was 0.5 vs 4.1, 'standing' was 4 vs 14 and 'lying' was 3 vs 18 (all P<0.002). These results suggest that the status of milk production and pregnancy did not affect activity and lying behaviour. However, EL cows were not pregnant in autumn and may show oestrous behaviour. This may explain the large variation of behaviour between EL cows in autumn, and therefore needs to be taken into account when analysing cow activity data.

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Moving distance and speed of Thoroughbred foals, one-year horses and broodmares under night and day grazing condition

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To investigate the amount and strength of exercise by rearing horses under night-and- day grazing conditions, moving distance and speed of 41 Thoroughbred foals, 50 one-year horses and 23 broodmares were measured by portable GPS fitted on head-collars. The research was carried out on grazing pasture (1 to 3 ha) in a private breeding farm in July, September and October from 2006 to 2008. The horses were grazed 840 to 1,200 minutes from afternoon to next morning and their behavior was recorded at 2 or 5-min intervals to measure the percentages of grazing or resting behavior at pasture. The data were analyzed statistically by ANOVA and student t-test. Grazing time of foals was shorter than that of one-year horses and broodmares (56.7 vs. 64.7 and 68.6 %, $P<0.05$), while their resting time was longer than that of older horses (34.0 vs. 25.4 and 22.6 %, $P<0.05$). Total distance covered and distance through grazing of one-year horses was 14.2 and 10.3 km/d, which were longer than those of foals (10.4 and 7.2 km/d, $P<0.05$) and broodmares (11.5 and 7.6 km/d, $P<0.05$). The average speed through moving of foals and one-year horses was 1,021 and 1,155 m/hr, which were faster than that of broodmares (905 m/hr, $P<0.05$). Total time of running with trot (2 to 5 m/sec.) and canter (>5 m/sec.) by one-year horses was 393 and 86 sec., which were longer than those by foals (181 and 43 sec., $P<0.05$) and broodmares (275 and 14 sec., $P<0.05$). Total distance through running by one-year horses was longer than that by foals and broodmares (1,730 vs. 770 and 820 m/d, $P<0.05$). In conclusion, the moving distance of foals was similar to those of broodmares although the grazing time was shorter, and one-year horses took the largest and strongest exercise under night-and-day grazing conditions.

Differences in the pre-calving behaviour of dairy heifers and cows, with and without calving difficulties

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Behavioural changes before calving could potentially be used to predict the time of calving using advanced methods, to help improve monitoring by farm staff and identify those animals likely to experience dystocia. This study aims to identify whether there are differences in the behaviour before calving between heifers and cows, and between those which experience dystocia and those which do not. Twelve Holstein-Friesian heifers and twelve cows were selected. Half of each group had calved without assistance, and half had been assisted using a calving jack (for >1 minute). Their behaviour was recorded for 12 hours prior to the calf being expelled and for a 12-hour control period at a similar time of day, 1-4 days earlier. Continuous focal observations from video recordings were used to quantify the frequencies and durations of behaviours during 2-hour periods. For each 2-hour period, paired t-tests were used to examine differences in behaviour between the calving and control periods. Compared with the control, both groups of heifers showed a significant increase in the duration of tail-raising from 4 hours before calving with an average increase of 31min 51s ± 34min SD (t=3.11, df=10, p=0.011). This was earlier than observed in cows which showed a significant increase (of 47min 42s ± 19min 41s: t=8.04, df=10, p<0.001) in the final 2 hours. In unassisted groups, a significant increase in lying frequency compared with the control period started 6 hours before calving (heifers: p=0.048, cows: p=0.042) whereas in the assisted calving groups a significant change only occurred in the final 2 hours before calving. These results show differences between heifers and cows in their pre-calving behaviour which must be taken into account when predicting the time of calving from behaviour. However, for those assisted with a calving jack, no early-warning signs of a difficult calving were identified.

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Lying during transport by lambs depends on the duration of pre-transport food and water deprivation as well as the duration of transport itself

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Australian livestock are commonly subjected to periods of food and water deprivation (FWD) prior to transport. The aim was to quantify the effect of pre-transport FWD on the response to transport in lambs. Merino lambs (n = 180; 6-7 months of age) were used for the experiment. Of these, detailed measurements were made on 120 focal ewe lambs. A factorial design was used comprising three pre-transport FWD treatments (0, 12 and 24 h) and two transport duration treatments (12 and 24 h), and these were replicated twice over a period of 4 weeks. Lambs were transported at the recommended stocking density (0.18 m2/animal) during Autumn (Mean temperature and range 11.3oC, 0.4 - 23.3oC). Detailed behavioural and physiological measurements were recorded pre- and post-FWD and pre- and post-transport but only the lying behaviour result are presented here. Lying behaviour during transport was measured using IceTagTM behavioural monitors. The data were analysed using GLM procedure in SAS. Lying time during transport was significantly influenced by the interaction between FWD duration x transport duration (P<0.01). Over 12 h transport, there was no significant difference in lying time between the FWD treatments. However, for the longer journey of 24 h, the lambs from the 12 and 24 h FWD treatments spent more time lying (20.2 and 12.5 min, respectively) than the lambs subjected to no FWD (3.0 min; P<0.01). The overall level of lying behaviour was relatively low and this was most likely due to stocking density. Furthermore, it is not possible to distinguish whether lying bouts were preceded by slippage or a loss in balance. It was concluded that lying incidence during transport of lambs depends on both the duration of transport and whether or not the lambs have been exposed to pre-transport periods of FWD.

Effect of broody hens on behaviour of chicks

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The objective of the present study was to clarify the details of maternal behaviour and the effects of broody hens on the behaviour and character of chicks. Five groups of five chicks each were reared by broody hens and five groups of five chicks were provided with a heater for 28 days. The behaviour of all chicks was recorded using scan sampling at 5 min intervals for 6 h per day at 1, 5, 9, 13, 17, 21, and 25 days of age. Two behavioural tests for evaluation of fearfulness and familiality with humans were conducted, and the number and latency of freezing, vocalizations, and steps taken were recorded for 10 min. The data was analyzed using repeated measure ANOVA or Student's t-test. The chicks spent 60% of their time on brooded behaviour (the state of chicks being brooded by hen) at 1 day of age. The time spent on brooded behaviour decreased sharply during two weeks with development of regulation of body temperature, and then decreased gently. At 25 days of age little brooded behaviour was observed. The brooded chicks spent more time on active behaviour (59.7% vs. 42.8% ; F=10.1, P<0.05), especially dust-bathing(0.8% vs. 0.4%; F=5.9, P<0.05) and floor pecking (43.8% vs.28.4%; F=10.2, P<0.05), but less time on gentle feather pecking (1.0% vs. 1.6%; F=12.1, P<0.01) than non-brooded chicks. In both behavioural tests, the total duration of freezing was shorter in brooded chicks (90.4-167.8 vs. 387.1-467.4 sec.; t=-4.4, P<0.001), and the total numbers of vocalizations (278.0-280.1 vs. 14.9-29.6; t=7.0, P<0.001) and steps (133.5-188.8 vs. 3.6-9.8; t=5.9, P<0.001) taken were greater in brooded chicks. In conclusion, maternal behaviour has a close relation with development of regulation of body temperature, and the development of behaviour of chicks was promoted and fearfulness was decreased remarkably by provision of broody hens.

Poster Group B

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Validation of onset data loggers as a tool to measure lying behavior in dairy cattle

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Lying behavior in dairy cattle can provide insight into how cows interact with their environment and can serve as a useful indicator of animal welfare. We tested the accuracy of the Onset Pendent G data logger for measuring lying behavior in dairy cattle (n = 12 cows in each of 2 experiments). Loggers sampled position at 4 intervals (6-s, 30-s, 60-s, and 300-s), and data were smoothed using 3 filtering methods, using an Excel macro to convert readings (i.e., lying bordered by standing or vice-versa) occurring singly, or in runs of 2 or less, or 6 or less. Cows wore the logger for at least 1.5 d on the lateral side (Experiment 1) or the medial side (Experiment 2) of the hind leg above the metatarsophalangeal joint and were simultaneously video recorded. The logger accurately measured lying behavior, including which side the cow was lying on: for example, predictability, sensitivity, and specificity were > 99% using 30-s sampling and the single event filter compared to continuously scored video. The 6-, 30- and 60-s sampling intervals were comparable for all aspects of lying behavior when using the 6, 1 and 1 event filters, respectively. Estimates of lying time generated with the 300-s, 1-event filter were highly correlated (r>0.99) with estimates from video, but the number of lying bouts was underestimated by 6.2 and 23.0% in Experiments 1 and 2, likely because short lying bouts were missed (on average, 1.5 and 23.8% bouts less than 300 s in Experiment 1 and 2, respectively). In summary, the data logger accurately measured lying behavior when the sampling interval was ≤60 s and single readings indicating lying or standing were filtered from the data set.

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Behavioral and physiological responses of dairy cows to lipopolysaccharide induced clinical mastitis

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Mastitis is the most prevalent disease in dairy cows, however, alleviation of pain is rare. This study aimed to assess the relationships between behavioral signs of pain and physiological responses to mammary inflammation, and provide evidence of the need for mastitis pain relief. Lipopolysaccharide (LPS) induced mastitis was used to introduce a controlled amount and type of non-replicating irritant to elicit symptoms of clinical mastitis, along with rapid elimination and recovery; typically within 24-36 h. Ethics approval was received. Twenty Holstein cows were assigned to five blocks of four cows grouped by parity and stage of lactation. Cows were individually housed in tie-stalls and continuously video-monitored for the duration of the study, which consisted of a 1-week pre-experimental period followed by a 4-day experimental period. Two cows within a block were randomly selected to receive either intramammary infusion of 25 μg of sterile LPS or intramammary infusion of sterile saline. Blood samples, milk samples, and rectal temperatures were collected five times on the day of challenge and then once daily for the next three days. Behavior was observed continuously for 24 h after infusion. Data were analysed by ANOVA. LPS treated cows had higher (P=0.05) mean (±SE) rectal temperatures (41.4±0.2 vs. 38.4±0.2 °C), concentrations of milk amyloid (3.4±0.3 vs. 1.4±0.2 μg/ml) and serum cortisol (63.0±6.0 vs. 28.3±2.9 μg/dl) in the 24 h after infusion compared with saline treated cows. LPS treated cows spent less time in the 24 h after infusion eating (16.9±0.8 vs. 21.0±1.2%), ruminating (35.8±2.3 vs. 39.8±1.5%), and lying down (40.7±4.0 vs. 47.9±3.4%) compared with saline infused cows. Using LPS infusion to model clinical mastitis, the results of this study suggest that the behavior of cows is significantly affected as a result of mammary inflammation, and that treatment of both the animal's infection and pain must be considered.

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The buck stops here – stress of semen collection

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Reproductive technologies are used routinely on-farm to hasten genetic progress and improve the efficiency of production. Some techniques have the potential to compromise the welfare of the animal so the use of methods that are less stressful will improve animal welfare on-farm. In goats, collection of semen from bucks for commercial use can be done via electro-ejaculation (EEJ) or using an artificial vagina (AV). We tested the hypothesis that semen collected from Cashmere bucks using an AV would be less stressful than EEJ. Buck sexual behaviour, vocalisation, struggling and plasma cortisol were measured as indicators of stress in three groups of males during EEJ, AV and natural mating (control). The data were analysed using repeated measures. Bucks that had semen collected using an AV expressed pawing and licking, but no flehmen response as seen with the natural mating. The absence of this behaviour did not appear to be a response to stress. During semen collections using an AV the bucks did not vocalise or struggle. Vocalisations had a higher decibel reading (F=19.31, P<0.01) in bucks subjected to EEJ (88.69 ± 1.07 db) compared to natural mating (56.32 ± 0.62 db). There were large differences between the treatments (F= 171.50, P<0.05) in the time from when the buck entered the pen to ejaculation - EEJ (275.3 ± 9.7 s), natural mating (82.5 ± 15.30 s) and AV (43.0 ± 6.05 s). Within a few minutes after semen collection, plasma cortisol was higher (P<0.05) for 20 minutes in the EEJ group (18.29 ± 1.84 µg/L) compared to bucks collected by AV (8.47 ± 1.07 µg/L) or natural mating (10.76 ± 1.94 µg/L) but returned to the pre-collection level by 40 minutes. Our data suggest that when natural mating is not possible, semen collection using an AV is less stressful than EEJ.

Breed differences in individual distance of domestic sheep

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The aim of this experiment was to investigate individual distance for two different breeds of sheep during resting and feeding. Eight groups of 4 Spæl sheep, a light, native Norwegian breed (Mean ewe weight ± STD; 56.9 ± 7.7 kg), and 8 groups of 4 Nor-X sheep, a heavy white sheep, bred for meat production (79.6 ± 5.2 kg), were used. The experimental pens were built in an insulated building with similar temperatures over test days; pens measured 2 m x 12 m. A solid wooden resting platform (0.6 m wide) was created along the 12 meter wall. After one week of acclimatisation to the experimental pens, 24 hour video recordings were performed. Both the distance between all 4 individuals (6 possible pairings) and their resting position (head against head, head against back or back against back) was scored every 15 minutes during 12 hours (6 p.m. to 6 a.m.). In addition, the distance between the ewes at the feed barrier was recorded every second minute for 2 hours after each feeding. Number of ewes feeding and resting simultaneously was also recorded. Spæl ewes kept in closer proximity to each other (Mean ± SE; 1.45 ± 0.16 m) compared to the Nor-X ewes (3.1 ± 0.16 m) ($F_{1,68}=48.5$, $P<0.0001$). The same breed difference was found in individual distance when feeding where the Spæl sheep kept within significantly closer distance to their group mates (2.3 ± 0.07 m) than Nor-X sheep (3.1 ± 0.09 m, $F_{1,68}=10.3$, $P<0.005$). No significant differences were found in synchrony of resting or feeding behaviour between the two breeds. More details on individual variation will be given in the presentation. In conclusion, there were clear differences in individual distance when resting between these two breeds of sheep, which might be influenced by the breeds' level of domestication.

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Does flight distance really reflect the reaction to direct contact of human in cow?

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The aim of this study was to examine the relationships between flight distance (FD) and the reactions to direct contact with a human including the behavioural and physiological responses during handling in cows. Firstly, we measured FD of 16 Japanese Black cows and selected the 4 longest and 4 shortest FD cows (LFD and SFD, respectively). Secondly, a handling (gentle brushing) test was conducted 1 week after the FD test. Each cow was tethered during the handling test and brushed by same person who conducted the FD test. Behavioural responses (vocalization, tail swinging, head shaking and stepping) and heart rate (HR) of each cow were recorded before, during and after the handling periods (5 min, respectively). Behavioural responses and the mean HR of each period, the percentage of time where the HR during handling was higher than the mean HR before handling (PHR) and recovery times from the first peaks during handling to mean pre-handling HR (RT) for the LFD and SFD cows were compared by t-test. No difference was found for any behavioural response in each period between LFD and SFD cows. However, the mean HR of each period (before handling; 78.5 vs 61.3 bpm, $P<0.05$, during handling; 80.9 vs 59.0 bpm, $P<0.01$, after handling; 78.2 vs 59.7 bpm, $P<0.05$, LFD vs SFD, respectively) and PHR (LFD: 68.3 ± 40.9 %, SFD: 22.1 ± 9.6 %, $P<0.05$) were higher in LFD than in SFD cows. Furthermore, RT was longer in LFD (147.5 ± 133.6 s) than in SFD (16.3 ± 23.6 s, $P=0.052$). Consequently, flight distance was closely associated with the reaction to direct contact with a human and might reflect the psychological stress of cows.

Changes in captive red river hog (Potamochoerus porcus) peripartum mother and infant behaviour for one month after farrowing

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In Japan, captive red river hogs are kept at only the Yokohama zoo. Management of the species has been based on information about the Japanese wild boar (Sus scrofa leucomystax), because there are few studies of captive African suids. The objective of this study was to collect basic behavioural data to provide the proper maintenance conditions for the animal. One mother and her litters were studied in 2007 and 2008. The mother's behaviour for 10 days prepartum and on the farrowing day and the piglets' behaviour for a month after birth were observed. Their use of each site (bedding site, feeding site, and outside site) was recorded before and after farrowing. The proportion of locomotion and exploratory behaviour increased in the three days before farrowing ($p<0.05$, chi-square test). The mother rooted, sniffed, carried burrowing material to or pawed hay at the farrowing site, similar to a wild boar's nest-building behaviour. The nest hay was replaced by keepers every day. During farrowing, the mother performed nest-building behaviour more often than nursing and resting. After parturition, mother and piglets spent most of day 1 in the bedding site. At 3 days of age, the proportion of time spent by the piglets with the mother and moving out of the farrowing site was higher than at 1 days of age ($p<0.001$, chi-square test). The piglets' locomotion increased and sucking behaviour decreased with age. The frequency of the piglets' contact with the mother decreased during the month. At outside site, the piglets explored actively and also investigated related individuals who were exhibited in the next paddock. These results showed the mother's nest-building behaviour does not differ widely from reported wild boar behaviour and also that the piglets adapt relatively easily to the external environment.

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The effects of a modified stall on gestating sow behavior and performance

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Sow housing is the most controversial welfare issues facing the swine industry.   We hypothesize that slight modifications of the stall may influence sow well-being, thus the objective was to evaluate the effects a modified gestation stall has on behavior and productive performance of dry sows. On d 23±5 of gestation 16 multi-parious sows were allocated to either a standard stall (CRATE) or adjustable stall (width only; FLEX); fixed dimensions for CRATE; 55.9cm × 218.4cm and FLEX; 48cm × 215.9cm. For sows in FLEX, once placed in the stall, width was adjusted based on sow body size to achieve 2cm of space between bottom bar and sow's udder while lying in full lateral recumbency at early-gestation, mid-gestation, and late-gestation. Widths were 51.9±0.56 (early-gestation), 57.8±0.64 (mid-gestation), and 62.3±0.61 (late-gestation); length was constant. Behavior was registered using continuous video-records. Lesions were recorded on d 25±5, 45±5, and 112±5 of gestation. Data were analyzed using Proc MIXED with repeated measures (SAS). Sows in CRATE performed more oral-nasal-facial (111.5min) and sham-chewing (98.8min) than sows in FLEX (53.8min; 57.5min, respectively, P<0.0001). Sows in CRATE also performed more of these sterotypies later in gestating (174min) than sows in FLEX (59.6min, P<0.0001). Sows in FLEX sat more (187.5min) than sows in CRATE (68.7min, P<0.05). Sows in CRATE tended to drink more (44.5min) than sows in FLEX (34min, P<0.10). Lesions (right side) were greater among sows in FLEX (10.8) than sows in CRATE (7.7, P<0.05), but lesions decreased from gestation d25 (24.1) to d112 (14.1) among all sows (P<0.05). Sows in FLEX had more piglets born (14.3, P<0.01) and tendency for more piglets born alive (12.9, P<0.10) than sows in CRATE (11.3 and 10.3 respectively, P<0.01). These data indicate that a slightly modified stall can affect stereotypic behaviors, lesions and productivity of the sow, thus potentially enhancing welfare.

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The impact of transition to a new housing system on milking cows' behaviour patterns

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The aim of the study was to evaluate the behavioural changes during the adaptation process in two dairy herds after their transition from tied housing to loose housing. In original farms cows were kept in similar tied systems with the difference that herd I (n=380) did not graze during the summer. Herd II (n=51) was taken to the new loose housing system directly after the grazing period ended. After introduction to the loose housing environment, herd I was divided into four groups, whereas the composition of herd II remained constant. In both farms cows were milked and fed twice daily. The study was conducted over one month with four five-day observation periods. Cows were observed between milking times (12.00-16.00). All the following behaviours were recorded with instantaneous recordings at 10 minute intervals during the study: lying, eating, walking, sleeping, ruminating and vocalizing. Of social behaviours, aggression and allogrooming were studied. Data were analysed with the binomial generalised linear models considering effects of period, farm and farm*period interaction using the SAS procedure GLIMMIX. Preliminary results showed that during the first observation period cows in farm one vocalized more (p<0.001) than in farm two (2.9% and 1,4%, respectively). At the same time cows from farm one showed less exploring and ruminating behaviour than cows from farm two (p<0.001; 0,9% and 2,5%; 17,9% and 23,9%, respectively). During later periods the vocalizing and exploring behaviours decreased in both farms whereas the rumination increased. Grooming and allogrooming were performed more by cows from farm one and those behaviours increased gradually in both farms during the study. It was concluded that the adaptation process in both farms lasted approximately three weeks and cows from the second farm that were introduced to the new environment from pasture were less stressed and adapted faster with the new environment.

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Effect of environmental enrichment on the behaviour and welfare of suckling dairy goat kids in confinement

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Goats have been subjected to production schemes with increasing levels of intensity, which imply space limitations and a decrease or even removal of the possibility to show behaviours they have developed during their evolution. The objectives of the present study were to: 1) evaluate the effect of environmental enrichment on welfare and behaviour and 2) find alternatives of handling through environmental enrichment in Murciano-Granadina suckling dairy goat kids in confinement. Two treatments, enriched and non-enriched, were the randomly assigned to 7-day-old dairy goat kids (n=96), with four replications of each treatment (n=12 for each replica). Enrichment elements were feeding on high, straw bales, concrete blocks and bricks. Observations were carried out by video (132 h), during 3 periods of 11 days each, during the 90 days of the experiment. The behaviours studied were: ingestion, body care, locomotion, exploration, rest-sleep and agonistic. Data were analyzed using a non-parametric test (Mann-Whitney) for comparisons between treatment groups The enriched compared to the non-enriched kids carried out more ingestive (2.55 ± 3.01 vs. 0.34 ± 0.52), body care (1.62 ± 1.56 vs. 1.16 ± 1.73), locomotion (8.43 ± 6.97 vs. 3.31 ± 4.67), exploration (2.83 ± 2.24 vs. 1.32 ± 1.67) and rest-sleep (3.81 ± 2.79 vs. 2.30 ± 2.10) ($P < 0.01$). The difference in agonistic behaviour (0.66 ± 0.97 vs. 0.98 ± 1.68) was not significant ($P > 0.05$). Exploration in non-enriched goats was directed to the elements of the pens, adversely affecting facilities. This study suggests that simple and low cost changes in the environment have significant effects in the behaviour and perhaps the welfare of kids in confinement.

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Effects of grazing opportunities on dairy cow comfort

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We aimed to evaluate comfort of dairy cows using behavioural and physiological indicators. In the 1st experiment, after a grazing period of 2-3 weeks and acclimatizing dairy cows to the experimental situation, access speeds of cows on a 100-m alley were measured twice to 3 grazing areas: large (900m2), medium (400m2) and small (100m2). Four parity groups of 3 cows were used: G1 (mean parity 4.7), G2 (2.7), G3 (1.7), G4 (1.3). Each area was allocated to each group in random sequence. The access speed to each area was analyzed by Kruskal-Wallis test or ANOVA. In the 2nd experiment, we established a grazing area and zero-grazing area (900m2 each) with 3 troughs, each containing fresh forage of 5kg. Four parity groups of 3 animals were used: G1 (3.0), G2 (1.7), G3 (2.0), G4 (1.0). The access speeds to both areas were measured as in the 1st experiment and analyzed by paired t-test. Additionally, plasma cortisol and oxytocin were measured in blood from cows (n=8) collected after a 10-min stay in both areas, and analyzed by Wilcoxon signed-ranks test. In the 2nd trial of experiment 1, G1, G2, and G3 did not differ in access speeds to the 3 areas. G4 moved slower to the large area than the other areas (P<0.05). In the 2nd trial of experiment 2, G1 and G2 moved faster to the grazing area (67.4±0.0 vs 15.4±1.5 (m/min);P<0.01, 71.6±3.1 vs 38.1±7.7 (m/min);P=0.07). 1 cow in G1 and G2, 2 cows in G3 and all heifers in G4 did not visit to the zero-grazing area. Plasma cortisol of animals was higher in the zero-grazing area than the grazing area (3.77±1.22 vs 2.33±0.74 (mg/dL); P<0.05), whereas plasma oxytocin showed the opposite effect (131.2±34.0 vs 155.7±34.7 (mU/ml); P<0.05). We conclude that grazing opportunity enhanced cow comfort.

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Reliability of categorical versus continuous scoring of welfare indicators: lameness in cows as a case study

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Many animal welfare traits vary on a continuous scale but are commonly scored using an ordinal scale with few categories, presumably because it is believed to increase data reliability. Using 54 observers of varying levels of expertise, inter-observer reliability (IOR) and user-satisfaction were compared between a 3-point ordinal scale (OS) versus a continuous modified visual analogue scale with multiple anchors (VAS) for scoring cattle lameness from video. Half the participants scored the first 20 videos using the VAS and the last 20 videos using the OS whereas the other participants used first the OS and then the VAS. Each video concerned a different cow walking over a 6m mat in the same setting. Each video was shown 4 times but only scored once per observer. ANOVA models indicated that IOR was significantly better for the VAS (r = 0.44) than for the OS (r = 0.35; P=0.016). Such a low IOR may not be surprising given the short training session (8 videos were scored communally prior to the trial), the difficulty of scoring from video, and the lack of experience of most observers. IOR increased with self-reported level of expertise for the VAS (P<0.001), whereas for the OS it was highest for moderately experienced observers (P<0.001). The mean continuous and categorical scores were highly correlated (r = 0.93, P<0.0001). Three times as many observers stated to prefer the VAS than the OS for investigating differences in lameness between herds. These results illustrate that it is possible for a continuous score to be more reliable and to have greater user acceptability than a simple categorical scale. As continuous scales are also potentially more sensitive, and produce data more amenable to algebraic processing and more powerful analyses, the scepticism against their application for assessing animal welfare traits should be reconsidered.

A diagnostic tool to assess and enhance calf welfare and management on-farm

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Unweaned calf morbidity remains high; a costly animal welfare concern. A survey of 115 Quebec dairy farmers found mean calf mortality of 8.8 %, which was underestimated by 20-50 % by producers: 94 % believed calf mortality was not a problem. Tools to assess calf health and welfare on-farm are needed. From this survey, we identified 10 areas of concern: calving management, newborn care and painful procedures, colostrum management, calf-dam separation, weaning, calf feeding, calf housing, heifer feeding, heifer housing, and health. We developed a diagnostic and intervention tool with recommended goals for each area of concern. An expert committee validated the scoring system and recommendations. The tool was tested in 28 dairy farms for feasibility, producer satisfaction and repeatability. Farmers were asked to take colostrum and blood samples, and record health data. The on-farm evaluation included an interview on management practices and in-barn measurements related to calf welfare. The efficiency and usefulness of the tool was evaluated by the producers. The visit required 3:38±1:07 h (Mean±SD). We found that 100 % of producers were convinced of the effectiveness of our diagnostic tool for identifying areas in need of improvement, and that our tool was useful as an advisory tool for technical advisors and veterinarians. Involving producers in the collection of data (e.g. checking colostrum quality by using a colostrodoser) and providing realistic targets, helped in putting emphasis on problem areas and in discussing ways of improvement. 75 % of producers would continue using the colostrodoser and keeping stock of colostrum. Although 65 % found it useful to keep health records, only 32 % continued to do so over a 6-month period. Voluntary improvements in animal welfare can be facilitated by using appropriate tools to educate producers and help them change their attitudes towards management and animal welfare.

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Animal-based measures for determining effectiveness of euthanasia of neonate piglets

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Low birth-weight and moribund piglets have low survival rates and often must be euthanized to prevent suffering. Stockpeople should be readily able to determine that the euthanasia procedure is effective. The objective of this study was to determine the most practical animal-based measures for assessing the effectiveness of euthanasia for neonate pigs. Low birth-weight and low viability piglets (<24 hr) were euthanized by stockpeople using either a non-penetrating captive bolt device (Zephyr; N=99) or a firm, sharp blow to the head (Blunt Trauma; N=76). An observer, blind to treatment, recorded the following measures immediately (within 3 sec) following application: 1) presence/absence of corneal reflex; 2) presence/absence of jaw tone; 3) presence/absence of breathing; 4) eye position (fixed/rotated); 5) presence/absence and duration of paddling leg movements; 6) presence/absence and duration of heart beat. All piglets were immediately rendered insensible by both treatments as determined by lack of both jaw tone and corneal reflex. Thirteen Zephyr piglets showed signs of returning to sensibility; data collection was terminated and euthanasia technique was immediately reapplied. Breathing, heart beat and leg paddling were observed in 0, 76.3 and 75.0% of the 76 Blunt Trauma piglets and in 2.3, 93.0 and 94.2% of the 86 remaining Zephyr piglets, respectively. In both treatments paddling ceased prior to heart beat, but piglets euthanized by Zephyr had longer durations of both paddling and heart beat compared to those killed by Blunt Trauma (PROC GLM; Paddling = 124.6±11.25 vs. 68.4±7.14 sec, P<0.001; Heart Beat = 408.65±38.82 vs. 170.91±18.43 sec, P<0.001). Paddling movements should be expected in a large proportion of piglets following physical means of euthanasia. Immediate and sustained lack of jaw tone, corneal reflex and absence of breathing combined with cessation of leg paddling within two minutes appear to be good signs of humane death in neonate piglets.

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The distribution of cat and kitten admissions to RSPCA animal shelters in Queensland, Australia and risk factors for euthanasia (a pilot study)

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The lack of fundamental statistical information on the number and nature of cats entering and exiting shelters creates difficulty in understanding the extent of the unwanted and stray cat problem. The aims of this study were to describe the characteristics of cats entering Queensland RSPCA shelters and identify risk factors for euthanasia after entry. Data for all cats entering Queensland RSPCA shelters from January 2006 to December 2007 were obtained from the RSPCA electronic database, ShelterMate©. Data collected included year of intake, category of age at entry, gender, postcode of origin, method of admission to shelter (stray, owner relinquished, council, euthanasia requested, returned, transferred in), breed, and outcome (euthanised, adopted, fostered, reclaimed, transferred out). Univariable and multivariable logistic regression was conducted to identify risk factors for euthanasia. In the study period 26,125 cats entered Queensland RSPCA shelters; 66% were adult cats and 34% were kittens. The most common admission source was stray (50% of adult cats and 69% of kittens), followed by relinquishment (22% of adult cats and 15% of kittens). When age was categorised into adult (> 6 months) and kittens (= 6 months) differences in risk of euthanasia were evident. Age category was strongly associated with the risk of euthanasia; odds of euthanasia were 6.9 (95% confidence interval: 6.4 - 7.5) times higher in kittens than adult cats (P <0.001) after adjusting for year, gender, postcode, admission source and breed. These results show that although kittens comprise approximately one-third of entries to shelters, they are much more likely to be euthanised than adult cats. It is not clear from these results what additional factors relating to kittens may be responsible for increasing euthanasia risk. Further studies collecting the precise age of kittens at entry are required to better elucidate the relationship between age at entry and risk of euthanasia.

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Ethical challenges in wildlife management

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Wildlife management requires the manipulation of individuals or populations of wild animals to control negative impacts of unwanted wildlife, increase numbers of endangered species, or maximise the harvest of game species. Such management engenders a wide range of responses with opponents raising both ethical and animal welfare questions.

Unlike farm and pet animals, no obvious "duty of care" applies to wild animals except in a conservation sense of care for populations. Although, there is an argument that any interference by humans should be subject to the same duty of care. Nevertheless society expects that whenever we undertake pest control it should be done humanely. However, the more challenging issue is whether we should be controlling wild animals at all. Is it right, for example, to control one population in order to preserve another or to kill sentient animals to protect non-sentient plants? Indeed a growing number of people find it difficult to support vertebrate pest control, particularly because of their negative perceptions of killing.

To develop a sound ethical basis for managing unwanted wildlife an ethical framework needs to be implemented. It needs to incorporate a balance between biocentric or ecocentric, animal rights, and anthropocentric ethics. In this, it differs from the approach to ethical issues with our treatment of domesticated animals, where the environment (and hence its interests) does not have to be confronted. We advocate a pluralistic approach with the acceptance of both environmentalism and concern for the individuals, recommending a shift in emphasis from one to the other depending on the situation. We also advocate immediate action in the operational consideration of animal welfare in wildlife management rather than further delay as the ongoing debate about whether and how the interests of animals intersect with those of the environment and humans continues.

The impact of an oral distraction in cattle during a painful procedure

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A total of 288 steers (274 ± 19 kg) were randomly allotted in a 2x2 design to investigate the effectiveness of an oral distraction at minimizing an animal's struggle during a painful procedure (i.e. freeze branding). The heart rate of 12 focal steers per treatment group was recorded using a remote recording system (Vmed PC-Vet). The oral insert consisted of a stainless steel oesophageal probe (25cm in length) modified with a handle and metal frame to hold it in place. Steers were restrained in an instrumented headgate to measure the maximum and average force exerted by each animal. Immediately after being caught in the headgate, a 10s settling period was allowed to elapse, after which the oral insert was placed in the animal's mouth or sham inserted. Immediately after insertion, a 10s baseline period of heart rate and exertion force was recorded. The area to be branded was then clipped of hair and saturated with methyl hydrate. The animal was branded with three separate irons cooled in liquid nitrogen or maintained at room temperature that were held on the animal for 15 seconds each. A square root transformation was applied to the exertion force to obtain normality. Exertion force and heart rate were analysed using a One-Way ANOVA. Steers with the oral insert exerted less force during restraint compared to steers receiving the sham insert treatment (means ± SE: 487 ± 43 mV and 709 ± 61 mV, respectively; p < 0.01), but freeze branding had no effect. No treatment differences in heart rate were observed. Animals given an oral distraction struggled less during restraint, which has the potential to not only reduce the stress on the animal during handling, but also improve the ease of handling animals.

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The effect of fetal programming on offspring coping and cognition

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Prenatal stress has been shown to alter brain development in utero resulting in offspring with reduced cognitive and coping abilities in response to stress. Stressful events experienced by sows during gestation could possibly increase the anxiety levels or reduce the coping ability of their offspring, resulting in long term welfare consequences for the offspring. The objective of this research was to determine the effects of prenatal stress on coping and cognition of piglets. Sows were challenged with adrenocorticotropic hormone (ACTH; 100 IU) 3 times a week during the last five weeks of gestation (ACTH; n = 10) or control handled (HAN; n = 10). The female offspring from the ACTH (PNS; n = 20) and HAN (CON; n = 20) sows were put through a back test to measure coping ability at 5 days of age. At 6 weeks of age blood was taken from PNS and CON pigs to measure cortisol. At 6 and 10 weeks of age, PNS and CON pigs were run through two different maze tests to measure learning and memory. Data were analyzed using the MIXED and NPAR1WAY procedures of SAS. There was no difference in birth weights, weaning weights, or baseline cortisol concentrations between PNS and CON piglets. During the back test, escape attempts did not differ between PNS and CON pigs, but PNS pigs tended (P = 0.057) to vocalize more than CON pigs (CON: 1.1 ± 1.7; PNS: 2.0 ± 1.9). Latency to navigate maze I did not differ between treatments. When pigs were run through maze II, PNS pigs tended (P = 0.053) to be quicker reaching the reward than CON pigs (CON: 286.9 ± 37.2; PNS: 183.2 ± 37.2 seconds). Elevated cortisol concentrations in utero may modify the coping and cognitive ability of the offspring.

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Does a picture of a peer's face decrease isolation stress in cows?

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The aim of this study was to identify if isolation stress in cows could be reduced by viewing a picture of a peer's face. Three Japanese black cows were tested and another cow was used as a companion (Peer). One cow was tested a day under the following conditions and the order of testing the cows was fixed. At 9:00, one cow was housed in an experimental pen with the Peer in a neighbouring pen, and they could have tactile contact. At 11:30, the Peer was taken back to the home pen and the test cow was socially isolated until 12:00 (SI). At 12:00, the cow was exposed to one of four treatments: presenting the Peer in the neighbouring pen (P), a picture of the Peer's face (PF), a picture of a Holstein's face (HF) or a blank picture (B) until the test cow was taken back to the home pen at 15:00. They were tested four times and exposed to all the treatments. Behaviour during the treatment was recorded at 2-minutes intervals. The saliva of the cows was sampled at 11:30, 12:00, 12:30 and 14:00 to measure the concentrations of salivary cortisol and chromogranin A (pmol/ml), During SI, the concentration of chromogranin A increased (7.8 ± 4.5 at 11:30, 15.7 ± 4.6 at 12:00; ANOVA, $P<0.01$). After conducting PF, the concentration of chromogranin A decreased at 12:30 (8.9 ± 1.6), but increased at 14:00 (17.8 ± 4.8) (ANOVA, $P<0.05$). The concentration of chromogranin A at 12:30 in B (28.1 ± 14.4) was higher than that in PF (Tukey HSD, $P<0.10$). The concentration of cortisol at 14:00 in PF (0.49 ± 0.16) was higher than that in P (0.26 ± 0.05) (Tukey HSD, $P<0.10$). It is suggested that PF might decrease the isolation stress of cows for a short period.

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Relationships of acute stress responses with plasma oxytocin in heifer calves

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Besides having major functions in ensuring successful parturition, and nutrition and care of the offspring, oxytocin is involved in the regulation of behavioural and physiological stress responses in the brain. To investigate the neurobiological basis of individual differences in stress responses in cattle, we examined the association of behavioural and hypothalamo-pituitary-adrenal axis reactivity to acute stressors and plasma oxytocin levels. Twenty Holstein heifer calves aged 2 weeks were subjected to a 10-minute open-field test followed by presentation of a feeding bucket for 15 min in the open field. If the calf contacted the bucket, a blast of air was applied to its muzzle (surprise test). Jugular blood samples collected before and after testing, via indwelling jugular catheters, were analyzed for oxytocin and cortisol. Because of insufficient volume of samples, the plasma oxytocin concentration could be measured for only 9 animals out of 20. Relationships of basal and percent change in oxytocin with behavioral responses in each test and percent change in cortisol were analyzed using principal components analysis and Spearman rank correlations. Plasma cortisol concentration was significantly elevated by the tests ($p < 0.005$). Four principal components explained 56.1% of the total variation: curiosity, general activity, fearfulness and dependence on humans. Curiosity was inversely correlated with basal oxytocin level ($rS = -0.683$, $p < 0.05$). General activity was inversely correlated with percent change in oxytocin ($rS = -0.717$, $p < 0.05$). Fearfulness tended to correlate positively with basal oxytocin level ($rS = 0.583$, $p < 0.1$). Dependence on humans correlated with none of the hormonal parameters. These results likely reflect relationships between individual differences in stress responses and basal oxytocin level in cattle.

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Variability in responses to novelty by feral horses and donkeys in a wildlife sanctuary

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This study investigated behavioral responses towards novel objects by equids. Goals were to (1) compare responses of feral horses and donkeys towards novel stimuli and (2) identify variables such as age, species, colour, or facial whorl position that may predict investigative behaviour. Measuring investigative behaviour using novel objects may benefit wildlife conservationists, because it has predicted dispersal and survival in reintroductions. It could also improve management strategies for feral and invasive species. It was hypothesized that a higher proportion of juveniles (here defined as = 2 y) would investigate novel stimuli. Three novel objects (Ball, Cube, and Saucer) were positioned on feeding grounds and videotaped in 60 minute trials at least 1 week apart. Responses were recorded only from those equids likely to have perceived the object (criterion: within 25 m of object and head oriented towards it). Responses were classified as Investigation (criterion: approach within .5 m and orient) or No Investigation. While the total percentage of feral equids investigating the object varied across trials (Saucer = 17.3%, Ball= 18.5%, Cube= 32.2%), the proportions of juveniles and adults that investigated were not significantly different from each other in any trial. In the Ball trial (N = 65), 17.2% of juveniles and 28.6% of adults investigated (Fisher's Exact Test (FET), p=.604). In the Cube trial (N=87), 34.3% of adults and 23.5% of juveniles investigated (p=.564, FET). In the Saucer trial (N=81), 18.8% of adults and 11.8% of juveniles investigated (p=.723, FET). Proportion of individuals investigating did not differ significantly between species (horses vs. donkeys), in the 2 trials where donkeys appeared: Ball, p=1.0 (FET) and Cube, p=.491 (FET). These findings suggest that the level of investigative behaviour does not decrease with maturation from juvenile to adult in the typical pattern of behavioural development of feral horses.

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Owner attributes and recreational horse ownership in Victoria, Australia

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The prevalence of recreational horse ownership in Victoria is believed to be 1-2%. Little, however, is known about recreational horse ownership due mainly to the absence of a compulsory identification and registration system, and the difficulty associated with contacting horse owners that are not members of horse clubs. The welfare of horses has become an increasingly important issue and many of the horse welfare problems involve horses used primarily for recreation. This preliminary study, part of a larger project examining the welfare of recreational horses in Victoria, Australia, examined the prevalence of recreational horse ownership and collected details regarding recreational horse ownership, focusing particularly on owner attributes and the beliefs underlying this ownership. Seven-hundred-and-eighty-two Victorian households were randomly surveyed (via a telephone book, a public domain source) using a properly constructed telephone questionnaire. The prevalence of recreational horse ownership was approximately 3.5%, suggesting some 185, 500 Victorians currently own a horse. Twenty-three percent of these horse owners reside within the city and surrounding suburbs. The main reasons for owning horses in Victoria were recreation and companions/pets. Sixty-eight percent of horse owners had been involved with horses in some form for more than 10 years. More than 50% of horse owners were not members of any horse clubs or societies. When considering that horse ownership in Victoria is not under any regulatory constraints, together with the fact that 3 out of 5 horse owners own more than one horse, the welfare implications for a substantial number of recreational horses are considerable. Clearly further research, as planned in this unique project, is necessary to understand owner attributes and the beliefs underlying horse ownership particularly in relationship to welfare problems. Such knowledge is essential in developing and implementing appropriate strategies to manage recreational horse welfare in Victoria.

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The relationship between dog ownership and the ability to recognize human facial emotion

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Nonverbal signals account for a large part of what we perceive when communicating with another human being. When interacting with dogs however, communication relies almost solely on nonverbal signals. Experience from owning a dog might increase a dog owner's nonverbal communicative capacities in general and improve his or her ability to detect social signals in other humans. In a pilot study, 77 veterinary students (67 females, 10 males, mean age 23.4±2.4 years) were tested on their ability to recognize facial emotion in humans, using the Micro-Expression Training Tool® (METT). In a multiple choice test, the students were tested on 28 faces showing the following seven emotions four times each: sadness, anger, surprise, fear, disgust, contempt and happiness. The faces were shown for 3 seconds each, after which the students were asked to identify which one of the seven emotions they had just seen. The METT score was calculated as number of correct responses on the METT test. After the test the students were asked to fill out a questionnaire regarding their experience with dogs and other animals. 53 students owned a dog or had owned a dog at some point growing up (dog owners), whereas 24 students had never owned a dog (non-dog owners). Dog owners had an average METT score of 23.9 (SD=2.6, q1=22, q3=26) whereas non-dog owners had an average METT score of 25 (SD=2.9, q1=24, q3=27). Using the Kruskal Wallis test it was found that this difference is significant (X2= 3.95 df=1; p=0.0468). Our tentative conclusion is that owning a dog does not necessarily increase a person's nonverbal communicative capacities. On the contrary this pilot study may suggest that dog owners are inferior to non-dog owners in recognizing human facial emotion.

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Effects of previous handling on responses of dairy calves during painful procedures

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Reducing stress during routine husbandry procedures may have potential for improving animal welfare. However, few studies have investigated the influence of previous handling before procedures are performed. We investigated the effects of different types of handling on responses of dairy calves during cautery disbudding with local anaesthetic and ear-tagging. Forty Holstein-Friesian calves were exposed to either positive (e.g. soft voices, slow movements, patting) or negative (e.g. rough voices, rapid movements, pushing) handling (n=20 calves/treatment), twice daily (7 min/session) from 4 days to 5 weeks of age. At 5 weeks of age, calves were ear tagged and then disbudded 2 days later. Respiratory rate (RR), heart rate (HR), heart rate variability (HRV) and struggling behaviour were recorded continuously 5 min before and 5 min after each procedure. In addition, eye temperature (measured using infrared thermography) was recorded before and after ear-tagging. REML was used to detect treatment differences. There were no significant treatment differences in struggling, eye temperature, RR, HR or HRV in response to either procedure (P=0.493). However, the following changes (mean±SEM) occurred across both treatment groups: 1) there was an increase in struggling (by 9.4±1.2 and 9.9±1.3 events/min, positive and negative respectively, P<0.001) and RR (by 8.2±3.4 and 9.3±3.3 breaths/min, positive and negative respectively, P<0.05) after disbudding, 2) HR increased after disbudding (by 14.7±4.0 and 18.6±3.8 beats/min, positive and negative respectively, P<0.001) and ear-tagging (by 8.7±3.1 and 10.3±3.0 beats/min, P<0.01), 3) changes in HRV parameters indicated a general increase in sympathetic activity after disbudding (P<0.05). In conclusion, type of handling had no significant effect on responses to disbudding or ear-tagging. The effects of handling may have been overridden by the pain and/or stress associated with the procedures. Further research is warranted to understand the welfare impact and interaction between previous handling and responses to husbandry procedures.

Effects of previous handling on calf responses towards humans

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Human-animal relationships affect the production and welfare of animals. We investigated whether the type of handling of dairy calves influences their response towards humans. Forty, group-housed, Holstein-Friesian calves were exposed to either positive (e.g. soft voices, slow movements, patting) or negative (e.g. rough voices, rapid movements, pushing) handling (n=20 calves/treatment, 5 calves/group), twice daily (7 min/session) from 4 days to 5 weeks of age. Reactions towards humans were investigated around 4 weeks of age in a 'calf escape test' in their home pens, and by measuring the flight distance in a raceway. In the calf escape test, each calf was given a score between 0 and 4 depending on whether the observer could (1) make eye contact, (2) take 1, or (3) 2 steps towards the calf, or (4) touch the calf before it moved away (defined as moving both forelegs). Data were analysed using ANOVA. Calves that received positive handling showed less avoidance behaviour (mean score; positive:3.7, negative:2.8, sd:0.66, p=0.039) but there was no difference between the treatment groups in flight distance (positive:0.6m, negative:0.7m, sed:0.24m, p=0.526). Calves that received positive handling were 3 times more likely to voluntarily approach a human within 1min, compared to negatively handled calves (50% vs 17% of the calves approached the human, sed: 9.8%, p=0.015). When the calves were 3 months old, we repeated the flight distance and calf escape tests and added a control group (n=20) of the same age that had been reared under normal farm management (minimal handling). Controls showed more avoidance behaviour in the calf escape test (mean score; positive:1.5, negative:1.0, control:0.3, sd:0.21, p<0.001) and greater flight distances (positive:3.3m, negative:3.7m, control:4.9m, sed:0.40m, p<0.001). In conclusion, the type and possibly the amount of handling during early rearing influence the behaviour of calves towards humans, which may have implications for animal welfare.

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Effect of parity on acute phase proteins and general activity in dairy cows during the puerperal period

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The objective of this study was to investigate the effect of parity on general activity and plasma levels of acute phase proteins (APP) as possible indicators of inflammation associated with calving. This experiment is part of a larger project aiming to assess the effects of the non-steroidal anti-inflammatory drug meloxicam on pain and discomfort associated with calving. Sixty Friesian dairy cows from first to sixth parity with calving that did not require mechanical assistance were included. Haptoglobin (Hp, mg/mL) and serum amyloid A (SAA, μg/mL) were determined in blood serum samples taken postcalving (d0) and on d2, d4 and d15 after calving, as APP. Cow activity, calculated as the number of steps per hour, was obtained using activity meters (Westfalia, Germany) around calving. Statistical analyses were carried out with the SAS software. A procedure of GENMOD and MIXED was used for activity and APP, respectively. Concentrations of APP on d2 and d4 were significantly higher than those on d0 and d15 ($p < 0.0001$). Heifers showed higher values than multiparous cows (Hp: 0.73 ± 0.07 vs 0.48 ± 0.06 and SAA: 132.04 ± 13.27 vs 85.86 ± 12.59). A significant correlation between Hp and SAA was found ($r = 0.79$; $p < 0.001$). Activity showed a day by parity interaction effect. Heifers showed higher general activity than cows from day 1 before until two days postcalving ($p < 0.01$). In heifers and cows, activity was higher around calving (from d-1 to d2) than from d3 to d7. Significant correlations were found between APP and total average activity (Hp, $r = 0.62$ and SAA, $r = 0.58$; $p < 0.0001$). Although further research is needed, these preliminary results suggest that inflammation associated with parturition, measured through the concentration of acute phase proteins, may cause an increase in general activity in dairy cows after calving and may be more pronounced in heifers than in multiparous cows.

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The relationship between milk traits and behavioural characteristics of newly calved cows after introduction to new social group

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Identifying individual behavioural characteristics associated with physiological indicators is useful for animal production and welfare to provide appropriate management in stressful situations. The present study examined relationships between milk productivity and milk cortisol concentration (MC) with behavioural characteristics of newly calved cows when introduction into a new social group. Behaviour of 37 newly calved cows were observed twice during one week after their introduction to a production group (approximately 4 hours/day around morning milking). Milk samples for MC measurement and milk trait data were collected on the test day every two months until drying-off. Mean MC was 35.4ng/dl. Estimated total, inter-cow and inter-test day variances of MC were 1266.0, 50.6, and 41.8, respectively. Each behaviour and milk trait was subjected to linear mix model analysis with a random effect of cows, for estimating the individual best linear unbiased prediction (BLUP) of each trait. Then behavioural BLUP data were subjected to principal component (PC) analysis. Three PCs with eigenvalues greater than 1.0 explained 63% of the total variation. The first PC, with large loadings for eating and allogrooming, was positively correlated with BLUP of milk yield (r=0.41, p<0.05). The first PC showed a significant relation with milk productivity. However, the second PC, with large loadings for drinking and self-grooming, was uncorrelated with milk traits, but had a negative correlation with BLUP of MC (r=-0.32, p<0.05). The third PC, with large loadings for exploring, fighting and the frequency of agonistic behaviour, was uncorrelated with all traits. Results show that MC might be an indicator of certain behavioural characteristics which were independent of productivity.

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Non beak-trimmed laying pullets kept with daylight may receive diets with only plant protein sources without increasing the risk for feather pecking and cannibalism

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Organic laying pullets should not be beak-trimmed, be reared with natural daylight and according to some guidelines receive no animal protein and synthetic amino acids. This may increase the risk for feather-pecking and cannibalism. This study aimed to examine possible effects of organic food rations (OF) with only plant protein sources versus conventional diets (CF) containing also animal protein sources on feather pecking, cannibalism and growth of non beak-trimmed pullets kept with daylight. Eleven strains were examined in two trials (A: 6 strains, B: 5 strains) in 22 groups of 85 with a stocking density of 7.4 birds/m². Each strain was treated as a paired sample receiving either OF or CF, with strains not being replicated. OF and CF had approximately the same total methionine and lysine contents. Food consumption was recorded weekly, plumage condition, injuries and body mass in week 16 of life (sample size A: 50, B: 40). Diet had no effect on percentages of pullets with featherless areas (A:CF 7.7±9.8%, OF 6.3±12.8%, p=0.859; B:CF 9.2±12.6%, OF 21.0±21.3%, p=0.160, paired t-tests) and injuries (A:CF 17.2±22.2%, OF 9.0±9.8%, p=0.0516; B:CF 19.6±16.8%, OF 8.2±17.3%, p=0.899) which were blood-crusted and under the feathers in the tail area. The range in prevalences of featherless areas was high with 0% to 50%. Percentages of injured pullets correlated with feather damage (rSpearman A:0.753, p<0.01;B: 0.828, p<0.01). OF-birds tended to be lighter in trial A (A:CF 1617.0±138.4g, OF 1587.8±144.3g, p=0.059; B:CF; 1482.7±134.7g, OF 1501.6±148.7g, p=0.397), combined with a lower food consumption (p<0.001), but better food conversion rate (p=0.016). Mortality was low (A:CF 0.8±1.0%, OF 1.6±1.0%, p=0.328; B:CF 0.5±1.1%, OF 0.7±0.7%, p=0.621). Feeding of rations with only plant protein, but sufficient methionine and lysine contents may in certain cases negatively affect food intake, but does not necessarily pose an increased risk for feather pecking and cannibalism.

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The change of the height of residual ration on trough in a free-stall barn

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In a free-stall barn, free access to a ration depends on feed being within reach of cows. The objective of this study was to determine the change of ration form with eating behavior of cows in a free-stall barn. Twenty Holstein cows (average parity 3.2) were offered total mixed ration once daily at 1030 in a flat feed trough, through a self-locking feed barrier. From 1730 to 0530 the following day, the ration height was measured, without contact, at 10 cm intervals from the trough wall to 140 cm away (15 points) at 2 m intervals on the trough (6 lines), every 30 minutes. Eating behavior of cows was observed at 5 minutes interval, individually. Kruskal-Wallis analysis was used. The average ration height decreased linearly with cumulative eating time of cows. Over time, the position of the ration peak in the trough moved away from the trough wall: at 180 minutes, 70 - 80 cm; at 360 minutes, 80 - 90 cm; at 540 minutes, 90-100 cm. The changes of ration form were related to the eating behavior of cows. There were three time phases in the changes of ration form. In the first phase (within 90 minutes after the start of experiment), cows ate the ration in the close area to trough wall. And the residual ration accumulated in 70 - 100 cm distance position. In second phase (90-360 minutes after), the area where cow ate was expanded. The ration accumulated in this phase in 90 - 100 cm distance position. In third phase (360-720 minutes after), cows had eaten almost all ration closer than 80 cm position, and the height of ration in 90-100 cm position was not changed. For keeping the free access to ration, the pushing up operation had to be done before 0130 (540 minutes after).

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Effect of feed barrier design on feeding and vigilance behaviour of freestall housed dairy cows

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The feed barrier has been shown to have major effects on feeding and social behaviour of housed dairy cows. Computerised systems allow continuous monitoring of feeding and drinking behaviour and are frequently used in research. However, the design of these feeders can obscure the cow's visual field. The objective of the study was to determine if obscuring the cows' visual field whilst feeding would increase vigilance behaviour and alter normal feeding behaviour. Twenty-four Holstein cows were divided into 4 groups. Two pens had headlock feed barriers (a conventional design where the cow puts her head through the bars of the barrier to reach food) and 2 pens had an electronic system (INSENTEC, Holland) where each cow is fitted with a passive transponder attached to the ear tag which permits access to feed when the transponder is detected. Groups were exposed to four treatments (6, 5, 4, or 3 feeding spaces) following a Latin Square design and repeated on each feed barrier. Restricted Maximum Likelihood (REML) mixed models were fitted to data. Average daily feeding time was higher ($P<0.05$) when cows were fed using the headlock system (265.8 ± 9.6; mean $\pm$ SE) compared to the electronic feeding stations (224.2 ± 7.01; mean $\pm$ SE). All groups of cows displayed vigilance scans, however, type of barrier did not have a significant difference on frequency of scans (headlock system, 91.07 ± 6.34; electronic system, 104.64 ± 7.10), and neither did number of feeding stations or dominance rank. The low status cows did, on average, scan slightly more times than the high status cows (however, this was not significant). These results indicate that neither feeder design nor stocking rate affected vigilance in dairy cows, at least over the treatment conditions assessed in the current study.

Behaviour epigenetics – implications for domestication and welfare

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Ever since Darwin formulated his theory of evolution, it has been assumed that genetic variation is a product of random events (mutations), providing the only basis for natural selection. However, recent advances in our understanding of how the genome is regulated suggest that information may also be passed from the environment to the genes, allowing individual experiences to be transferred into altered gene expression. It has also been demonstrated that such acquired genetic modifications can be transferred to the offspring, opening previously unknown pathways for evolutionary adaptations. In this review, such effects, their possible mechanisms, and their implications for applied ethology will be discussed, using examples from various experiments, including those from my own group. For example, it has been shown that stressful events in plants, chickens, rodents and humans can modify the phenotype of the exposed individuals and their offspring in more than one generation. Primary mechanisms appear to be chemical modulation of DNA (methylation) and histones (acetylation), but also RNA interference and other regulatory factors have been implied. Common mediators could be steroid-hormones, which respond to stressful experiences of an animal. This may have large implications for our understanding of how animals have adapted during domestication. For example, animals may have been inadvertently selected for their ability to modify gene expression across generations ("evolvability"), suggesting that domesticated populations may be able to respond more rapidly to environmental challenges. Furthermore, although stress is associated with poor welfare of the affected individual, it may perhaps allow offspring to adapt better, hence improving long-term welfare in future generations.

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